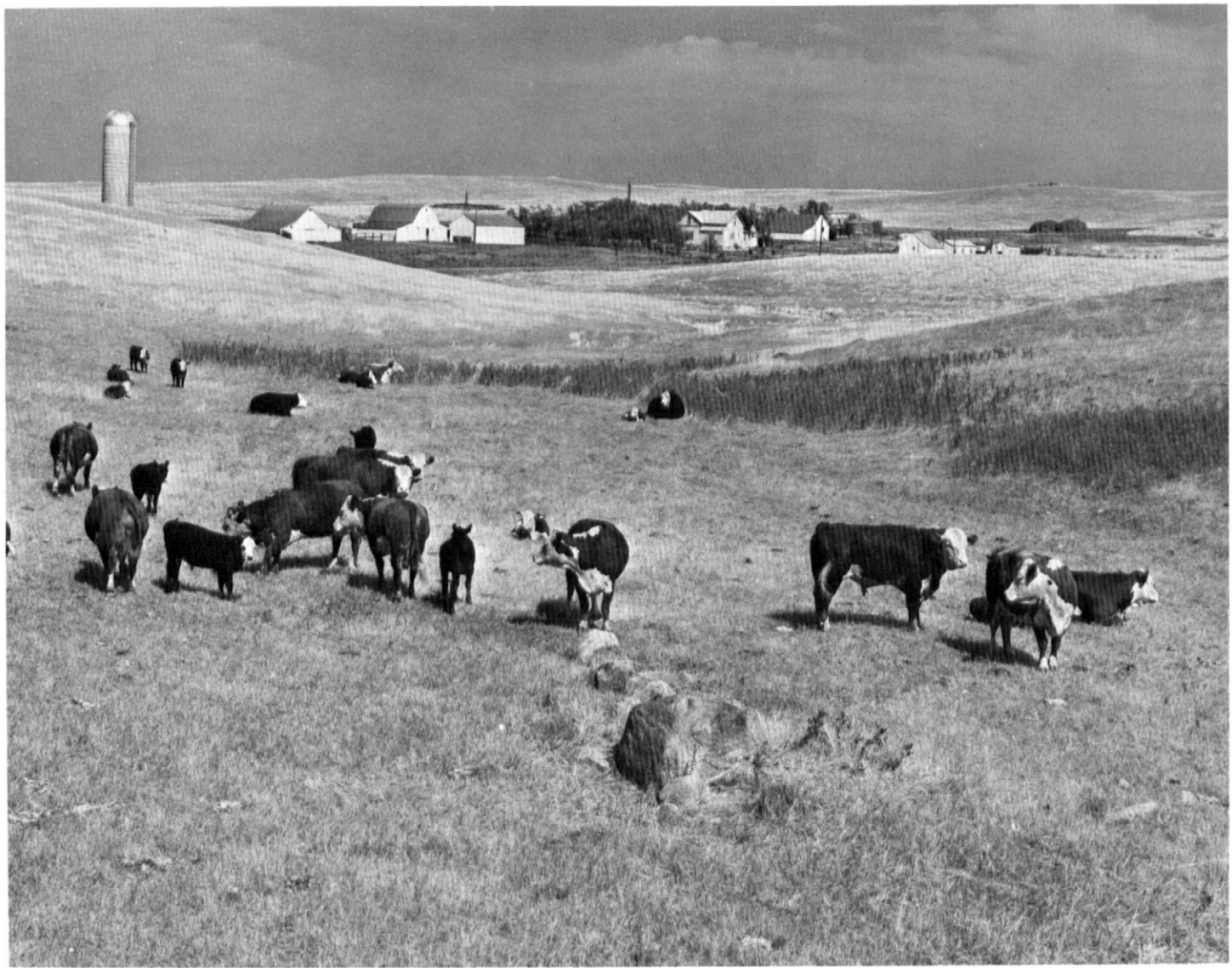
SOIL SURVEY OF

Walworth County, South Dakota

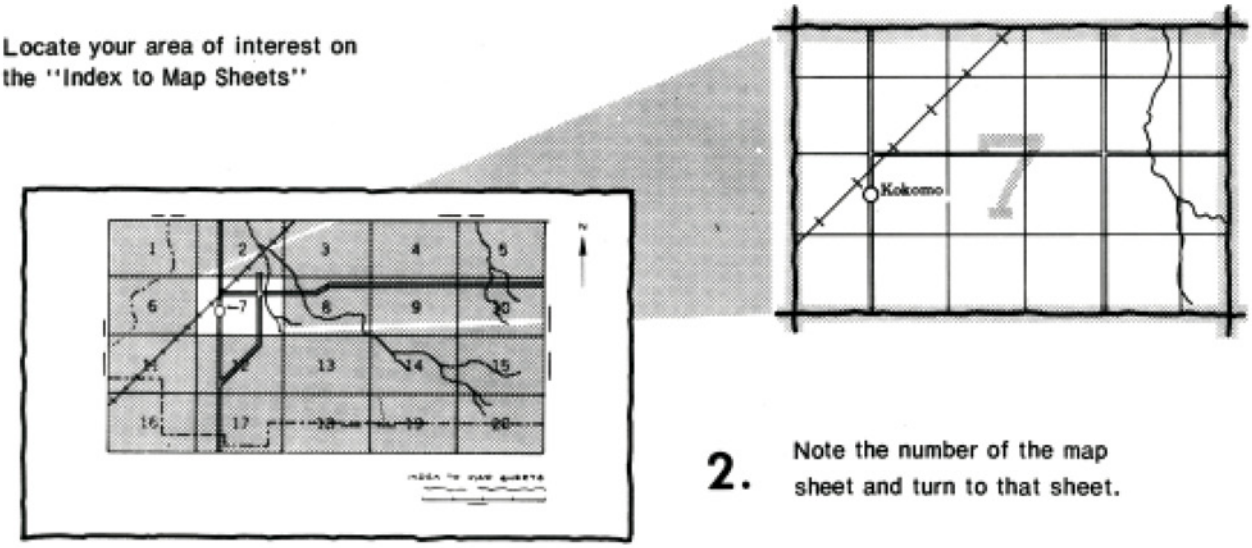


United States Department of Agriculture
Soil Conservation Service

In cooperation with
South Dakota Agricultural Experiment Station

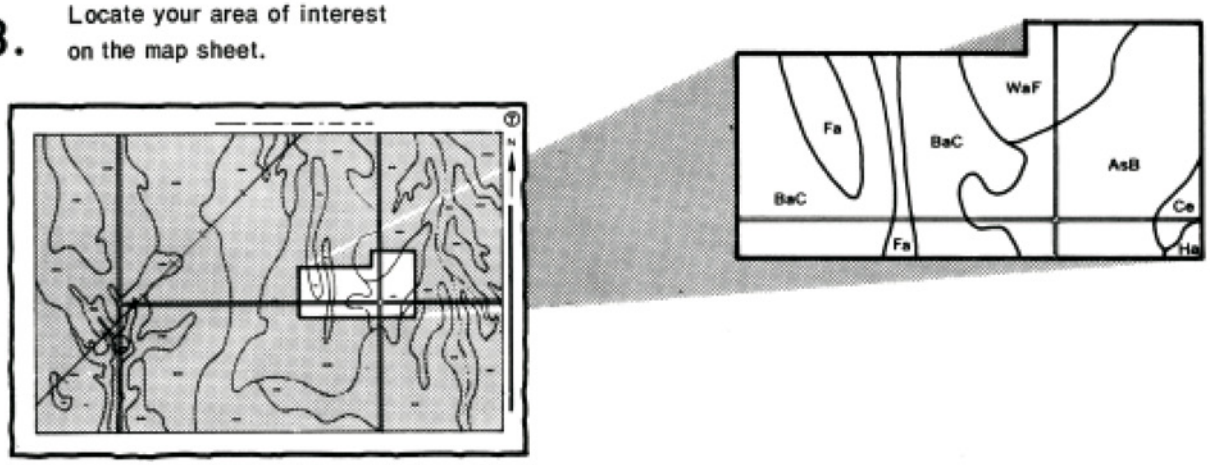
HOW TO USE

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

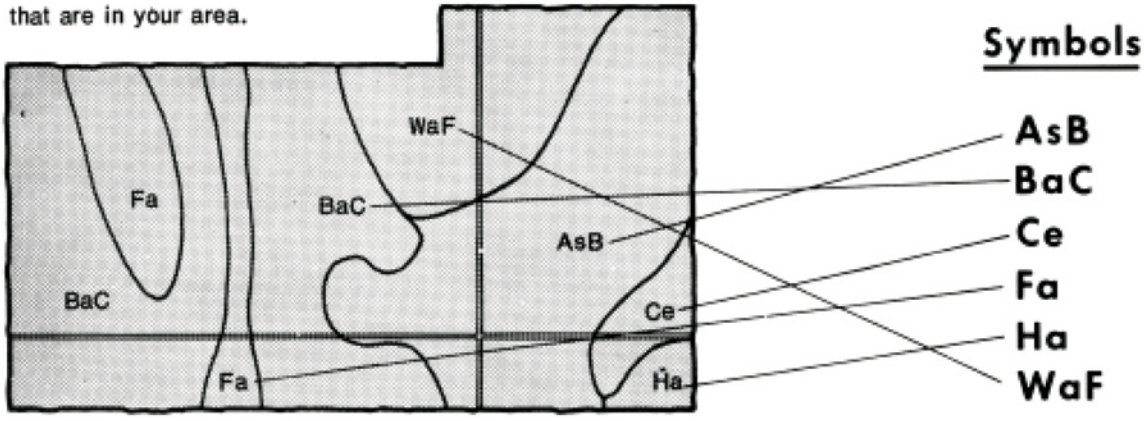


2. Note the number of the map sheet and turn to that sheet.

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

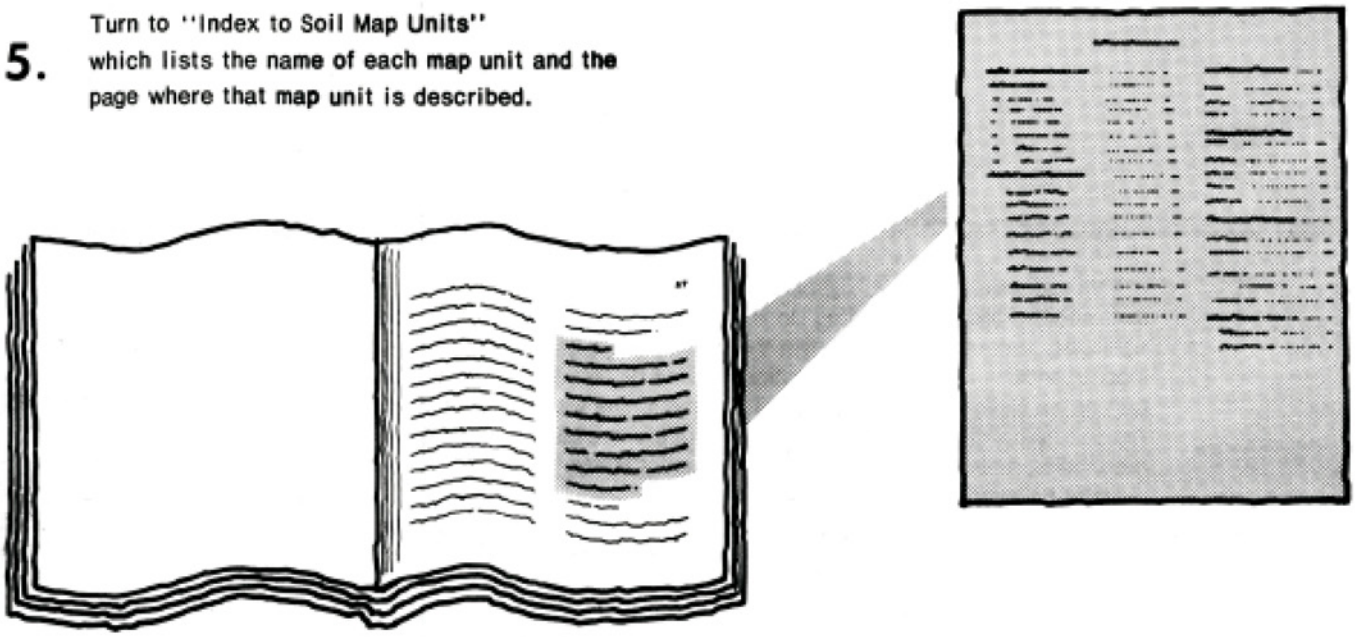


4. List the map unit symbols that are in your area.

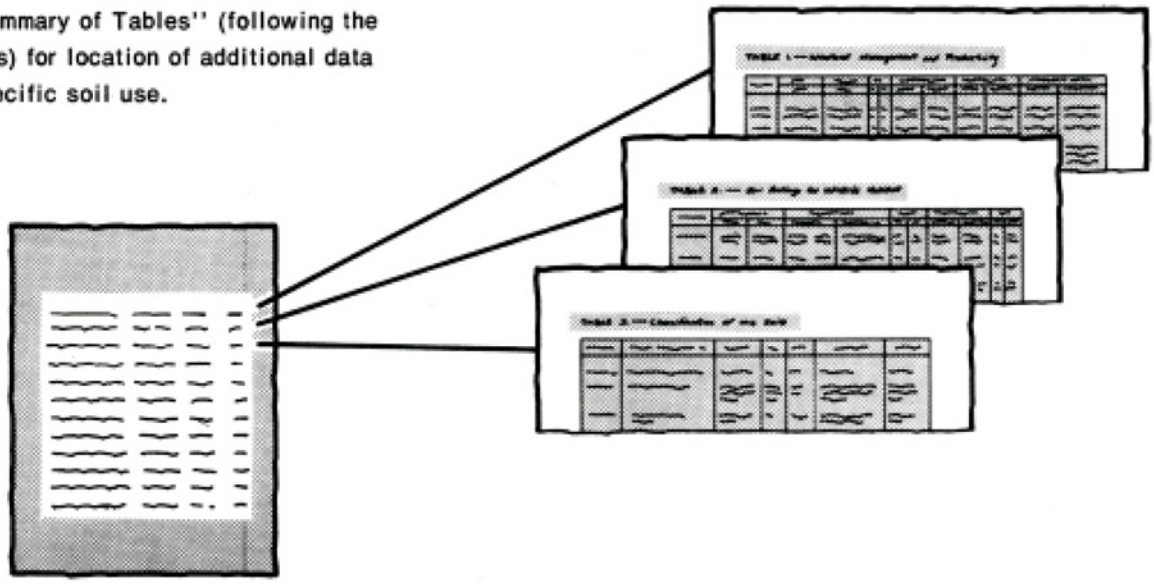


THIS SOIL SURVEY

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 is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. 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 the period 1967-74. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1974. This survey was made cooperatively by the Soil Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Walworth County Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Typical ranch on Opal-Sansarc clays, 6 to 15 percent slopes.

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Issued April 1981

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Foreword

The Soil Survey of Walworth County, South Dakota, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

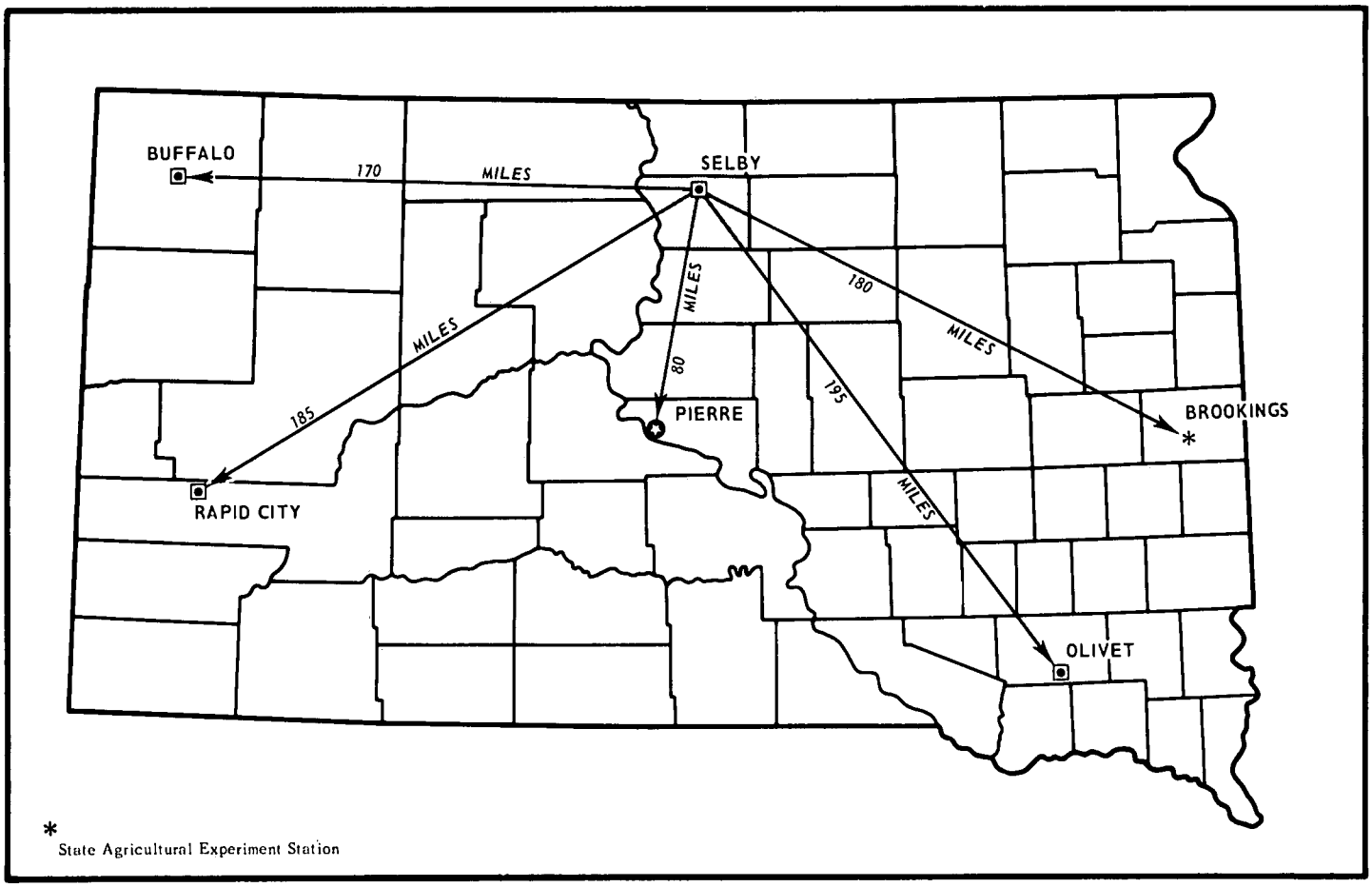
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Many people assume that soils are all more or less alike. They are unaware that great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to 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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

We believe that this soil survey can help bring us a better environment and a better life. Its widespread use can greatly assist us in the conservation, development, and productive use of our soil, water, and other resources.

R. D. Swenson
State Conservationist
Soil Conservation Service



Location of Walworth County in South Dakota.

SOIL SURVEY OF WALWORTH COUNTY, SOUTH DAKOTA

By Kenneth J. Heil, Soil Conservation Service

Soils surveyed by Kenneth J. Heil, Edgar H. Ensz, John Kalvels, Roland K. Krauss, Loren Nestrud, Thomas Schumacher, and Loren D. Schultz, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the South Dakota Agricultural Experiment Station

WALWORTH COUNTY is in the north-central part of South Dakota (see facing page). It has a total area of 750 square miles, or 480,000 acres, which includes 20,672 acres of open water. Selby is the county seat.

The county is mostly in the Coteau du Missouri division of the Missouri Plateau part of the Great Plains province(*3*). The western edge of the county is in the Missouri River Trench, which is partly occupied by Lake Oahe, an impoundment on the Missouri River. Most of the county is an undulating to gently rolling glaciated plain. Relief is hilly to steep on the breaks adjacent to Lake Oahe. It is rolling to hilly on the sides of the valley cut by Swan Creek where the creek flows westerly from Swan Lake to Lake Oahe. Some hilly to steep glacial moraines are in the eastern part of the county. Elevation ranges from about 1,700 feet at the mouth of Swan Creek in the southwestern part of the county to 2,000 feet in the northeastern part.

General nature of the county

This section gives general information concerning the county. It discusses settlement, natural resources, climate, and farming.

Settlement

French fur traders probably frequented Walworth County before Lewis and Clark passed the county on their way up the Missouri River early in the 19th century. The first settlement along the Missouri River, at the mouth of Swan Creek, was established by Antoine LeBeau in 1873.

Walworth County was established by an act of the 1873 Dakota Territory Legislature. It was formally organized in 1883, when the settlement of LeBeau was selected as the first county seat. The county seat was later moved to Bangor and, in 1906, to Selby.

Rapid settlement of the county began in 1901, when railroads were extended into the county. The river town of Evarts, about 16 miles upstream from LeBeau, was the terminus of one railroad and soon became the main trading and shipping center for a large area.

In 1906, a railroad bridge was constructed across the Missouri River at a site several miles upstream from Evarts. The town of Mobridge, which was established at this site, quickly replaced Evarts as a railroad and business center. The strategic site of Mobridge was further enhanced by the construction of a highway bridge across the river in 1924.

The county was settled quickly between 1901 and 1920. In 1920, the population was 8,447. It began to decline during the drought and the depression of the 1930's. In 1950, it was 7,648. The growth of towns accounted for an increase to 8,097 by 1960. The continued decrease of farm population in the next decade offset modest gains in Mobridge. By 1970, the population of the county had decreased to 7,842. Selby had a populaton of 957; Mobridge, 4,545; Java, 305; and Glenham, 178. The villages of Akaska and Lowry each have less than 50 inhabitants. The pioneer towns of Bangor, Evarts, and LeBeau remain only as historic sites.

Natural resources

Soil is the most important natural resource in the county. Crops produced on farms and livestock that graze the grasslands are marketable products that are affected by the soil.

In most of the county, water is adequate for domestic use and watering of livestock. In glaciated areas, wells range from 6 to 300 feet deep. The quantity and quality ranges from poor to good. Generally, the most important sources are areas where there are thick deposits of outwash sand and gravel. An aquifer in the southeastern part of the county supplies water in quantities sufficient for irrigation. Surface water impoundments and deep wells are the main sources of water in those parts of the county where clay shale is near the surface. The Dakota Group of sandstones is a source of water in wells, which generally are about 1,800 feet or more deep. Lake Oahe is an important source of water for domestic use and irrigation.

Mineral resources are mainly deposits of outwash sand and gravel, which are used in construction.

Climate

Walworth County is usually warm in summer and has frequent spells of hot weather and occasional cool days. It is very cold in winter, when Arctic air frequently surges over the county. Most precipitation falls during the warm period. Precipitation is usually heaviest late in spring and early in summer. Winter snowfall is normally not 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 county, as recorded at Selby for the period 1960 to 1974. 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 15 degrees F, and the average daily minimum is 4 degrees. The lowest temperature on record, minus 36 degrees, occurred at Selby on December 31, 1967. In summer the average temperature is 70 degrees, and the average daily maximum is 84 degrees. The highest temperature, 110 degrees, was recorded on July 12, 1973.

Growing degree days, shown in table 1, 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.

Of the total annual precipitation, 14 inches, or 82 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the April-September rainfall is less than 12 inches. The heaviest 1-day rainfall during the period of record was 2.68 inches at Selby on June 18, 1964. Thunderstorms occur on about 38 days each year. About 26 of these days occur in summer.

Average seasonal snowfall is 28 inches. The greatest snow depth at any one time during the period of record was 24 inches. On the average, 68 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

The average relative humidity in midafternoon in spring is about 60 percent. Humidity is higher at night in all seasons, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 in summer and 55 in winter.

Several blizzards occur each winter. In scattered small areas, summer thunderstorms are accompanied by hail.

Farming

The first settlers in Walworth County were mainly rivermen and cattle ranchers. The rivermen lived in river settlements, such as LeBeau, and were engaged in hunting, fishing, trapping, and supplying fuel wood to river steamers. The cattle ranchers made use of the abundant prairie grasses. They marketed their grass-fed cattle by drives to the mining districts in the Black Hills or to railheads to the east and south.

Homesteaders began to file claims in the 1880's. The early homesteaders endured hardships from the severe winters and from crop failures caused by droughts in the early 1890's. As the railroads crossed the county in the 1890's, however, the rate of homesteading increased so that by 1910 general farms were the main type of farms. Cattle ranching persists in those parts of the county where the homesteaders perceived that the soils were too steep, too stony, or too shallow for cultivation.

In 1920, the Bureau of Census reported that there were 653 farms in the county. These farms averaged 569 acres in size. The number of farms has gradually decreased since 1920. In 1969, the Bureau of Census reported that there were 444 farms in the county. These farms averaged 974 acres. A total of 184 farms were more than 1,000 acres. Of these, 38 were more than 2,000 acres.

Spring wheat has long been the principal crop grown in the county. Oats, corn, and alfalfa are the other major crops. According to the South Dakota Crop and Livestock Reporting Service, 86,000 acres was in spring wheat in 1974. About 36,000 acres of oats, 31,000 acres of corn, and 27,000 acres of alfalfa hay were harvested in 1974. Smaller acreages were in barley, durum wheat, flax, rye, winter wheat, and sorghum.

The number of cattle has gradually increased since 1945. In 1974, there were 50,000 cattle of all classes on farms in Walworth County. Of this total, 21,000 were beef cows and heifers held for breeding and 2,000 were milk cows held for milk production (4). There were 11,200 hogs and 4,400 sheep. Further information on trends in crops and livestock can be obtained from the annual reports of the South Dakota Crop and Livestock Reporting Service.

A succession of dry years in the 1930's caused considerable soil blowing in the county. Farmers and ranchers recognized the problems of water erosion, soil blowing, and overgrazing of grassland when they organized the Walworth County Conservation District in 1956.

Economic conditions and the capability and potential of the soil in Walworth County indicate that beef cattle and spring wheat will continue to be the basis of the future economy in the county.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general

pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the section "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and their interpretations are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily useful to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, the map units for broad land-use planning described in this survey. Each map unit is a unique natural landscape that has a distinct pattern of soils and of relief and drainage features. A unit typically consists of one or more soils of major extent and some soils of minor extent. It is named for the major soils. The kinds of soil in one unit can occur in other map units, but in a different pattern.

The map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are generally suitable for certain kinds of farming or other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soils in any one map unit ordinarily differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Sansarc-Opal

Shallow and moderately deep, well drained, moderately sloping to steep clayey soils underlain by shale; on uplands

The landscape of this unit is one of breaks and many small draws and large drainageways (fig. 1). The soils are mostly moderately steep to steep, but are less steep on the lower parts of the landscape and on some of the broader ridgetops. Glacial stones commonly are on the surface on the higher parts of the landscape. Small areas of shale are exposed on cutbanks and on the shoulders of the small draws.

This unit makes up about 7 percent of the county. It is about 35 percent Sansarc soils, 30 percent Opal soils, and 35 percent minor soils.

Sansarc soils are shallow over shale. They are on the tops and upper sides of ridges and on the shoulders of drainageways. Opal soils are moderately deep over shale. They are on the middle and lower parts of the landscape and on some of the broader ridgetops. Both soils are clayey down to the underlying soft shale, and both swell markedly when wet and shrink markedly when dry. Permeability is slow to very slow in both soils, and available water capacity is very low or low.

Promise soils are the most extensive of the minor soils. These deep clayey soils are on foot slopes and fans along drainageways. Other minor soils are Egas, Hurley, and Swanboy soils on foot slopes and fans along drainageways and Gettys, Lowry, Raber, Sully, and Wabek soils on high ridges. Egas soils are very poorly drained and, like Hurley and Swanboy soils, contain harmful salts. The loamy Gettys and Raber soils formed in glacial till, and the silty Lowry and Sully soils formed in loess. The excessively drained Wabek soils are less than 14 inches deep over sand and gravel.

This unit is used almost entirely for range. Only a few isolated tracts of the less sloping soils are farmed. Runoff is rapid over much of the area, and the hazard of erosion on the major soils is severe to very severe.

This unit has fair to good potential for range and rangeland wildlife. An adequate grass cover and ground mulch help to prevent excessive soil losses and improve the moisture supply for plants by reducing runoff. The major soils are not suited to cultivated crops, tame pasture, and windbreaks because the slope is moderately sloping to steep and the erosion hazard is severe. The potential for most urban uses is poor because of the unstable nature of the underlying shale, the moderately sloping to steep slopes, and the slow to very slow permeability and because of a high shrink-swell potential and low strength. The potential for most recreation uses is poor because of the moderately sloping to steep slopes and the clayey texture of the major soils.

2. Opal-Promise

Moderately deep and deep, well drained, nearly level to strongly sloping clayey soils underlain by shale; on uplands and terraces

This unit is on uplands and terraces. It is mostly gently sloping to moderately sloping, but is nearly level on the terraces. The steeper slopes are on the sides of ridges and entrenched drainageways. Many small draws and entrenched drainageways dissect the unit.

This unit makes up about 10 percent of the county. It is about 25 percent Opal soils, 25 percent Promise soils, and 50 percent minor soils.

Opal soils are moderately deep. They generally are higher on the landscape than Promise soils. Promise soils are more than 40 inches deep over shale. They are in swales and on foot slopes and valley terraces. Both soils are clayey down to the underlying shale, and both shrink markedly when wet and swell markedly when dry. Permeability is very slow in both soils, and available water capacity is low to moderate.

Sansarc soils are the most extensive of the minor soils. These shallow clayey soils are on the upper sides of ridges and entrenched drainageways. Other minor soils are the silty Agar, Eakin, and Highmore soils on smooth, broad ridgetops; the very poorly drained Egas soils and mixed, channeled soils on bottom land; the loamy Gettys and Raber soils on ridges mantled with glacial till; and Hurley, Jerauld, and Swanboy soils on terraces and fans along drainageways. Egas, Hurley, Jerauld, and Swanboy soils contain harmful salts.

Most of this unit remains in native grass and is used for range. About 30 percent of the acreage is used for cultivated crops. Most of the farmed tracts are in areas where slopes are less than 9 percent. Runoff is medium throughout much of the unit, and controlling erosion and conserving moisture are management concerns if the major soils are used for range, crops pasture, and windbreaks. Controlling soil blowing, improving water intake, and maintaining fertility and tilth are also concerns if these soils are farmed.

This unit has good potential for range and rangeland wildlife. Where slopes are less than 9 percent, the major soils have fair potential for cultivated crops, pasture, and windbreaks. Maintaining an adequate grass cover on range and using conservation measures on the cultivated tracts are helpful in overcoming the limitations of these soils. The potential for most urban uses is poor because of the very slow permeability, high shrink-swell potential, and low strength of the major soils and the unstable nature of the underlying shale. The potential for most recreation uses is poor because of the clayey texture of the major soils.

3. Agar-Lowry

Deep, well drained, nearly level to moderately sloping silty soils formed in loess on uplands and terraces

This unit is on uplands and terraces. It is mostly gently sloping. Slopes are long and smooth. The smooth relief is broken by shallow swales and a few closed depressions.

This unit makes up about 6 percent of the county. It is about 65 percent Agar soils, 20 percent Lowry soils, and 15 percent minor soils.

Agar soils generally are at elevations above Lowry soils. Lowry soils generally are on terraces. Both soils have a silt loam surface layer and are free of stones. Agar soils have a friable silty clay loam subsoil, and Lowry soils have a very friable silt loam subsoil. Permeability is moderate in both soils, and available water capacity is high.

Sully soils are the most extensive of the minor soils. They have a thin surface layer and are on the crest of ridges or on the sides of entrenched drainageways that cut back into this unit. Other minor soils are the poorly drained Hoven and Tetonka soils in closed depressions, the moderately well drained Mobridge soils in swales, and Tally soils on terraces. Tally soils contain more sand than Agar and Lowry soils.

About 80 percent of the acreage of this unit is used for cultivated crops. Runoff is medium to slow. Controlling erosion and soil blowing and conserving moisture are the main management concerns.

This unit has good potential for cultivated crops, pasture, range, windbreaks, wildlife, and recreation uses. Measures that overcome the limitations of Agar and Lowry soils are easy to apply. These soils are well suited to irrigation if an adequate supply of water is available. They have fair potential for most urban uses.

4. Highmore

Deep, well drained, nearly level to moderately sloping silty soils formed in glacial drift on uplands

The landscape of this unit is one of slight rises interrupted by swales and closed depressions. The soils are mostly gently sloping. They are moderately sloping in areas adjacent to drainageways and around some of the

closed depressions and lakes. Slopes are long, smooth, and slightly convex. A few glacial stones are on the surface in places, but in most places the soils are almost free of stones.

This unit makes up about 50 percent of the county. It is about 55 percent Highmore soils and 45 percent minor soils (fig. 2).

Highmore soils have a surface layer of silt loam and a subsoil of friable silty clay loam. The underlying material to a depth of 40 inches or more is silt loam. Permeability is moderate, and available water capacity is high.

Eakin and Mobridge soils are the most extensive of the minor soils. Eakin soils are intermingled with Highmore soils on rises. They are underlain by glacial till within a depth of 40 inches. The moderately well drained Mobridge soils are in swales. Other minor soils in this unit are the moderately well drained Demky soils on flats and in swales, the loamy Gettys and Raber soils on ridges, the poorly drained Hoven and Tetonka soils in closed depressions, and the moderately well drained Jerauld soils on terraces along streams and drainageways.

About 80 percent of the acreage of this unit is used for cultivated crops. Runoff is medium throughout much of the unit. Controlling erosion and soil blowing and conserving moisture are the main management concerns.

This unit has good potential for cultivated crops, pasture, range, windbreaks, and openland and rangeland wildlife. Measures that overcome the limitations of Highmore soils are easy to apply. These soils generally are well suited to irrigation if an adequate supply of water is available. They have fair to good potential for most urban and recreation uses.

5. Bowdle-Lehr

Well drained and somewhat excessively drained, nearly level to rolling loamy soils that are moderately deep and shallow over outwash sand and gravel; on uplands and terraces

The landscape of this unit is one of glacial outwash plains on uplands and terraces. On the terraces, the soils are mostly nearly level to gently sloping. Slopes are smooth on the terraces and short and convex on upland ridges. In places scattered glacial stones are on the surface.

This unit makes up about 8 percent of the county. It is about 35 percent Bowdle soils, 15 percent Lehr soils, and 50 percent minor soils.

Bowdle soils generally are on the middle and lower parts of the landscape where slopes are smooth. Bowdle soils are well drained, and Lehr soils are somewhat excessively drained. Both soils have a loam surface layer and a friable loam subsoil. Bowdle soils are moderately deep over sand and gravel, and Lehr soils are shallow over sand and gravel. Permeability is rapid in the underlying sand and gravel of both soils. Available water capacity is moderate in the Bowdle soils and low in the Lehr soils.

Akaska and Maddock soils are the most extensive of the minor soils. Akaska soils are mostly in the southeastern part of the county. They have more silt in the surface layer and subsoil than Bowdle soils. Maddock soils are in the northern part of the unit. They formed in outwash sand. Other minor soils in this unit are the poorly drained and very poorly drained Arveson, Colvin, and Regan soils on bottom land; the moderately well drained Bowbells, Divide, and Mobridge soils in swales; the sandy Hecla and Yecross soils intermingled with Maddock soils; Parshall fine sandy loam on terraces; and Wabek soils on ridges and knolls. Wabek soils are less than 14 inches deep over sand and gravel.

About 50 percent of the acreage of this unit is used for cultivated crops. The more rolling parts of the unit remain in native grass and are used for range. Runoff is medium to slow, and the soils are droughty in most areas. Conserving moisture and controlling erosion and soil blowing are the main management concerns if these soils are used for crops, pasture, range, and windbreaks. Soil blowing is especially critical in areas where the more sandy minor soils are farmed.

This unit has fair to good potential for range and rangeland wildlife. An adequate grass cover and ground mulch help to improve the moisture supply for range plants. The Bowdle soils that have slopes of less than 9 percent have fair potential for cultivated crops, pasture, and windbreaks, but Lehr soils have poor potential for these uses. In most years an early maturing crop, such as small grain, is better suited than row crops. Bowdle soils are well suited to irrigation if an adequate supply of water is available. Bowdle and Lehr soils have good potential for recreation uses and some urban uses, but have poor potential for those engineering uses in which seepage is critical. Akaska, Bowdle, Lehr, and Wabek soils are possible sources of sand and gravel for use in construction.

6. Williams-Bowbells

Deep, well drained and moderately well drained, nearly level to gently rolling loamy soils formed in glacial till on uplands

The landscape of this unit is a glacial till plain where gentle swells rise 10 to 30 feet above intervening swales and closed depressions. The soils are mostly undulating. The steeper areas are on the sides of the higher ridges and around the more deeply entrenched depressions. Slopes are short and convex on the swells and concave in the swales. Scattered glacial stones are on the surface and in the soil.

This unit makes up about 12 percent of the county. It is about 30 percent Williams soils, 20 percent Bowbells soils, and 50 percent minor soils (fig. 3).

Williams soils are well drained. They are above the moderately well drained Bowbells soils, which are in swales. Both soils have a loam surface layer and a friable

to firm clay loam subsoil and are underlain by clay loam glacial till. They are moderately permeable in the subsoil and moderately slowly permeable in the underlying glacial till. The shrink-swell potential is moderate. Available water capacity is high.

Of minor extent in this unit are the well drained silty Eakin and Highmore soils on smooth rises mantled with glacial drift, the poorly drained Hoven and Tetonka soils and very poorly drained Parnell soils in closed depressions, and Vida and Zahl soils on the crest and upper sides of the steeper knolls and ridges.

About 65 percent of the acreage of this unit is used for cultivated crops. The more rolling parts of the unit and many of the depressions and potholes remain in native grass and are used for range. Runoff is medium, and water collects in the swales and depressions. Controlling erosion and soil blowing and conserving moisture are the main concerns of management.

This unit has good potential for cultivated crops, pasture, range, and openland and rangeland wildlife. Measures that overcome the limitations of the major soils generally are easy to apply, but slopes commonly are too irregular for contour farming. Close-sown crops are better suited than row crops if slopes are more than 6 percent. These soils have fair potential for most urban uses. The poorly drained minor soils have poor potential for urban uses. The major soils have good to fair potential for most recreation uses.

7. Vida-Zahl

Deep, well drained and excessively drained, undulating to steep loamy soils formed in glacial till on uplands

The landscape of this unit is one of prominent hills and ridges on a glacial till plain. The soils are mostly rolling to steep, but are less steep on the lower parts of the landscape and on some of the broader ridgetops. Slopes are short and convex. Many closed depressions and swales are on the lower parts of the landscape. Glacial stones are on the surface and in the soil and are numerous on some of the ridges.

This unit makes up about 3 percent of the county. It is about 55 percent Vida soils, 25 percent Zahl soils, and 20 percent minor soils.

Vida soils are well drained. They are on the middle parts of the landscape and on some ridgetops. Zahl soils are excessively drained. They are on the upper sides of hills and ridges. Both soils have a loam surface layer and are underlain by friable to firm clay loam glacial till. These soils are moderately permeable in the upper part and moderately slowly permeable in the underlying material. Available water capacity is high, and the shrink-swell potential is moderate.

Williams soils are the most extensive of the minor soils. They are on the lower parts of the landscape. Williams soils are deeper over lime than Vida and Zahl soils. Other minor soils in this unit are the moderately well drained Bowbells soils in swales, the silty Eakin and Highmore soils on smooth rises in the less steep parts of the unit, and the poorly drained Hoven and Tetonka soils and very poorly drained Parnell soils in closed depressions.

Over half of the acreage of this unit remains in native grass and is used for range. Cultivated crops are grown mainly in the scattered areas of less steep soils throughout the unit. Runoff is medium to rapid, and water collects in the swales and closed depressions. Controlling erosion and conserving moisture are the main concerns of management.

This unit has good to fair potential for range and rangeland wildlife. An adequate grass cover and ground mulch help to improve the moisture supply for range plants. A large acreage of this unit has poor potential for cultivated crops, pasture, and windbreaks because of steep slopes, stoniness, and erodibility. Vida soils that have slopes of less than 9 percent and some of the minor soils have fair to good potential for crops, pasture, and windbreaks. Because slopes generally are too irregular for contour farming, close-sown crops are better suited than row crops. This unit has poor to fair potential for most urban and recreation uses, depending upon the slope at a given site.

8. Raber-Highmore

Deep, well drained, gently sloping to rolling loamy and silty soils formed in glacial till and glacial drift on uplands

The landscape of this unit is a glacial till plain that in places is mantled with silty glacial drift. Slopes are smooth in the mostly gently sloping areas of silty drift, but are short and convex in the undulating to rolling areas of till. There are a few scattered closed depressions. Glacial stones are on some of the ridges.

This unit makes up about 4 percent of the county. It is about 45 percent Raber soils, 35 percent Highmore soils, and 20 percent minor soils.

Raber soils generally are on the higher parts of the landscape above Highmore soils, but in some areas they are below Highmore soils. They have a loam surface layer and a firm clay loam subsoil and are underlain by glacial till. Highmore soils have a silt loam surface layer and a friable silty clay loam subsoil and are underlain by silt loam to a depth of 40 inches or more. In the Raber soils, permeability is moderately slow or slow, the shrink-swell potential is high, and available water capacity is moderate to high. In the Highmore soils, permeability is moderate, the shrink-swell potential is moderate, and available water capacity is high.

Gettys soils are the most extensive of the minor soils. They are on the tops and upper sides of hills and ridges. They are shallower over lime than Raber soils. Other minor soils in this unit are the moderately well drained Demky and Mobridge soils in swales, the Eakin soils intermingled with Highmore soils, and the poorly drained

Hoven and Tetonka soils in closed depressions. Also, clayey Opal soils are on the sides of entrenched drainageways that cut back into the southern part of this unit.

About 55 percent of the acreage of this unit is used for cultivated crops. The rest of the acreage mostly remains in native grass and is used for range. Runoff is mostly medium. Controlling erosion and conserving moisture are the main concerns of management.

This unit has good potential for range and rangeland wildlife and fair to good potential for cultivated crops, pasture, windbreaks, and openland wildlife. Where slopes are less than 6 percent, measures that overcome the limitations of the major soils are easy to apply. These soils have fair to poor potential for most urban uses and fair to good potential for most recreation uses.

Soil maps for detailed planning

The kinds of soil (map units) shown on the detailed soil maps at the back of this publication are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each soil is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the unit on the detailed soil map. Each map unit description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated and the management concerns and practices needed are discussed.

A soil map unit represents an area on the landscape and consists mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map at the back of this publication are phases of soil series.

Soils that have similar profiles make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. All the soils in the United States having the same series name have essentially the same properties that affect their use and their response to management practices.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristic that affects the use of the soils. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Highmore silt loam, 0 to 2 percent slopes, is one of several phases within the Highmore series.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. The soils that are included in mapping are described in each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Gravel pits is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each mapping unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of Tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

AgA—Agar silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregularly shaped and range from 5 to 400 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsoil is friable silty clay loam about 20 inches thick. It is dark brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and contains spots and streaks of lime that extend into the underlying material. The underlying material is pale brown, calcareous silt loam. In places the subsoil contains less clay than is typical for Agar soils.

Included with this soil in mapping were small areas of Hoven, Mobridge, and Tetonka soils, which make up less than 15 percent of any one mapped area. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size. The moderately well drained Mobridge soils are in swales.

The content of organic matter is moderate, and fertility is medium. The surface layer is easy to work, but has a tendency to crust after hard rains. Permeability is moderate. The shrink-swell potential is moderate. Runoff is slow, and available water capacity is high.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing or hay. The soil has good potential for crops, pasture, range, trees and shrubs, openland and rangeland wildlife, and most recreation uses. It has fair potential for most engineering uses.

This soil is well suited to small grain and corn and to grasses and legumes for hay and pasture. The water erosion hazard is slight. The risk of soil blowing is slight to moderate if the soil is bare during winter and spring. A periodic shortage of moisture is the main limitation for crops. Stubble mulch, crop residue management, and minimum tillage help in conserving moisture, controlling soil blowing, and maintaining fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing and conserve moisture.

All climatically suited pasture plants grow well on this soil. Using this soil for tame pasture or hay is an effective way of controlling soil blowing. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition.

All kinds of windbreaks are well suited to this soil. All climatically suited trees and shrubs grow well on this soil because the root zone is deep and available water capacity is high. A year of fallow prior to planting helps to conserve needed moisture.

This soil is suitable for building site development and for onsite waste disposal if proper design and proper installation procedures are used. It lacks sufficient strength and stability to support vehicular traffic, but this limitation can be overcome by strengthening the base material. The moderate permeability is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the filter field. Seepage from sewage lagoons can be prevented by sealing the bottom of the lagoon.

This soil has good potential for irrigation because of the nearly level slope, the deep root zone, the high available water capacity, and a moderately slow water intake rate. Capability unit IIc-2; Silty range site.

AgB—Agar silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregularly shaped and range from 5 to 600 acres in size. Slopes are convex, long, and smooth.

Typically, the surface layer is dark gray silt loam about 6 inches thick. The subsoil is friable silty clay loam about 18 inches thick. It is dark brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and contains spots and streaks of lime that extend into the underlying material. The underlying material is pale brown, calcareous silt loam. In places the subsoil contains less clay than is typical for Agar soils.

Included with this soil in mapping were small areas of Hoven, Mobridge, and Tetonka soils, which make up less than 15 percent of any one mapped area. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size. The moderately well drained Mobridge soils are in swales.

The content of organic matter is moderate, and fertility is medium. The surface layer is easy to work, but has a tendency to crust after hard rains. Permeability is moderate. The shrink-swell potential is moderate. Runoff is medium, and available water capacity is high.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing or hay. The soil has good potential for crops, pasture, range, trees and shrubs, openland and rangeland wildlife, and most recreation uses. It has fair potential for most engineering uses.

This soil is well suited to small grain and corn and to grasses and legumes for hay and pasture. The main limitations are periodic shortages of moisture and, if the soil is bare, a moderate hazard of water erosion and a slight to moderate risk of soil blowing. Stubble mulch, crop residue management, minimum tillage, and grassed waterways help to control water erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Slopes generally are long enough to be terraced and contour farmed. Wind stripcropping and field windbreaks are effective in controlling soil blowing.

All climatically suited pasture plants grow well on this soil. Using the soil for tame pasture or hay is an effective way of controlling water erosion and soil blowing. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

The natural plant cover on this soil is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps in keeping the range in good condition. Pasture furrowing and range seeding improve the range condition.

All kinds of windbreaks are well suited to this soil. All climatically suited trees and shrubs grow well because the root zone is deep and available water capacity is high. A year of fallow prior to planting helps to store needed moisture.

This soil is suitable for building site development and for onsite waste disposal if proper design and proper installation procedures are used. It lacks sufficient strength and stability to support vehicular traffic, but this limitation can be overcome by strengthening the base material. The moderate permeability is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the filter field. Seepage from sewage lagoons can be prevented by sealing the bottom of the lagoon.

This soil has good potential for irrigation because of the deep root zone, the high available water capacity, and a moderately slow water intake rate. Capability unit IIe-1; Silty range site.

AgC—Agar silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are convex and mostly long and smooth.

Typically, the surface layer is dark gray silt loam about 5 inches thick. The subsoil is friable silty clay loam about 14 inches thick. It is dark brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and contains spots and streaks of lime that extend into the underlying material. The underlying material is pale brown, calcareous silt loam. In places the subsoil contains less clay than is typical for Agar soils.

Included with this soil in mapping were small areas of Gettys, Mobridge, and Sully soils, which make up less than 15 percent of any one mapped area. Gettys and Sully soils are on the tops and upper sides of low hills and ridges. They have a thinner surface layer than this Agar soil and are calcareous at or near the surface. The moderately well drained Mobridge soils are in swales and along drainageways.

The content of organic matter is moderate, and fertility is medium. The surface layer is easy to work, but has a tendency to crust in cultivated fields after hard rains. Permeability is moderate. The shrink-swell potential is moderate. Runoff is medium, and available water capacity is high.

Some areas of this soil are farmed. Many areas remain in native grass and are used for grazing or hay. The soil has good potential for crops, pasture, range, trees and shrubs, and rangeland wildlife. The potential for most recreation uses is good, but the potential for playgrounds is poor. The potential for most engineering uses is fair to poor.

This soil is well suited to small grain and corn and to grasses and legumes for hay and pasture. The main limitations are a severe hazard of water erosion and a slight to moderate risk of soil blowing if the soil is bare. Stubble mulch, crop residue management, mimimum tillage, and grassed waterways help to control water erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Contour farming and terracing help to control water erosion and conserve moisture, especially if row crops are grown. Wind stripcropping and field windbreaks also help to control soil blowing and conserve moisture.

All climatically suited pasture plants can be grown on this soil, but bunch-type species that are planted alone should be avoided because the hazard of water erosion is severe. Using this soil for tame pasture or hay is an effective way of controlling water erosion and soil blowing. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

The natural plant cover on this soil is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pasture furrowing and range seeding improve the range condition.

All kinds of windbreaks are well suited to this soil. All climatically suited trees and shrubs grow well because the root zone is deep and available water capacity is high. A year of fallow prior to planting conserves needed moisture. Planting on the contour also conserves moisture.

This soil is suitable for building site development and for onsite waste disposal if proper design and proper installation procedures are used. It lacks sufficient strength and stability to support vehicular traffic, but this limitation can be overcome by strengthening the base material. The moderate permeability is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the filter field. The slope severely limits the use of this soil for sewage lagoons. Generally, more desirable alternative sites can be selected. The slope also limits the use of this soil for gravity irrigation, but the soil is suitable for sprinkler irrigation. Capability unit IIIe-1; Silty range site.

AkA—Akaska silt loam, 0 to 2 percent slopes. This well drained, nearly level soil is on uplands and terraces. Areas are irregularly shaped and range from 10 to 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsoil is friable silty clay loam about 19 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and contains spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 34 inches is light brownish gray, calcareous silt loam. Below this is varicolored sand and gravel. In places the subsoil contains more sand than is typical for Akaska soils. In places the depth to sand and gravel is slightly more than 40 inches, and in a few places it is slightly less than 20 inches.

Included with this soil in mapping were small areas of Mobridge and Tetonka soils, which make up less than 10 percent of any one mapped area. The moderately well drained Mobridge soils are in swales. The poorly drained Tetonka soils are in closed depressions less than 5 acres in size.

The content of organic matter is moderate, and fertility is medium. The soil is easy to work, but has a tendency to crust after hard rains. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Runoff is slow, and available water capacity is moderate. The underlying sand and gravel restricts root growth, and the soil is somewhat droughty.

Most areas of this soil are farmed. Some remain in native grass and are used for grazing or hay. The soil has fair potential for crops, pasture, and openland wildlife and good potential for range, rangeland wildlife, and most recreation uses. It has fair to poor potential for windbreaks and most engineering uses. It is a fair source of sand and gravel for use in construction.

This soil is suited to small grain and corn and to grasses and legumes for hay and pasture. Early maturing small grain is better suited than late-maturing row crops. The hazard of water erosion is slight, and the risk of soil

blowing is slight to moderate. Conserving moisture is the main concern of management. Stubble mulch, crop residue management, and minimum tillage help to conserve moisture, control soil blowing, and maintain fertility and tilth. Wind stripcropping also helps to control soil blowing.

The choice of pasture plants and forage production are limited by the moderate depth to sand and gravel. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

The natural plant cover on this soil is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition.

Windbreaks and other types of trees and shrubs are poorly suited to this soil. Farmstead windbreaks and other trees and shrubs can be planted, however, if supplementary moisture is provided or if optimum survival and growth are not required or expected.

This soil is suitable for building site development and for onsite waste disposal if proper design and proper installation procedures are used. It is well suited to septic tank absorption fields, but the rapid permeability of the underlying sand and gravel can result in pollution of shallow ground water. Seepage is a problem if the soil is used for sewage lagoons and sanitary landfills, but this problem can be solved by lining the cuts with less permeable material. If used as a base for roads and streets, the soil can be mixed with the underlying sand and gravel to increase its strength and stability. If the soil is used for buildings without basements, providing a gravel base can prevent damage from shrinking and swelling.

This soil is well suited to irrigation (fig. 4) because of the nearly level slopes, a moderately slow water intake rate, and good subdrainage provided by the underlying sand and gravel. Capability unit IIIs-2; Silty range site.

AkB—Akaska silt loam, 2 to 6 percent slopes. This well drained, gently sloping soil is on uplands and terraces. Areas are irregularly shaped and range from 5 to 400 acres. Slopes are convex, moderately long, and smooth.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsoil is friable silty clay loam about 17 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and contains spots and streaks of time that extend into the underlying material. The underlying material to a depth to 32 inches is light brownish gray, calcareous silt loam. Below this is varicolored sand and gravel. In places the subsoil contains more sand. In places the depth to sand and gravel is slightly less than 20 inches; in a few places it is more than 40 inches.

Included in mapping were small areas of Mobridge and Tetonka soils, which make up less than 15 percent of any one area. The moderately well drained Mobridge soils are in swales. The poorly drained Tetonka soils are in closed depressions less than 5 acres in size.

The content of organic matter is moderate, and fertility is medium. The soil is easy to work, but has a tendency to crust after hard rains. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Runoff is medium, and available water capacity is moderate. The underlying sand and gravel restricts roots, and the soil is somewhat droughty.

Most areas are farmed. Some remain in native grass and are used for grazing or hay. The soil has fair potential for crops, pasture, and openland wildlife and good potential for range, rangeland wildlife, and most recreation uses. It has fair to poor potential for windbreaks and most engineering uses. It is a fair source of sand and gravel for construction.

This soil is suited to small grain and corn and to grasses and legumes for hay and pasture. Early maturing small grain is better suited than late-maturing row crops. The hazard of water erosion is moderate, and the risk of soil blowing is slight to moderate during winter and spring. Controlling water erosion and soil blowing and conserving moisture are the main concerns of management. Stubble mulch, crop residue management, minimum tillage, and contour farming help to control water erosion and conserve moisture. Wind stripcropping helps to control soil blowing.

The choice of pasture plants and forage production are limited by the depth to sand and gravel. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

The natural plant cover is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help to keep the range in good condition. Pasture furrowing and range seeding improve the range condition.

Windbreaks are poorly suited to this soil. The soil can be used for farmstead windbreaks and other types of trees and shrubs if supplementary moisture is provided or if optimum survival and growth are not required or expected.

This soil is suitable for building site development and onsite waste disposial if proper design and installation procedures are used. It is well suited to septic tank absorption fields, but there is danger of polluting shallow ground water. Seepage is a problem for sewage lagoons and sanitary landfills, but this problem can be solved by lining the cuts with less permeable material. If used as a base for roads and streets, the soil can be mixed with the underlying sand and gravel to increase its strength and stability. If the soil is used for buildings without basements, providing a gravel base can prevent damage from shrinking and swelling.

This soil responds well to irrigation. Good subdrainage is provided by the underlying sand and gravel. The water intake is moderately slow. Capacity unit III-6; Silty range site.

Ao—Aquolls. This mapping unit consists of deep, very poorly drained, level soils in marshy areas (fig. 5) in closed depressions and along the edges of lakes. Areas are irregularly shaped or long and narrow and range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray loam or silt loam, but it ranges from fine sandy loam to clay. In places the surface layer is covered with a thin layer of partly decomposed organic matter. The underlying material ranges from fine sand to clay and commonly is stratified with finer or coarser material.

These soils are covered with water during the growing season in most years. During wet years the water is as much as 3 feet deep.

These soils are used mainly as habitat for waterfowl and amphibious animals. Deer, pheasant, and other wildlife frequent the edges of areas of these soils. The soils have a good potential for wetland wildlife. Under natural conditions, they generally have poor to fair potential for range and rangeland wildlife. They generally are not suited to crops, pasture, windbreaks, and most recreation and engineering uses.

The native vegetation commonly is aquatic plants, such as cattails, rushes, and sedges. Small bodies of open water commonly are interspersed throughout areas of these soils. Tall, coarse grasses are in some of the less wet areas, but typically less than 50 percent of the vegetation is suitable for grazing by domestic livestock.

Drainage of these soils generally is not feasible because of the lack of available outlets. Features generally are favorable, however, for the construction of ground water dugouts. Capability unit VIIIw-1; cannot be assigned to range site unless drainage is improved.

Ar—Arveson sandy loam, wet. This deep, poorly drained, nearly level soil is along sluggish upland drainageways. It is subject to flooding. Areas are long and narrow and range from 10 to 125 acres in size.

Typically, the surface layer is dark gray, calcareous sandy loam about 13 inches thick. Below this is 8 inches of light brownish gray, very friable sandy loam that has a high content of lime. The underlying material is light brownish gray, calcareous sand.

Included with this soil in mapping were small areas of Hecla, Maddock, and Yecross soils, which make up less than 15 percent of any one mapped area. These soils are on slight rises. They are better drained, contain more sand, and are less calcareous than Arveson soils.

The content of organic matter is moderate, and fertility is medium. Permeability is moderately rapid in the upper 21 inches and rapid in the underlying sand. Available water capacity is moderate, and runoff is very slow. The water table is at or near the surface early in the growing season.

All areas remain in native grass and are used as range. In dry years some areas are in hay. This soil has good potential for range, fair potential for wetland and rangeland wildlife, and poor potential for crops, pasture plants, windbreaks, recreation uses, and most engineering uses.

If this soil is used as range, it can produce a luxuriant stand of tall prairie grasses. Under continuous overgrazing, however, tall grasses can decrease and be replaced by less productive sedges, Kentucky bluegrass, other short grasses, and unpalatable weeds. A planned grazing system that includes proper grazing use and no grazing during wet periods helps to keep the range in good or excellent condition. Mechanical treatment generally is not feasible because of wetness.

This soil generally is not suited to crops and pasture plants because of wetness. If the soil is adequately drained, late-planted crops can be grown, but the soil blowing hazard is severe in disturbed areas and the availability of plant nutrients is affected by the high content of lime. The choice of pasture plants is limited to water-tolerant species.

Windbreaks that are commonly planted by machinery are not suited to this soil. Trees and shrubs that can tolerate wetness can be grown.

This soil generally is not suitable for building site development and onsite waste disposal because of wetness from the high water table and flooding. Some areas can be drained if outlets are available, but alternative sites are generally less costly. Capability unit Vw-3; Subirrigated range site.

Bn—Bon loam. This deep, moderately well drained and well drained, nearly level soil is on low terraces and bottom land (fig. 6). Areas are long and irregular in shape and range from 5 to 350 acres in size. Slopes are smooth and are plane to concave.

Typically, the surface layer is very friable loam about 27 inches thick. It is dark gray and grayish brown in the upper part and dark grayish brown and dark gray in the lower part. The underlying material is grayish brown and dark gray, calcareous clay loam. On some of the terraces, a subsoil of clay loam or silty clay loam is within a depth of 15 inches. On slight rises the surface layer is thinner than is typical for Bon soils.

Included with this soil in mapping were small areas of Parshall and Tetonka soils, which make up less than 10 percent of any one mapped area. Parshall soils have a texture of fine sandy loam. They commonly are near the stream channel. The poorly drained Tetonka soils are in low wet spots.

Tilth is good, and fertility and the content of organic matter are high. Available water capacity is high, and permeability is moderate. Runoff is slow. Most areas receive additional moisture from stream flooding and from runoff that flows in from adjacent upland soils.

Most areas of this soil are farmed. Some remain in native grass and are used for grazing or hay. This soil has good potential for crops, pasture, range, trees and shrubs, and openland wildlife. It has fair potential for recreation uses. The potential for engineering uses is poor.

This soil is well suited to all crops grown in the county. Small grain, corn, and alfalfa are the main crops. The soil is easy to work, and the risks of erosion and soil blowing are slight. Spring tillage is delayed in some years by temporary wetness, but the main limitation for crops is the lack of moisture during dry years. Stubble mulch, crop residue management, and minimum tillage help to conserve moisture, control soil blowing, and maintain fertility and tilth. Wind stripcropping and field windbreaks help to

control soil blowing in some of the broader areas of this soil.

All climatically suited pasture plants grow well on this soil. Because moisture is favorable, forage production is better on this soil than on upland soils. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control are effective in keeping the pasture in good condition.

The natural plant cover on this soil is mainly tall and mid grasses and some clumps of native trees along the channels of streams or drainageways. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less desirable short grasses. Kentucky bluegrass becomes dominant in areas subject to continuous overgrazing. A planned grazing system that includes proper grazing use helps to keep the range in excellent or good condition. Range seeding is applicable in areas in poor range condition. Water spreading helps to increase production in areas used for native hay.

All kinds of windbreaks are well suited to this soil. All climatically suited trees and shrubs can grow well.

This soil is suited to most recreation uses despite inconveniences caused by seasonal wetness. Generally, it should not be used for camp areas unless it is adequately protected against flooding.

Potential flooding severely limits this soil for most engineering uses. Buildings and sewage disposal systems can be constructed in some areas that are protected against flooding. Sealing treatment reduces the hazard of excessive seepage from pond reservoir areas and sewage lagoons. Effluent from septic tank absorption fields can pollute ground water and surface water. Roads and streets should be elevated above expected flood levels.

This soil responds well to irrigation if the irrigated site is protected against damaging floods. Some areas are well suited to water spreading for increased native hay or tame hay production. Capability unit IIc-3; Overflow range site.

BoA—Bowbells loam, 0 to 3 percent slopes. This deep, moderately well drained, nearly level soil is in upland swales. Areas are long and irregularly shaped and range from 5 to 150 acres in size. Slopes are slightly concave.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsoil is dark grayish brown, firm clay loam about 18 inches thick. The underlying material is light brownish gray, calcareous clay loam. On the edges of some mapped areas, the surface layer and subsoil are lighter colored than is typical and the soil is well drained.

Included with this soil in mapping were small areas of Hoven, Parnell, and Tetonka soils, which make up as much as 15 percent of some mapped areas. These poorly drained and very poorly drained soils are in closed depressions less than 5 acres in size.

Tilth is good, and fertility and the content of organic matter are high. Available water capacity is high. Permeability is moderate in the subsoil and moderately slow in the underlying material. The shrink-swell potential is moderate below the surface layer. Runoff is slow, and most areas receive runoff from adjacent soils.

Most areas of this soil are farmed. Some remain in native grass and are used for grazing and hay. This soil has good potential for crops, pasture, range, trees and shrubs, and openland wildlife. It has fair to good potential for most recreation and engineering uses if sites are protected against local flooding.

This soil is well suited to small grain, corn, alfalfa, and other crops. The hazards of water erosion and soil blowing are slight. Spring tillage is delayed in some years by temporary wetness, but the main limitation for crops is the lack of moisture during dry years. Stubble mulch, crop residue management, and minimum tillage help to conserve moisture, control soil blowing, and maintain fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing.

All climatically suited pasture plants grow well on this soil. Forage production is better on this soil than on adjacent upland soils. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

The natural plant cover is tall and mid grasses. If the range is overgrazed, the taller, more desirable plants lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition.

This soil is well suited to all kinds of windbreaks. All climatically suited trees and shrubs can grow well because of the deep root zone, the high available water capacity, and a position on the landscape that results in favorable moisture.

If buildings are constructed on this soil, artificial drainage around the buildings and proper design of foundations and footings help to prevent structure damage caused by shrinking and swelling. Local roads should be graded to shed water, and suitable base material should be hauled in. Limitations are slight for sewage lagoons and sanitary landfills if runoff is diverted by dikes. The limitation for septic tank absorption fields is severe because of a slow percolation rate and flooding, but this limitation can be overcome by enlarging the absorption field and protecting it against flooding. Capability unit IIc-3; Overflow range site.

BwA—Bowdle loam, 0 to 2 percent slopes. This well drained, nearly level soil is on uplands and terraces. It is underlain by sand and gravel. Areas are irregularly shaped and range from 10 to 900 acres in size. Slopes are smooth and plane to slightly convex.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil is dark grayish brown, friable loam about 14 inches thick. The underlying material to a depth of 25 inches is dark grayish brown, calcareous gravelly loam. Below this is varicolored, calcareous sand and gravel. In places the soil is more silty than is typical, and in places the depth to sand and gravel is slightly less than 20 inches.

Included with this soil in mapping were small areas of Tetonka and Williams soils, which make up less than 10 percent of any one mapped area. The poorly drained Tetonka soils are in closed depressions less than 5 acres in size. Williams soils are on very slight rises and are underlain by clay loam glacial till.

Fertility and the content of organic matter are high. Available water capacity is moderate, and the soil is somewhat droughty. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Runoff is slow.

Most areas of this soil are farmed. The soil has fair potential for crops, tame pasture, and openland wildlife. It has good potential for range, rangeland wildlife, recreation uses, and many engineering uses. The potential for trees and shrubs is poor. This soil is a fair source of sand and gravel. It has good potential for irrigation if an adequate supply of water is available.

This soil is suited to small grain, corn, alfalfa, and other crops. Unless the soil is irrigated, an early maturing crop, such as small grain, is better suited than a late-maturing crop, such as corn. Droughtiness is the main limitation of this soil for crops. Also, the hazard of soil blowing is moderate. Stubble mulch, crop residue management, and wind stripcropping help to conserve moisture, control soil blowing, and maintain fertility and tilth.

Using the soil for tame pasture and hay is an effective way to control soil blowing. The choice of pasture plants and the amount of forage produced are limited by the moderate available water capacity. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

The natural plant cover on this soil is mainly a mixture of mid and short grasses. If the range is overgrazed, plant vigor is reduced and the taller, more desirable plants are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pond sites are scarce, and shallow wells are more satisfactory as a source of livestock water.

This soil is poorly suited to trees and shrubs because it is somewhat droughty. It can be used for farmstead windbreaks and other kinds of trees and shrubs if optimum survival and growth are not required or expected. Providing extra water helps to overcome the droughtiness.

This soil is well suited to most recreation and engineering uses. Cutbanks in shallow excavations tend to cave in, however, and seepage from onsite waste disposal systems can pollute shallow ground water. Sealing the bottom and sides of sewage lagoons reduces the hazard of seepage.

This soil has good internal drainage and responds well to irrigation. The length of runs and the frequency of irrigation are affected by the moderate available water capacity and the rapid permeability of the underlying sand and gravel. Capability unit IIIs-2; Silty range site.

BwB—Bowdle loam, 2 to 6 percent slopes. This well drained, gently sloping soil is on uplands and terraces. It is underlain by sand and gravel. Areas are irregularly shaped and range from 10 to 600 acres in size. Slopes are smooth and convex.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, friable loam about 14 inches thick. The underlying material to a depth of 25 inches is dark grayish brown, calcareous loam. Below this is varicolored, calcareous sand and gravel. In a few places the soil is more silty than is typical for Bowdle soils. On the higher parts of the landscape, the depth to sand and gravel is slightly less than 20 inches.

Included with this soil in mapping were small areas of Tetonka and Williams soils, which make up less than 10 percent of any one mapped area. The poorly drained Tetonka soils are in closed depressions less than 5 acres in size. Williams soils are underlain by clay loam glacial till.

Fertility and the content of organic matter are high. Available water capacity is moderate, and the soil is somewhat droughty. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Runoff is medium.

Most areas of this soil are farmed. The soil has fair potential for crops, tame pasture, and openland wildlife. It has good potential for range, rangeland wildlife, and most recreation and engineering uses. The potential for trees and shrubs is poor. The soil is a fair source of sand and gravel for use in construction. It responds well to irrigation if an adequate supply of water is available.

This soil is suited to small grain, corn, alfalfa, and tame grasses. If the soil is dry-farmed, early maturing small grain is better suited than corn. The second growth of alfalfa is limited in most years. Controlling erosion and soil blowing and conserving moisture are the main management concerns if this soil is cultivated. Stubble mulch, crop residue management, contour farming, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth.

Using this soil for tame pasture and hay is an effective way of controlling erosion and soil blowing. Forage production and the choice of plants are affected by the moderate available water capacity. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

The natural plant cover on this soil is mainly mid and short grasses. If the range is overgrazed, plant vigor is reduced and the more desirable, taller grasses are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pasture furrowing and range seeding improve pastures that are in poor condition. Shallow wells are more satisfactory than ponds as a source of livestock water.

This soil is poorly suited to trees and shrubs because it is somewhat droughty. It can be used for farmstead windbreaks and other kinds of trees and shrubs if optimum survival and growth are not required or expected. Plant-

ing on the contour and providing supplementary water from other sources help to overcome the droughtiness.

This soil is well suited to most recreation and engineering uses. Cutbanks in shallow excavations tend to cave in, however, and seepage from onsite waste disposal systems can pollute ground water. Sealing the bottom and sides of sewage lagoons reduces the hazard of seepage.

This soil has good internal drainage and responds well to irrigation. The length of runs and the frequency of irrigation are affected by the moderate available water capacity and the rapid permeability in the underlying material. Capability unit IIIe-6; Silty range site.

BxB—Bowdle-Wabek loams, 2 to 6 percent slopes. This map unit consists of well drained and excessively drained, undulating soils that are underlain by sand and gravel. These soils are on uplands and terraces. Areas are irregularly shaped and range from 5 to 200 acres in size. Slopes are short and convex.

This map unit is about 55 percent Bowdle soil and 35 percent Wabek soil. These soils are so intricately mixed that it was not practical to separate them in mapping. The Bowdle soil is on the middle and lower parts of the landscape. The Wabek soil is on the tops and upper sides of ridges and knolls. In places stones and pebbles are on the surface of the Wabek soil.

Typically, the Bowdle soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, friable loam about 14 inches thick. The underlying material to a depth of about 25 inches is dark grayish brown, calcareous gravelly loam. Below this is varicolored, calcareous sand and gravel. In a few places the soil is more silty than is typical for Bowdle soils, and in places the depth to sand and gravel is slightly less than 20 inches. In some swales and low areas, the underlying sand and gravel is stratified with loamy to clayey material.

Typically, the Wabek soil has a surface layer of dark grayish brown loam about 5 inches thick. The next layer is dark grayish brown, loose, calcareous gravelly sandy loam about 5 inches thick. Varicolored, calcareous sand and gravel is at a depth of 10 inches.

Included with these soils in mapping were small areas of poorly drained Tetonka soils, which make up less than 10 percent of any one mapped area. These Tetonka soils are in closed depressions less than 5 acres in size.

Fertility and the content of organic matter are high in the Bowdle soil, but fertility is low and the content of organic matter is moderately low in the Wabek soil. Available water capacity is moderate in the Bowdle soil and low in the Wabek soil. Permeability is moderate in the upper part of the Bowdle soil and moderately rapid in the upper part of the Wabek soil. It is rapid in the underlying sand and gravel of both soils. Runoff is medium on the Bowdle soil and slow on the Wabek soil.

Some areas of this map unit are farmed, and some remain in native grass and are used for range. The Bowdle soil has fair potential for crops, tame pasture, openland wildlife, and trees and shrubs and good potential for range, rangeland wildlife, and most recreation and engineering uses. The Wabek soil has fair potential for recreation uses, good potential for some engineering uses, and poor potential for all other uses. The Bowdle soil responds well to irrigation, but the Wabek soil has poor potential for irrigated crops.

Cultivated areas of this map unit are used for small grain, corn, alfalfa, and tame grasses, but crop growth is affected by the droughtiness of the Wabek soil. Small grain and tame grasses are better suited than corn and alfalfa. Conserving moisture and controlling erosion and soil blowing are the major problems. Stubble mulch and crop residue management help to conserve moisture and prevent excessive soil losses. In most areas slopes are too irregular for contour farming. Wind stripcropping helps to control soil blowing. The Wabek soil generally is not suitable for farming. In the many areas where the Wabek soil is closely intermingled with the Bowdle soil, this map unit is better suited to range or tame pasture.

Establishing tame pasture plants on this map unit is difficult because the Wabek soil is too droughty for most pasture plants. In addition, forage production and the choice of plants on the Bowdle soil are affected by the moderate depth to sand and gravel. If a stand of grass is established, proper stocking rates, rotation grazing, clipping, and weed control help to keep the pasture in good condition.

This map unit is best suited to range. The natural plant cover is mid and short grasses. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supply by reducing runoff. If the range is overgrazed, the taller, more desirable plants lose vigor and are replaced by less productive short grasses. Overgrazing on the Wabek soil results in considerable areas of bare ground and increases the risk of soil blowing. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Proper grazing use is especially important because successful range reseeding is difficult on the Wabek soil.

Field windbreaks are not suited. Farmstead windbreaks and other kinds of trees and shrubs can be planted on the Bowdle soil if optimum survival and growth are not expected or required. Trees and shrubs fail to survive on the Wabek soil unless additional water is applied frequently.

This map unit has slight limitations for buildings, roads and streets, septic tank absorption fields, and most recreation uses. Effluent from septic tank absorption fields and other waste disposal systems, however, can pollute ground water. Sewage lagoons can be constructed on the Bowdle soil if the sides and bottom of the lagoon are sealed. Alternative sites for sanitary landfills and ponds are more practical than the sites on these soils. Generally, irrigating the Wabek soil is not feasible because of the low available water capacity. Both soils are a fair source of sand and gravel. Bowdle soil in capability unit IIIe-6, Silty range site; Wabek soil in capability unit VIs-4, Very Shallow range site.

BxC—Bowdle-Wabek loams, 6 to 9 percent slopes. This map unit consists of well drained and excessively drained, gently rolling soils that are underlain by sand and gravel. These soils are on uplands. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are short and convex.

This map unit is about 50 percent Bowdle soil and 40 percent Wabek soil. These soils are so intricately mixed that it was not practical to separate them in mapping. The Bowdle soil is on the middle and lower parts of the landscape. The Wabek soil is on the tops and upper sides of ridges and knolls. In places stones and pebbles are on the surface of the Wabek soil.

Typically, the Bowdle soil has a surface layer of dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown, friable loam about 12 inches thick. The underlying material to a depth of 25 inches is dark grayish brown, calcareous gravelly loam. Below this is varicolored, calcareous sand and gravel. On the higher parts of the landscape, the subsoil is lighter colored than is typical and the depth to sand and gravel is slightly less than 20 inches. In some swales and low areas, the underlying sand and gravel is stratified with loamy to clayey material.

Typically, the Wabek soil has a surface layer of dark grayish brown loam about 5 inches thick. The next layer is dark grayish brown, loose, calcareous gravelly sandy loam about 5 inches thick. Varicolored, calcareous sand and gravel is at a depth of 10 inches.

Included with these soils in mapping were small areas of Tetonka soils, which make up less than 10 percent of any one mapped area. These poorly drained Tetonka soils are in closed depressions less than 5 acres in size.

Fertility and the content of organic matter are high in the Bowdle soil, but fertility is low and the content of organic matter is moderately low in the Wabek soil. Available water capacity is moderate in the Bowdle soil and low in the Wabek soil. Permeability is moderate in the upper part of the Bowdle soil and moderately rapid in the upper part of the Wabek soil. It is rapid in the underlying sand and gravel of both soils. Runoff is medium on the Bowdle soil and slow on the Wabek soil.

Some areas of this map unit are farmed. Many remain in native grass and are used for range. The Bowdle soil has fair potential for crops, tame pasture, and trees and shrubs and good potential for range and rangeland wildlife. The Wabek soil has poor potential for these uses. Both soils have fair to poor potential for most recreation and engineering uses.

This map unit is best suited to range. The natural plant cover is mid and short grasses. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supply. If the range is overgrazed, the taller, more desirable plants lose vigor and are replaced by less productive short grasses. Overgrazing on the Wabek soil commonly results in considerable areas of bare ground and increases the risk of erosion and soil blowing. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Proper grazing use is especially important because successful range reseeding is difficult on the Wabek soil.

Conserving moisture and controlling erosion and soil blowing are major problems if this map unit is farmed. The Bowdle soil is suited to small grain and tame grasses, but the Wabek soil generally is not suited to crops or tame pasture. Stubble mulch, crop residue management, and wind stripcropping help to conserve moisture and control erosion and soil blowing in cultivated areas. Slopes are too irregular in most areas for contour farming. In most areas, as a result of the pattern of the two soils, it is impractical to farm the Bowdle soil separately or to establish tame pasture.

This map unit generally is not suited to field windbreaks. Farmstead windbreaks and other kinds of trees and shrubs can be planted on the Bowdle soil if optimum survival and growth are not expected or required. Trees and shrubs fail to survive on the Wabek soil unless they are watered frequently.

This map unit can be used for building sites and local roads and streets if the buildings and the roads and streets are properly designed for gently rolling soils. Measures that control erosion and soil blowing generally are needed along graded roads and around excavations for buildings. Septic tank absorption fields function satisfactorily unless the effluent pollutes shallow ground water. This map unit is not suited to sewage lagoons because of the slope and excessive seepage. Alternative sites for sewage lagoons, sanitary landfills, and farm ponds are more practical than the sites on these soils. Both soils are a fair source of sand and gravel. Bowdle soil in capability unit IVe-5, Silty range site; Wabek soil in capability unit VIs-4, Very Shallow range site.

BxD—Bowdle-Wabek loams, 9 to 15 percent slopes. This map unit consists of well drained and excessively drained, rolling soils that are underlain by sand and gravel. These soils are on uplands. Areas are irregularly shaped and range from 5 to 100 acres in size. Slopes are short and convex.

This map unit is about 50 percent Bowdle soil and 40 percent Wabek soil. These soils are so intricately mixed that it was not practical to separate them in mapping. The Bowdle soil is on the middle and lower parts of the landscape. The Wabek soil is on the tops and upper sides of ridges and knolls. In places stones and pebbles are on the surface of the Wabek soil.

Typically, the Bowdle soil has a surface layer of dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown, friable loam about 11 inches thick. The underlying material to a depth of about 25 inches is dark grayish brown, calcareous gravelly loam. Below this is varicolored, calcareous sand and gravel. On the higher parts of the landscape just below areas of Wabek soil, the subsoil is lighter colored than is typical and the depth to sand and gravel is slightly less than 20 inches.

Typically, the Wabek soil has a surface layer of dark grayish brown loam about 5 inches thick. The next layer is dark grayish brown, loose, calcareous gravelly sandy loam about 4 inches thick. Varicolored, calcareous sand and gravel is at a depth of 9 inches.

Included with these soils in mapping were small areas of Tetonka soils, which make up less than 10 percent of any one mapped area. These poorly drained Tetonka soils are in closed depressions less than 5 acres in size.

Fertility and the content of organic matter are high in the Bowdle soil, but fertility is low and the content of organic matter is moderately low in the Wabek soil. Available water capacity is moderate in the Bowdle soil and low in the Wabek soil. Permeability is moderate in the upper part of the Bowdle soil and moderately rapid in the upper part of the Wabek soil. It is rapid in the underlying sand and gravel of both soils. Runoff is medium on the Bowdle soil and slow on the Wabek soil.

Most areas of this map unit remain in native grass and are used for range. The soils have poor potential for crops and for trees and shrubs. The Bowdle soil has fair potential for pasture and good potential for range and rangeland wildlife. The Wabek soil has poor potential for these uses. Both soils have fair to poor potential for most recreation and engineering uses.

This map unit is best suited to range. The natural plant cover is mid and short grasses. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supply. If the range is overgrazed, the taller, more desirable plants lose vigor and are replaced by less productive short grasses. Overgrazing on the Wabek soil generally results in considerable areas of bare ground and increases the risk of erosion and soil blowing. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Proper grazing use is especially important because successful range reseeding is difficult on the Wabek soil.

This map unit generally is not suitable for cultivation because of the severe erosion hazard, the risk of soil blowing, and the droughtiness. The Bowdle soil is suited to tame pasture, but pasture plants grow poorly on the Wabek soil. In most areas pasture plants cannot be grown because of the pattern of the two soils.

Windbreaks that are generally planted by machinery are not suited. Drought-resistant trees and shrubs can be grown if they are planted by hand and given special care.

This map unit can be used for building sites and local roads and streets if the buildings and the roads and streets are properly designed for rolling soils. Measures that control erosion and soil blowing generally are needed along graded roads and around excavations for buildings. Septic tank absorption fields are suitable for waste disposal, but the effluent can pollute ground water. Alternative sites for sewage lagoons, sanitary landfills, and ponds are more feasible than the sites on these soils. Both soils are a fair source of sand and gravel. Bowdle soil in capability unit VIe-5, Silty range site; Wabek soil in capability unit VIIe-6, Very Shallow range site.

Co—Colvin silt loam. This deep, poorly drained, level soil is in swales and basins on uplands. It is subject to flooding in most years. Areas are long and irregularly shaped and range from 10 to 400 acres in size. Slopes are smooth and slightly concave and are less than 1 percent.

Typically, the surface layer is dark gray silt loam about 11 inches thick. The next layer is gray, friable silty clay loam about 13 inches thick. The underlying material is light gray and light brownish gray silty clay loam. The entire profile is calcareous. On the lower lying parts of some areas, the soil is very poorly drained.

Included with this soil in mapping were small areas of Divide and Parnell soils, which make up less than 10 percent of any one mapped area. Divide soils are on very slight rises. They are better drained than this Colvin soil. Parnell soils are in closed depressions less than 5 acres in size. They have a clay subsoil.

Fertility is medium, and the content of organic matter is moderate to high. The availability of plant nutrients is affected by the high content of lime. Available water capacity is high, and permeability is moderately slow. The shrink-swell potential is high. The seasonal high water table is within 1 foot to 3 feet of the surface early in the growing season.

Most areas of this soil remain in native grass and are used for range and hay. The soil has good potential for range and fair potential for pasture and for wetland and rangeland wildlife. Unless drained, it has poor potential for crops, trees and shrubs, recreation uses, and engineering uses.

If used as range, this soil produces a luxuriant stand of tall prairie grasses. The major problems of range management are related to wetness. If the range is overgrazed, the tall grasses are replaced by saltgrass, sedges, and Kentucky bluegrass. Unpalatable weeds increase as a result of trampling by livestock if the range is grazed when the surface is wet. A planned grazing system that includes proper grazing use and a timely deferment of grazing helps to keep the range in good condition. Livestock water is provided by shallow wells and excavated ponds. Many areas in native grass are used as high-producing hay meadows.

This soil is poorly suited to crops unless it is artificially drained. Artificial drainage is not feasible in most areas because good outlets are scarce. Late-planted crops, such as millet and sudangrass, are better suited than small grain. The soil can be used for tame pasture, but the choice of pasture plants is limited to water-tolerant species, such as creeping foxtail, reed canarygrass, and western wheatgrass.

Windbreaks and other kinds of trees and shrubs are suited if water-tolerant species are selected. Trees and shrubs can grow well because the supply of moisture is abundant. Artificial drainage that regulates the water table improves the growing conditions for the trees.

This soil generally is not suitable for dwellings with basements and onsite waste disposal systems. If the soil is protected against flooding and artificial drainage lowers

the water table, other buildings can be constructed. Foundations and footings should be designed to prevent damage from shrinking and swelling of the soil. Local roads should be graded above flood levels, and suitable base material should be hauled in. Capability unit IVw-1; Subirrigated range site.

DeA—Demky loam, 0 to 2 percent slopes. This deep, moderately well drained, nearly level soil is on uplands. Areas are irregularly shaped and range from 5 to 100 acres in size. Slopes are plane to slightly concave.

Typically, the surface layer is dark gray and dark grayish brown loam about 7 inches thick. The next layer is grayish brown clay loam about 2 inches thick. The subsoil is firm heavy clay loam about 14 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam. In places, the surface layer is about 5 inches thick and the subsoil is very firm clay. In a few places the underlying material below a depth of 35 inches is sand and gravel.

Included with this soil in mapping were small areas of Hoven, Mobridge, and Tetonka soils, which make up less than 15 percent of any one mapped area. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size. The Mobridge soils are in shallow swales and have a friable silty clay loam subsoil.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is moderate or high, but the subsoil is a mild claypan that takes in water slowly and releases moisture slowly to plants. Permeability is slow. The shrink-swell potential is high. The surface layer is easy to till, but it crusts after hard rains. Runoff is slow.

Many of the smaller areas of this soil and areas of adjacent soils are farmed. Some of the larger areas remain in native grass and are used for range or hay. The soil has fair potential for crops, tame pasture and hay, trees and shrubs, and openland wildlife and good potential for range and rangeland wildlife. It has fair to good potential for recreation uses and fair to poor potential for most engineering uses.

This soil is suited to corn, small grain, sorghum, alfalfa, and tame grasses. It is better suited to early maturing and drought-resistant crops than to corn. If this soil is used for crops, management problems are related mainly to the claypan subsoil, which restricts the penetration of moisture and plant roots. Also, the risk of soil blowing is slight to moderate if the soil is bare. Stubble mulch, crop residue management, and grasses and legumes in the cropping system improve water intake, conserve moisture, help to control soil blowing, and maintain fertility and tilth. Returning crop residue to the soil reduces soil crusting. Chiseling or subsoiling improves water intake.

This soil is suited to tame pasture plants, but the choice of plants is limited somewhat by the claypan subsoil. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is mainly mid and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Water spreading, which is feasible on this soil, stimulates the growth of cool-season mid grasses. Range seeding improves range that is in poor condition.

Windbreaks and other kinds of trees and shrubs are moderately well suited to this soil. The expected height is no more than 25 feet. A year of fallow generally is a necessary part of site preparation.

If buildings are constructed on this soil, properly designing foundations and footings and keeping runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soil. Local roads should be graded to shed water, and suitable base material should be hauled in. Sewage lagoons are the most satisfactory means of waste disposal. Capability unit IIIs-1; Clayey range site.

DeB—Demky loam, 2 to 6 percent slopes. This deep, moderately well drained, gently sloping soil is on uplands. Areas are irregularly shaped and range from 5 to 250 acres in size. Slopes are plane to slightly convex. A few stones are on the surface on the tops of ridges and knolls.

Typically, the surface layer is dark gray and dark grayish brown loam about 6 inches thick. The next layer is grayish brown clay loam about 2 inches thick. The subsoil is firm heavy clay loam about 12 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam. In places, the surface layer is 5 inches or less thick and the subsoil is very firm clay.

Included with this soil in mapping were small areas of Hoven, Mobridge, and Tetonka soils, which make up less than 15 percent of any one mapped area. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size. The Mobridge soils are in swales. They have a friable silty clay loam subsoil.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is moderate or high, but the subsoil is a mild claypan that takes in water slowly and releases moisture slowly to plants. Permeability is slow. The shrink-swell potential is high. The surface layer is easy to till, but it tends to crust after hard rains. Runoff is medium.

Many of the smaller areas of this soil are farmed together with areas of adjacent soils. Some of the larger areas remain in native grass and are used for range or hay. The soil has fair potential for crops, tame pasture and hay, trees and shrubs, and openland wildlife and good potential for range and rangeland wildlife. It has fair to

good potential for recreation uses and fair to poor potential for most engineering uses.

This soil is suited to corn, small grain, sorghum, alfalfa, and tame grasses. It is better suited to early maturing and drought-resistant crops than to corn. The claypan subsoil takes in water slowly and releases moisture slowly to plants. If this soil is used for crops, the risks of erosion and soil blowing are moderate. Stubble mulch, crop residue management, grassed waterways, and grasses and legumes in the cropping system help to control erosion and soil blowing, improve water intake, conserve moisture, and maintain fertility and tilth. In some areas where slopes are long enough, terracing and contour farming also help to control erosion and conserve moisture. Chiseling or subsoiling improves water intake.

This soil is suited to tame pasture plants, but the choice of plants is limited somewhat by the claypan subsoil. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is mainly mid and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Water spreading, which is feasible in some areas, stimulates the growth of cool-season mid grasses. Pasture furrowing and range seeding improve range that is in poor condition.

Windbreaks and other kinds of trees and shrubs are moderately well suited to this soil. The expected height is no more than 25 feet. A year of fallow commonly is a necessary part of site preparation.

If buildings are constructed on this soil, properly designing foundations and footings and keeping runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soil. Local roads should be graded to shed water, and suitable base material should be hauled in. Sewage lagoons are the most satisfactory means of waste disposal. Capability unit IIIe-3; Clayey range site.

DgA—Demky-Jerauld complex, 0 to 2 percent slopes. This map unit consists of deep, moderately well drained, nearly level soils that have a claypan subsoil. These soils are on uplands. Areas are irregularly shaped and range from 5 to 150 acres in size. The surface is uneven because low mounds rise a few inches above intervening low spots. In places a few stones are on the surface.

This map unit is about 50 percent Demky loam and 30 percent Jerauld silt loam. These soils are so closely intermingled that it was not possible to separate them in mapping. The Demky soil is on low mounds. The Jerauld soil is in low spots that commonly are less than 15 feet in diameter.

Typically, the Demky soil has a surface layer of dark gray and dark grayish brown loam about 7 inches thick. The next layer is grayish brown clay loam about 2 inches thick. The subsoil is firm heavy clay loam about 14 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam.

Typically, the Jerauld soil has a surface layer of gray silt loam about 2 inches thick. The subsoil is firm silty clay about 14 inches thick. It is dark grayish brown in the upper 9 inches and grayish brown in the lower 5 inches. The lower 5 inches is calcareous and has spots and streaks of salts that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam.

Included with these soils in mapping were small areas of Durrstein, Hoven, and Tetonka soils, which make up less than 20 percent of most mapped areas. The poorly drained Durrstein soils are in some of the low spots on the lower part of the landscape. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size.

Fertility is medium in the Demky soil. Crop growth on the Jerauld soil is affected by the content of salts. Available water capacity is moderate or high in the Demky soil and low to moderate in the Jerauld soil. The claypan subsoil, especially in the Jerauld soil, takes in water slowly and releases moisture slowly to plants. Permeability is slow to very slow in both soils, and the shrink-swell potential is high. The Jerauld soil has poor tilth and is difficult to work. Runoff is slow, and water accumulates on the Jerauld soil after hard rains.

Many areas remain in native grass and are used for range. Some areas are farmed. The Demky soil has fair potential for crops, tame pasture and hay, trees and shrubs, and openland wildlife and good potential for range and rangeland wildlife. In most areas, however, this map unit is affected by the poor potential of the Jerauld soil for most of these uses. This map unit has poor potential for most recreation and engineering uses.

This map unit is best suited to range. The natural plant cover is mainly mid and short grasses. Short grasses are dominant on the Jerauld soil. If this map unit is used for range, management is governed considerably by changes in the plant community on the Jerauld soil. These changes are the result of overgrazing. If the range is overgrazed, the taller, more desirable plants lose vigor and are replaced by less desirable short grasses. In overgrazed pastures, the Jerauld soil commonly is bare of vegetation during dry cycles and supports unpalatable weeds during wet periods. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition.

The pattern of the two soils in most areas makes this map unit poorly suited to cultivated crops and pasture plants. Where sizable parts of mapped areas are Demky soil, however, the Demky soil can be successfully farmed. Small grain is the best suited crop. Stubble mulch, grasses and legumes in the cropping system, and chiseling

or subsoiling improve water intake, conserve moisture, help to control soil blowing, and maintain fertility and tilth.

Windbreaks and other kinds of trees and shrubs are moderately well suited to the Demky soil, but are not suited to the Jerauld soil. Windbreaks are not feasible in most areas because of the pattern of the soils. Special plantings of selected species can be made, but the height of the trees is limited.

This map unit is poorly suited as a site for buildings, roads, and most kinds of waste disposable systems. If buildings are constructed, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soils. The soils lack sufficient strength and stability to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the base material and grading the roads to shed water. Sewage lagoons are the best means of waste disposal. Demky soil in capability unit IIIs-1, Clayey range site; Jerauld soil in capability unit VIs-1, Thin Claypan range site.

Dm—Divide loam. This somewhat poorly drained to moderately well drained, nearly level, calcareous soil is on terraces along upland streams and drainageways. It is underlain by sand and gravel at a moderate depth. Areas are long and irregularly shaped and range from 10 to 100 acres in size. Slopes are 0 to 3 percent. They are plane to slightly convex and in places are short.

Typically, the surface layer is very dark gray loam about 9 inches thick. The underlying material to a depth of 23 inches is grayish brown, very friable or friable loam. Below this is varicolored sand and gravel.

Included with this soil in mapping were small areas of Bowdle, Colvin, and Lehr soils, which make up less than 15 percent of any one mapped area. The well drained to somewhat excessively drained Bowdle and Lehr soils are on slight rises. They contain less calcium carbonate than this Divide soil. The poorly drained Colvin soils are in swales.

The content of organic matter is moderate to high, and fertility is medium. A high content of lime affects the availability of plant nutrients and the choice of crops. Available water capacity is moderate, and the soil is droughty in dry years. Permeability is moderate in the upper part of the soil and rapid in the underlying sand and gravel. Runoff is slow. The seasonal high water table is between depths of 3 and 5 feet during the early part of the growing season.

Some areas of this soil are farmed. Many areas remain in native grass and are used for range or hay. This soil has good potential for range, rangeland wildlife, and trees and shrubs and fair potential for crops, tame pasture and hay, and most recreation uses. It has poor potential for most engineering uses.

This soil is suited to most crops commonly grown in the county. Wetness from the water table delays planting and tillage in wet years. In dry years small grain is better suited than corn. As a result of the high lime content, the soil is highly susceptible to soil blowing. If the soil is used for crops, stubble mulch, crop residue management, minimum tillage, wind stripcropping, and field windbreaks help to conserve moisture, control soil blowing, and maintain fertility. Applying animal manure and fertilizer also helps to maintain fertility.

Using this soil for tame pasture or hay is an effective means of controlling soil blowing. Forage production and the choice of plants are limited somewhat by droughtiness late in summer. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is mainly mid and short grasses. If the range is overgrazed, the taller, more desirable plants are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition.

This soil is well suited to windbreaks. All climatically suited trees and shrubs grow well. Keeping a cover of crop residue on the surface helps to control soil blowing during site preparation.

As a result of wetness from a seasonal high water table, this soil is poorly suited to most engineering uses. Buildings and roads can be constructed if they are properly designed and if artificial drainage can lower the water table. Sewage lagoons can be used for waste disposal if the bottom and sides are treated to prevent seepage. Alternative sites generally are more practical than the sites on this soil for waste disposal. Capability unit IIIs-4; Silty range site.

Du—Durrstein silt loam. This deep, poorly drained, nearly level soil is on bottom land along upland streams and drainageways. Areas are irregularly shaped and range from 5 to 300 acres in size. The surface is uneven because many small mounds rise a few inches above intervening low spots.

Typically, the surface layer is gray silt loam about 2 inches thick. The subsoil is very firm clay and silty clay about 12 inches thick. It is dark gray in the upper part, dark grayish brown in the next part, and grayish brown in the lower part. The lower part has spots and streaks of salts that extend into the underlying material. The underlying material to a depth of 47 inches is light brownish gray, calcareous silty clay. Below this are layers of sandy loam, sand and gravel, and silty clay loam. In some low spots the very firm claypan subsoil does not occur.

Included with this soil in mapping were small areas of Jerauld, Macken, and Swanboy soils, which make up less than 15 percent of any one mapped area. The moderately well drained Jerauld and Swanboy soils are on slight rises, generally on the edges of the mapped areas. The poorly drained to very poorly drained Macken soils are in closed depressions and contain less salts than this Durrstein soil.

The content of organic matter is moderate. Fertility is medium to low because of the salts content. This soil is

difficult to work when dry or wet. Permeability is slow or very slow. The shrink-swell potential is high. Runoff is slow, and the soil is subject to flooding. The water table is between depths of 1 foot and 6 feet during part of the growing season.

Almost all areas of this soil remain in native grass and are used for range or hay. The soil has poor potential for crops and tame pasture and for trees and shrubs in windbreaks. It has good potential for range and fair potential for rangeland wildlife. The potential for recreation and engineering uses is poor.

This soil is best suited to range. The natural plant cover is mostly tall and mid grasses. The major problems of range management are related to the ease with which highly productive plants are replaced by unpalatable species. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. Continuous overgrazing generally results in a plant community dominated by saltgrass and weeds. A planned grazing system that includes proper grazing use helps to keep the range in good condition.

This soil generally is not suited to farming and is poorly suited to tame pasture. Tall wheatgrass and western wheatgrass are suitable for seeding in areas where the original plant cover has been destroyed by cultivation or overgrazing or has been otherwise disturbed.

This soil lacks sufficient strength and stability to support vehicular traffic. Roads should be graded above flood levels, and suitable base material should be hauled in. The soil is not suited to dwellings. Locating other buildings and waste disposal systems on alternative sites is more practical than overcoming the limitations of this soil. These limitations are wetness, a high shrink-swell potential, and the potential pollution of ground water. Sewage lagoons can be built if they are protected against flooding. Capability unit VIw-4; Saline Lowland range site.

Eg—Egas silty clay loam. This deep, very poorly drained, nearly level soil is on bottom land along upland streams and drainageways. Areas are irregularly shaped and range from 5 to 100 acres in size. Slopes are plane to slightly concave. The landscape is dotted by bare spots that commonly have crusts of salts on the surface.

Typically, the surface layer is dark gray silty clay loam about 5 inches thick. The lower part has spots and streaks of salts that extend into the layers below. The next layer is gray, calcareous, friable silty clay loam about 8 inches thick. The underlying material is light brownish gray and grayish brown, calcareous silty clay loam. In places the layer below the surface layer is very firm silty clay that contains sodium.

Included with this soil in mapping were small areas of Jerauld and Swanboy soils, which make up less than 10 percent of any one mapped area. The moderately well drained Jerauld and Swanboy soils are on very slight rises, generally on the edges of the mapped areas.

The content of organic matter is moderate. Fertility is low because of salinity. Reaction commonly is strongly alkaline at or near the surface. Available water capacity is moderate, and permeability is slow. The shrink-swell potential is high. Runoff is slow. The seasonal high water table is 1 foot to 5 feet below the surface during much of the growing season and commonly is at or near the surface during wet years. Most areas are subject to stream flooding.

All areas of this soil remain in native grass and are used for grazing or hay. The soil has poor potential for crops and tame pasture and for trees and shrubs in windbreaks. It has good potential for range and fair potential for rangeland wildlife. The potential for most recreation and engineering uses is poor.

This soil is best suited to range. The natural plant cover is mainly tall and mid grasses that are salt tolerant. If the range is overgrazed, these more desirable grasses lose vigor and are replaced by saltgrass and other unpalatable plants. A planned grazing system that includes proper grazing use helps to keep the range in good condition. Shallow wells and excavated ponds or dugouts are sources of livestock water, but the quality may be poor because of salts.

This soil lacks sufficient strength and stability to support vehicular traffic. If alternative sites are not feasible, roads should be graded above flood levels and suitable base material should be hauled in. This soil is not suited to dwellings. Locating other buildings and waste disposal systems on alternative sites is more practical than overcoming the limitations of this soil. These limitations are wetness, a high shrink-swell potential, and the potential pollution of ground water. Sewage lagoons can be constructed if they are protected against flooding and if the hazard of excessive seepage is reduced by sealing the bottom of the lagoons. Capability unit VIw-4; Saline Lowland range site.

GeE—Gettys clay loam, 9 to 40 percent slopes. This deep, well drained to excessively drained, strongly sloping to steep soil is on the tops and upper sides of upland hills and ridges. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are mostly short and convex. In some areas scattered glacial stones and boulders are on the surface.

Typically, the surface layer is dark gray clay loam about 3 inches thick. The next layer is grayish brown, calcareous, friable clay loam about 7 inches thick. The underlying material is grayish brown, calcareous clay loam. In places the soil has a thin subsoil of firm clay loam. On some of the ridges, the soil is more silty than is typical for Gettys soils.

Included with this soil in mapping were small areas of Opal, Raber, Sansarc, and Wabek soils, which make up less than 15 percent of any one mapped area. The clayey Opal and Sansarc soils are along drainageways on the lower parts of the landscape. The Raber soils are below the Gettys soil in some areas and are deeper to lime. The Wabek soils are on gravelly ridgetops. They have loose sand and gravel within a depth of 14 inches.

Fertility and the content of organic matter are low. Available water capacity is moderate or high, but permea-

bility is moderately slow and much of the rainfall is lost because runoff is rapid. This soil has an elastic type of clay that shrinks markedly when dry and swells markedly when wet.

All areas of this soil remain in native grass and are used for range. The soil has poor potential for crops and tame pasture and for trees and shrubs in windbreaks. It has fair potential for range and rangeland wildlife and poor potential for most recreation and engineering uses.

This soil is best suited to range. The natural plant cover is mainly mid and short grasses. The major problems of range management are related to the erosion hazard and water losses caused by rapid runoff. A good grass cover and ground mulch help to prevent excessive soil losses and improve moisture conditions by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Potential pond sites are in most areas.

This soil generally is not suitable for farming because of the steep slopes and the severe erosion hazard. Where slopes are less than 25 percent, however, it is suitable for seeding to tame pasture. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil generally is not suited to windbreaks planted by machinery, but can be used for special plantings if selected species are planted by hand and given special care.

If buildings are constructed on this soil, proper design of foundations and footings helps to prevent structure damage caused by shrinking and swelling of the soil. Artificial drainage around the buildings helps to keep the soil and underlying glacial till from becoming saturated.

Local roads can be built if routes are carefully selected and roadside erosion is controlled. The roads should be graded to shed water, and base material should be strengthened or hauled in. The less sloping areas on foot slopes are suitable sites for waste disposal systems. Enlarging septic tank absorption fields helps to overcome the slow percolation rate. Capability unit VIIe-3; Thin Upland range site.

Gp—Gravel pits. This map unit consists of open excavations from which several feet of soil and sand and gravel have been removed. Areas are irregularly shaped and range from 3 to 50 acres in size. Slopes are uneven and broken. They range from nearly level on the bottom of the excavations to almost vertical cutbanks on the rims.

Typically, the bottom of the excavations is sand and gravel or is exposed glacial till or silty drift where the sand and gravel has been completely removed. Mounds of overburden material consisting of mixed loamy soil material are on the edges of the mapped areas. The bottom and sides of the pits support little or no vegetation. Annual weeds grow on the mounds of overburden material.

This map unit is used almost exclusively as a source of sand and gravel for construction purposes. A few areas provide a limited acreage of wildlife habitat. Abandoned gravel pits can be restored to range if reclamation measures are applied, including shaping the areas and using the mounds of overburden as topsoil dressing. Capability unit VIIIs-2; not assigned to a range site.

HeA—Hecla loamy sand, 0 to 3 percent slopes. This deep, moderately well drained, nearly level to gently undulating soil is on upland flats and in upland basins. Areas are irregularly shaped and range from 40 to 160 acres in size. Slopes are plane to convex.

Typically, the surface layer is very dark gray loamy sand about 19 inches thick. The next layer is very dark grayish brown, loose loamy sand about 5 inches thick. The underlying material to a depth of 30 inches is dark grayish brown, calcareous sand. Light brownish gray, calcareous sand is at a depth of 30 inches. On some rises, a dark brown subsoil is at a depth of about 15 inches. On the crests of some of the undulating hills, the surface layer is thinner than is typical.

Included with this soil in mapping were small areas of Parshall soils, which make up less than 10 percent of any one mapped area. The Parshall soils have a texture of fine sandy loam. They are on the lower parts of the landscape.

Fertility is medium, and the content or organic matter is moderate. The soil is easy to work, but loses its granular structure if it is farmed. Available water capacity is low or moderate, and permeability is moderately rapid or rapid. Runoff is slow. The seasonal high water table is between depths of 3 and 6 feet during the early part of the growing season in most years. Wetness from the water table delays spring tillage during wet years. In most years, however, wetness is not a problem for crops and the additional moisture is beneficial for deep-rooted crops.

Most areas of this soil remain in native grass and are used for range or hay. The soil has fair potential for farming, trees and shrubs, and openland wildlife. It has good potential for range, tame pasture, and rangeland wildlife. The potential for most recreation and engineering uses is fair to poor.

This soil is well suited to range. The natural plant cover is mainly tall and mid grasses. Controlling soil blowing by maintaining an adequate grass cover and ground mulch is the major range management problem. If the range is overgrazed, tall grasses lose vigor and eventually are replaced by less productive mid grasses and sedges. Bare areas that are susceptible to soil blowing are also the result of overgrazing. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition.

If this soil is used for crops, controlling soil blowing and conserving moisture are the major concerns. Corn, spring-sown small grain, and alfalfa are suitable crops, but growing corn or other row crops increases the risk of soil blowing. Stubble mulch, crop residue management,

wind stripcropping, grasses and legumes in the cropping system, and field windbreaks help to control soil blowing, conserve moisture, and maintain fertility and tilth. Green manure crops and animal manure help to maintain fertility and the organic-matter content.

This soil is well suited to tame pasture, but the risk of soil blowing is severe until the pasture is established. Spring seeding on a stubble-mulched field reduces the risk of soil blowing. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

Windbreaks are well suited to this soil. Most trees and shrubs grow well because of the moisture supplied by the water table. Maintaining a cover of crop residue during site preparation and planting reduces the risk of soil blowing.

If this soil is used for buildings with basements, artificial drainage helps to prevent structure damage caused by excess moisture. Artificial drainage and other measures that keep the roadbed from being saturated reduce road damage caused by frost action. Septic tank absorption fields function well if drainage measures lower the water table below a depth of 6 feet, but seepage from the fields can pollute ground water. Locating other waste disposal systems on alternative sites generally is more practical than applying measures that overcome the seepage and pollution hazards that accompany use of this soil. Capability unit IVe-9; Sands range site.

HhA—Highmore silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregularly shaped and range from 5 to 600 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray silt loam about 5 inches thick. The subsoil is friable silty clay loam about 22 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray, calcareous silt loam. In places loam or clay loam glacial till is within a depth of 40 inches.

Included with this soil in mapping were small areas of Demky, Hoven, Mobridge, and Tetonka soils, which make up less than 15 percent of any one mapped area. The moderately well drained Demky and Mobridge soils are in sags and shallow swales. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size.

Fertility is medium, and the content or organic matter is moderate. The soil is easy to work, but it tends to crust after hard rains. Available water capacity is high, and permeability is moderate. The subsoil has a moderate potential for shrinking and swelling with changes in moisture content. Runoff is slow.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing and hay. The soil has good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, openland and rangeland wildlife, and recreation uses. It has fair to good potential for most engineering uses.

This soil is well suited to all crops grown in the county. Corn, small grain, and alfalfa are the main crops. The soil has few limitations for crops other than the periodic shortages of moisture that are common to the climate. The risk of soil blowing is slight to moderate if the surface is bare during winter and spring. Stubble mulch, crop residue management, and minimum tillage help to conserve moisture, control soil blowing, and maintain fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing.

Using this soil for tame pature and hay is effective in controlling soil blowing. All climatically suited pasture plants can grow on this soil. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use maintains or improves the range condition.

This soil is well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings helps to prevent structure damage caused by shrinking and swelling of the soil. Enlarging septic tank absorption fields helps to overcome the slow percolation rate. Sealing the bottom and sides of sewage lagoons reduces the hazard of seepage. Limitations for sanitary landfills and shallow excavations are slight.

Local roads can be constructed if they are graded to shed water. Strengthening or replacing the base material helps to overcome the low strength and poor stability of this soil for supporting vehicular traffic. The properties of this soil are favorable for irrigation. Capability unit IIc-2; Silty range site.

HhB—Highmore silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregularly shaped and range from 20 to 1,500 acres in size. Slopes are long and smooth. In places a few stones are on the surface.

Typically, the surface layer is dark gray silt loam about 5 inches thick. The subsoil is friable silty clay loam about 22 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray, calcareous silt loam. In places loam or clay loam glacial till is within a depth of 40 inches.

Included with this soil in mapping were small areas of Demky, Hoven, Mobridge, Tally, and Tetonka soils, which make up less than 15 percent of any one mapped area.

The moderately well drained Demky and Mobridge soils are in swales. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size. The Tally soils have a texture of fine sandy loam. They are in a few areas on the higher parts of the landscape.

Fertility is medium, and the content of organic matter is moderate. The soil is easy to work, but it tends to crust after hard rains. Available water capacity is high, and permeability is moderate. The subsoil has a moderate potential for shrinking and swelling with changes in moisture content. Runoff is medium.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing and hay. This soil has good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, openland and rangeland wildlife, and recreation uses. It has fair to good potential for most engineering uses.

This soil is well suited to all crops commonly grown in the county. Corn, small grain, and alfalfa are the main crops. Controlling erosion and soil blowing is a major concern if the soil is used for crops. Conserving moisture and maintaining fertility and tilth are other concerns of management. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Wind stripcropping and field windbreaks (fig. 7) also help to control soil blowing.

Using this soil for tame pasture and hay is an effective way of controlling erosion and soil blowing. All climatically suited pasture plants can grow on this soil. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant community is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pasture furrowing and range seeding improve range that is in poor condition.

This soil is well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings helps to prevent structure damage caused by shrinking and swelling of the soil. This soil is limited for septic tank absorption fields because the percolation rate is slow, but this limitation can be overcome by enlarging the absorption area. The hazard of seepage from sewage lagoons and pond reservoirs can be reduced by sealing the bottom and sides of the lagoons and the reservoir area of ponds. Limitations for sanitary landfills and shallow excavations are slight.

Local roads can be constructed if they are graded to shed water and roadside erosion is controlled. Strengthening or replacing the base material helps to overcome the low strength and poor stability of this soil for supporting vehicular traffic. The properties of this soil are favorable for irrigation. Capability unit IIe-1; Silty range site.

HhC—Highmore silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregularly shaped and range from 5 to 500 acres in size. Slopes are mostly long and smooth. In places a few scattered stones are on the surface.

Typically, the surface layer is dark gray silt loam about 5 inches thick. The subsoil is friable silty clay loam about 18 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. In some places on the higher parts of the landscape, the soil is less than 40 inches deep over loam or clay loam glacial till. On some of the ridges and knolls, it is moderately eroded and the surface layer and subsoil have been mixed by plowing.

Included with this soil in mapping were small areas of Hoven, Mobridge, Tally, and Tetonka soils, which make up less than 15 percent of any one mapped area. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size. The moderately well drained Mobridge soils are in swales. The Tally soils have a texture of fine sandy loam. They are in a few areas on the higher parts of the landscape.

Fertility is medium, and the content of organic matter is moderate. The soil is easy to work, but it tends to crust after hard rains. Available water capacity is high, and permeability is moderate. The subsoil has a moderate potential for shrinking and swelling with changes in moisture content. Runoff is medium.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing or hay. The soil has good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, and rangeland wildlife. It has fair potential for most recreation and engineering uses.

This soil is moderately well suited to all crops commonly grown in the county. Corn, small grain, and alfalfa are the main crops. The erosion hazard is severe, especially if row crops are grown. Controlling erosion and soil blowing is a major concern if the soil is used for crops. Conserving moisture and maintaining fertility and tilth are other concerns of management. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Field windbreaks also help to control soil blowing. If slopes are too irregular for contour farming and terracing, increasing the use of close-sown crops and grasses and legumes in the cropping system helps to control erosion.

Using this soil for tame pasture and hay is an effective way of controlling erosion and soil blowing. All climatically suited pasture plants can be grown, but bunch-type

species should not be planted alone because of the erosion hazard. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good plant cover and grass mulch reduces runoff and supplies moisture to plants. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pasture furrowing and range seeding improve range that is in poor condition.

This soil is well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture. Planting the trees on the contour also conserves moisture.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soil. Increasing the size of septic tank absorption fields helps to overcome the slow percolation rate. The hazard of seepage from sewage lagoons and pond reservoirs can be reduced by sealing the bottom and sides of the lagoons and the reservoir area of ponds.

Local roads can be constructed if they are graded to shed water and roadside erosion is controlled. Strengthening or replacing the base material helps to overcome the low strength and poor stability of this soil for supporting vehicular traffic. Capability unit IIIe-1; Silty range site.

HkA—Highmore-Eakin silt loams, 0 to 2 percent slopes. This map unit consists of deep, well drained, nearly level soils on uplands. Areas are irregularly shaped and range from 5 to 300 acres in size. A few scattered stones are on the surface in some areas.

This map unit is about 50 percent Highmore soil and 30 percent Eakin soil. These soils are so closely intermingled that it was not practical to separate them in mapping. The Highmore soil generally is on the plane to slightly concave parts of the landscape, and the Eakin soil is on slightly convex rises.

Typically, the Highmore soil has a surface layer of dark gray silt loam 5 inches thick. The subsoil is friable silty clay loam about 22 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray silt loam.

Typically, the Eakin soil has a surface layer of dark gray silt loam about 7 inches thick. The subsoil is about 25 inches thick. It is brown, friable silty clay loam in the upper part and light brownish gray, calcareous silt loam in the lower part. The lower part has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clayey glacial till.

Included with these soils in mapping were small areas of Demky, Hoven, Mobridge, and Tetonka soils, which make up about 20 percent of any one mapped area. The moderately well drained Demky and Mobridge soils are in sags and shallow swales. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is high. The soils are easy to work, but they tend to crust after hard rains. Permeability is moderate in the subsoil of both soils and moderately slow in the glacial till underlying the Eakin soil. The shrink-swell potential is moderate in the subsoil of both soils and high in the underlying material of the Eakin soil. Runoff is slow, and water collects in the small depressions in the landscape.

Most areas of these soils are farmed. A few areas remain in native grass and are used for grazing or hay. The soils have good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, openland and rangeland wildlife, and recreation uses. They have fair to poor potential for most engineering uses.

These soils are well suited to all crops commonly grown in the county. Corn, small grain, and alfalfa are the main crops. Except for the periodic moisture shortages common to the climate, limitations for crops are slight. The risk of soil blowing is slight to moderate if the surface is bare during winter and spring. Stubble mulch, crop residue management, and minimum tillage conserve moisture, help to control soil blowing, and maintain fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing.

Using these soils for tame pasture and hay is effective in controlling soil blowing. All climatically suited pasture plants can grow on these soils. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

These soils are well suited to range. The natural plant community is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition.

These soils are well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soils. The underlying glacial till of the Eakin soil severely limits the use of these soils for septic tank absorption fields. Enlarging the size of the absorption area helps to overcome

the slow percolaton rate. Sealing the bottom and sides of sewage lagoons reduces the hazard of seepage. Seepage is more likely to be a problem if the lagoon is on the Highmore soil. These soils generally are suited to sanitary landfills and shallow excavations, but the underlying material of the Eakin soil is clayey.

Local roads can be constructed if they are graded to shed water. Strengthening or replacing the base material helps to overcome the low strength and poor stability of these soils for supporting vehicular traffic. Capability unit IIc-2; Silty range site.

HkB—Highmore-Eakin silt loams, 2 to 6 percent slopes. This map unit consists of deep, well drained, gently sloping soils on smooth uplands. Areas are irregularly shaped and range from 5 to 1,000 acres in size. Slopes are long and slightly convex. A few scattered stones are on the surface in some areas.

This map unit is about 50 percent Highmore soil and 30 percent Eakin soil. These soils are so closely intermingled that it was not practical to separate them in mapping. Generally, the Highmore soil is on the middle and lower parts of the landscape below areas of the Eakin soil.

Typically, the Highmore soil has a surface layer of dark gray silt loam 5 inches thick. The subsoil is friable silty clay loam about 22 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray, calcareous silt loam.

Typically, the Eakin soil has a surface layer of dark gray silt loam about 7 inches thick. The subsoil is about 25 inches thick. It is brown, friable silty clay loam in the upper part and light brownish gray, calcareous silt loam in the lower part. The lower part has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clayey glacial till. On some ridges and knolls, the soil is moderately eroded and the surface layer and subsoil have been mixed by plowing. In these areas, the surface layer is lighter colored than is typical and the soil is calcareous at or near the surface.

Included with these soils in mapping were small areas of Demky, Hoven, Mobridge, and Tetonka soils, which make up about 20 percent of some mapped areas. The moderately well drained Demky and Mobridge soils are in swales. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is high. The soils are easy to work, but they tend to crust after hard rains. Permeability is moderate in the subsoil of both soils and moderately slow in the glacial till underlying the Eakin soil. The shrink-swell potential is moderate in the subsoil of both soils and high in the underlying material of the Eakin soil. Runoff is medium.

Most areas of these soils are farmed. A few areas remain in native grass and are used for grazing or hay. The soils have good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, openland and rangeland wildlife, and recreation uses. They have fair to poor potential for most engineering uses.

These soils are well suited to all crops commonly grown in the county. Corn, small grain, and alfalfa are the main crops. Controlling erosion and soil blowing is a major concern if the soils are used for crops. Conserving moisture and maintaining fertility and tilth are other management concerns. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing.

Using these soils for tame pasture and hay is an effective way of controlling erosion and soil blowing. All climatically suited pasture plants can grow on these soils. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

These soils are well suited to range. The natural plant community is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pasture furrowing and range seeding improve range that is in poor condition.

These soils are well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grasses and weeds and conserves moisture.

If buildings are constructed on these soils, properly designing fondations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soils. The underlying glacial till of the Eakin soil severely limits the use of these soils for septic tank absorption fields. Enlarging the size of the absorption area helps to overcome the slow percolation rate. The hazard of seepage from sewage lagoons and pond reservoirs can be reduced by sealing the bottom and sides of the lagoons and the reservoir area of ponds. Seepage is more likely to be a problem on the Highmore soil. These soils generally are suitable for sanitary landfills and shallow excavations, but the underlying material of the Eakin soil is clayey.

Local roads can be constructed if they are graded to shed water and roadside erosion is controlled. Strengthening or replacing the base material helps to overcome the low strength and poor stability of these soils for supporting vehicular traffic. Capability unit IIe-1; Silty range site.

HkC—Highmore-Eakin silt loams, 6 to 9 percent slopes. This map unit consists of deep, well drained, moderately sloping soils on smooth uplands. Areas are irregularly shaped and range fom 5 to 150 acres in size.

Slopes are mostly long and convex. A few scattered stones are on the surface in some areas.

This map unit is about 45 percent Highmore soil and 35 percent Eakin soil. These soils are so closely intermingled that it was not practical to separate them in mapping. The Highmore soil is on the middle and lower parts of the landscape. The Eakin soil is on the tops and upper sides of ridges and knolls.

Typically, the Highmore soil has a surface layer of dark gray silt loam about 5 inches thick. The subsoil is friable silty clay loam about 18 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray, calcareous silt loam.

Typically, the Eakin soil has a surface layer of dark gray silt loam about 5 inches thick. The subsoil is about 22 inches thick. It is brown, friable silty clay loam in the upper part and light brown, calcareous silt loam in the lower part. The lower part has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clayey glacial till. On some ridges and knolls, the soil is moderately eroded and the surface layer and subsoil have been mixed by plowing. In these areas, the surface layer is light colored and clayey glacial till is just below the surface.

Included with these soils in mapping were small areas of Hoven, Mobridge, Tally, and Tetonka soils, which make up 20 percent of some mapped areas. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size. The moderately well drained Mobridge soils are in swales. The Tally soils have a texture of fine sandy loam. They are in a few areas on the higher parts of the landscape.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is high. The soils are easy to work, but they tend to crust after hard rains. Permeability is moderate in the subsoil of both soils and moderately slow in the glacial till underlying the Eakin soil. The shrink-swell potential is moderate in the subsoil of both soils and high in the underlying material of the Eakin soil. Runoff is medium.

Most areas of these soils are farmed. A few areas remain in native grass and are used for grazing or hay. The soils have good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, and rangeland wildlife. They have fair potential for most recreation uses and fair to poor potential for most engineering uses.

These soils are moderately well suited to all crops commonly grown in the county. Corn, small grain, and alfalfa are the main crops. The erosion hazard is severe, especially if row crops are grown. Controlling erosion and soil blowing is a major concern if the soils are used for crops. Conserving moisture and maintaining fertility and tilth also are important. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Field windbreaks also help to control soil blowing. If slopes are too irregular for contour farming and terracing, increasing the use of close-sown crops and grasses and legumes in the cropping system helps to control erosion.

Using these soils for tame pasture and hay is effective in controlling erosion and soil blowing. All climatically suited pasture plants can grow on these soils, but bunch-type species should not be planted alone because of the erosion hazard. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

These soils are well suited to range. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good plant cover and grass mulch reduces runoff and supplies moisture to plants. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pasture furrowing and range seeding improve range that is in poor condition.

These soils are well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture. Planting the trees on the contour also conserves moisture.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soils. The underlying glacial till of the Eakin soil severely limits the use of these soils for septic tank absorption fields. Enlarging the size of the absorption area helps to overcome the slow percolation rate. The hazard of seepage from sewage lagoons and pond reservoirs can be reduced by sealing the bottom and sides of the lagoons and the reservoir area of ponds. Seepage is more likely if the site is on the Highmore soil.

Local roads can be constructed if they are graded to shed water and roadside erosion is controlled. Strengthening or replacing the base material helps to overcome the low strength of these soils for supporting vehicular traffic. Capability unit IIIe-1; Silty range site.

HmB—Highmore-Raber complex, 2 to 6 percent slopes. This map unit consists of deep, well drained, gently sloping to undulating soils on uplands. Areas are irregularly shaped and range from 5 to 200 acres in size. Slopes are moderately long on the middle parts of the landscape, but are short and convex on the higher parts. On the tops of knolls, a few scattered stones are on the surface.

This map unit is about 55 percent Highmore silt loam and 25 percent Raber loam. These soils are so intermingled that it was not practical to separate them in mapping. The Raber soil generally is on the tops and upper sides of knolls.

Typically, the Highmore soil has a surface layer of dark gray silt loam about 5 inches thick. The subsoil is friable silty clay loam about 22 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray, calcareous silt loam. In places clay loam glacial till is at a depth of slightly less than 40 inches.

Typically, the Raber soil has a surface layer of dark gray loam about 4 inches thick. The subsoil is firm clay loam about 22 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam.

Included with these soils in mapping were small areas of Demky, Hoven, Mobridge, and Tetonka soils, which make up about 20 percent of any one mapped area. The moderately well drained Demky and Mobridge soils are in swales. The poorly drained Hoven and Tetonka soils are in closed depressions less than 5 acres in size.

Fertilty is medium, and the content of organic matter is moderate. Available water capacity is high or moderate. The soils are easy to work, but they tend to crust after hard rains. Permeability is moderate in the Highmore soil and moderately slow in the Raber soil. The shrink-swell potential is moderate in the Highmore soil and high in the Raber soil. Runoff is medium.

Most areas of these soils are farmed. A few areas remain in native grass and are used for grazing or hay. The soils have good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, and openland and rangeland wildlife. They have fair to good potential for recreation uses and fair to poor potential for most engineering uses.

These soils are well suited to all crops commonly grown in the county. Corn, small grain, and alfalfa are the main crops. Controlling erosion and soil blowing is a major concern if the soils are used for crops. Conserving moisture and maintaining fertility and tilth are other important management concerns. Stubble mulch, crop residue management, minimum tillage, and grassed waterways help to control erosion and soil blowing. Contour farming and terracing also help to control erosion in areas where slopes are regular. Wind stripcropping and field windbreaks help to control soil blowing.

Using these soils for tame pasture and hay is an effective way of controlling erosion and soil blowing. All climatically suited pasture plants can grow on these soils. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

These soils are well suited to range. The natural plant community is dominated by mid and short grasses, but some tall grasses grow on the Highmore soil. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pasture furrowing or pitting and range seeding improve range that is in poor condition.

These soils are well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soils. The slow percolation rate is a major problem if the soils are used for septic tank absorption fields. It is especially a problem in the Raber soil. Enlarging the absorption area helps to solve this problem. The hazard of seepage from sewage lagoons and pond reservoirs can be reduced by sealing the bottom and sides of the lagoons and the reservoir area of ponds. Seepage is more likely to be a problem on the Highmore soil. These soils generally are suitable for sanitary landfills and shallow excavations, but the Raber soil has a somewhat clayey subsoil.

Local roads can be constructed if they are graded to shed water and roadside erosion is controlled. Strengthening or replacing the base material helps to overcome the low strength and poor stability of these soils for supporting vehicular traffic. Capability unit IIe-1; Highmore soil in Silty range site, Raber soil in Clayey range site.

HmC—Highmore-Raber complex, 6 to 9 percent slopes. This map unit consists of deep, well drained, moderately sloping to gently rolling soils on uplands. Areas are irregularly shaped and range from 5 to 200 acres in size. Slopes are moderately long and smooth on the middle parts of the landscape, but are short and convex on the higher parts. On the tops and upper sides of some ridges and knolls, a few scattered stones are on the surface.

This map unit is about 55 percent Highmore silt loam and 30 percent Raber loam. These soils are so intermingled that it was not practical to separate them in mapping. The Raber soil generally is on the tops and upper sides of ridges and knolls.

Typically, the Highmore soil has a surface layer of dark gray silt loam about 5 inches thick. The subsoil is friable silty clay loam about 18 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. In places clay loam glacial till is at a depth of slightly less than 40 inches.

Typically, the Raber soil has a surface layer of dark gray loam about 3 inches thick. The subsoil is firm clay loam about 21 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam. On some

of the ridges and knolls, the subsoil is only about 10 inches thick. In moderately eroded spots, the surface layer is light colored because it has been mixed with the subsoil by plowing.

Included with these soils in mapping were small areas of Demky and Mobridge soils, which make up about 15 percent of any one mapped area. The moderately well drained Demky and Mobridge soils are on foot slopes and in swales.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is high or moderate. The soils are easy to work, but they tend to crust after hard rains. Permeability is moderate in the Highmore soil and moderately slow in the Raber soil. The shrink-swell potential is moderate in the Highmore soil and high in the Raber soil. Runoff is medium.

Most areas of these soils are farmed. A few areas remain in native grass and are used for grazing or hay. The soils have good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, and rangeland wildlife. They have fair potential for most recreation uses and fair to poor potential for most engineering uses.

These soils are moderately well suited to all crops commonly grown in the county. Corn, small grain, and alfalfa are the main crops. The erosion hazard is severe, especially if row crops are grown, and during winter and spring the risk of soil blowing is moderate if the surface is bare. Controlling erosion and soil blowing is a major concern if the soils are used for crops. Conserving moisture and maintaining fertility and tilth also are important. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Field windbreaks also help to control soil blowing. If slopes are too irregular for contour farming and terracing, increasing the use of close-sown crops and grasses and legumes in the cropping system helps to control erosion.

Using these soils for tame pasture and hay is effective in controlling erosion and soil blowing. All climatically suited pasture plants can grow on these soils, but bunch-type species should not be planted alone because of the erosion hazard. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

These soils are well suited to range. The natural plant community is dominated by mid and short grasses, but some tall grasses grow on the Highmore soil. Maintaining a good plant cover and grass mulch reduces runoff and supplies moisture to range plants. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to keep the range in good condition. Pasture furrowing or pitting and range seeding improve range that is in poor condition.

These soils are well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow helps to eliminate grass and weeds and conserves moisture. Planting the trees on the contour also conserves moisture.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soils. The slow percolation rate is a major problem if these soils are used for septic tank absorption fields. It is especially a problem in the Raber soil. Enlarging the absorption area helps to solve this problem. The hazard of seepage from sewage lagoons and pond reservoirs can be reduced by sealing the bottom and sides of the lagoons and the reservoir area of ponds. Seepage is more likely to be a problem on the Highmore soil. These soils generally are suitable for sanitary landfills and shallow excavations, but the Raber soil has a somewhat clayey subsoil.

Local roads can be constructed if they are graded to shed water and roadside erosion is controlled. Strengthening or replacing the base material helps to overcome the low strength and poor stability of these soils for supporting vehicular traffic. Capability unit IIIe-1; Highmore soil in Silty range site, Raber soil in Clayey range site.

Ho—Hoven silt loam. This deep, poorly drained, level soil is in closed depressions on uplands. It has a claypan subsoil. Areas are circular or irregularly shaped and range from 5 to 85 acres in size. The surface is uneven in some areas where small mounds rise a few inches above low spots. Slopes are less than 1 percent.

Typically, the surface layer is dark gray silt loam about 2 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is dark gray, very firm silty clay about 20 inches thick. The underlying material is dark gray, calcareous silty clay. In places, the surface layer and subsurface layer are thicker and the subsoil contains less sodium than is typical for Hoven soils.

Included with this soil in mapping were small areas of Demky and Mobridge soils, which make up less than 5 percent of most mapped areas. These moderately well drained soils are on the edges of the depressions.

Fertility is medium, and the content of organic matter is moderate. Tilth is very poor, and the soil is difficult to work. The availability of plant nutrients is affected by the sodium content in the subsoil. Available water capacity is moderate or high, but the dense claypan subsoil releases moisture slowly to plants and restricts roots. The shrink-swell potential is high. Runoff ponds on this soil and remains on the surface until the water evaporates.

Most areas of this soil remain in native grass and are used for grazing or hay. Some small areas of this soil and areas of adjacent soils are farmed. The soil has good potential for range, fair potential for wetland wildlife, and poor potential for farming, tame pasture and hay, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses.

This soil is best suited to range, but the natural plant community lacks stability because of alternating periods of wetness and dryness. The plant cover in most areas is dominantly western wheatgrass and, to a small extent, sedges. If the range is overgrazed, the western wheatgrass is replaced by sedges and smartweed during wet periods and by short grasses and weeds during dry periods. A planned grazing system that includes proper grazing use and a timely deferment of grazing helps to keep the range in good condition.

This soil generally is not suited to crops. Even if the soil is adequately drained, crops grow poorly because of the sodium-affected subsoil. Tame pasture plants, such as creeping foxtail, reed canarygrass, and western wheatgrass, can be seeded in disturbed areas, but establishment of a stand is difficult.

Windbreaks are generally not suited to this soil. Water-tolerant trees and shrubs are suited if they are planted by hand and given special care.

This soil has fair potential for wetland wildlife in areas that are fenced to exclude grazing livestock. Constructing shallow dugouts to provide open water for longer periods is beneficial.

Locating buildings, septic tank absorption fields, and sanitary landfills on alternative sites is more practical than overcoming the limitations of this soil. The soil can be used for sewage lagoons only if the embankments are large enough to protect the lagoon against flooding. If roadbeds are raised above flood levels and suitable base material is hauled in, local roads can be constructed, but repairing road damage caused by shrinking and swelling and by frost action is difficult. Capability unit VIs-1; Closed Depression range site.

HuB—Hurley silt loam, 2 to 9 percent slopes. This moderately deep, moderately well drained, gently sloping to moderately sloping soil is on uplands. It has a claypan subsoil. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are mostly plane to concave. In many areas the surface is uneven because small mounds rise a few inches above intervening low spots.

Typically, the surface layer is grayish brown silt loam about 2 inches thick. The subsoil is very firm clay about 14 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of salts and lime that extend into the underlying material. The underlying material to a depth of 27 inches is gray clay and very shaly clay. Bedded soft shale is at a depth of 27 inches. In some areas on the lower parts of the landscape, the depth to shale is more than 40 inches. In some areas, the surface layer is clay and the subsoil contains less sodium than is typical.

Included with this soil in mapping were small areas of Opal and Promise soils, mainly on the higher parts of the landscape. These included soils make up less than 15 percent of most mapped areas. They are well drained and contain less sodium in the subsoil than this Hurley soil.

Fertility is low, and the content of organic matter is moderate. The availability of plant nutrients is affected by the sodium in the subsoil. Tilth is very poor, and the soil is difficult to work. Available water capacity is low, and permeability is very slow. The dense claypan subsoil releases moisture slowly to plants and restricts roots. The shrink-swell potential is high. Runoff is medium.

Most areas of this soil remain in native grass and are used for grazing. A few small areas of this soil and areas of adjacent soils are farmed. This soil has poor potential for farming, pasture, range, windbreaks and other kinds of trees and shrubs, wildlife, recreation uses, and most engineering uses.

This soil is best suited to range. The natural plant community is mid and short grasses. If the range is overgrazed, the mid grasses lose vigor and are replaced by less productive short grasses. Continued overuse results in considerable areas of bare ground and a plant cover of pricklypear during dry cycles and weeds during wet cycles. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range interseeding improves range that is in poor condition.

This soil generally is not suited to crops, tame pasture plants, and those trees and shrubs in windbreaks that are generally planted by machinery. Trees and shrubs that can tolerate alkalinity and salts are suited if they are planted by hand and given special care.

If buildings are constructed on this soil, proper design of foundations and footings reduces structure damage caused by the shrinking and swelling and the low strength of the soil. Diverting runoff away from the buildings helps to keep the soil and underlying shale from becoming saturated. Sewage lagoons and area-type landfills are suitable means of waste disposal. Suitable sites for lagoons generally are on the lower parts of the landscape.

This soil lacks the strength and stability needed to support vehicular traffic. This limitation can be partly overcome by grading roads to shed water and by hauling in suitable base material. Control of roadside erosion helps to prevent gullying on the more sloping parts of the landscape. Capability unit VIs-1; Thin Claypan range site.

Je—Jerauld silt loam. This deep, moderately well drained, nearly level soil is on terraces along streams and drainageways. It has a claypan subsoil. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are plane to concave and are less than 2 percent. The surface is uneven in some areas where small mounds rise a few inches above intervening low spots.

Typically, the surface layer is gray silt loam about 2 inches thick. The subsoil is firm silty clay about 14 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has accumulations of salts that extend into the underlying material. The underlying material is grayish brown, calcareous silty clay. In some areas, the surface layer is clay and the subsoil contains less sodium than is typical for Jerauld soils.

Included with this soil in mapping were small areas of Demky soils and Slickspots. These included soils and Slickspots make up less than 10 percent of any one mapped area. Demky soils have a thicker surface layer and subsoil than this Jerauld soil and contain less sodium and other salts at a shallow depth. They are on slight rises, mainly on the edges of mapped areas. Slickspots have salts at the surface. They are in some of the small low areas.

The content of organic matter is moderate, but the availability of plant nutrients is affected by the sodium and other salts in the subsoil. Tilth is very poor, and the soil is difficult to work. Available water capacity is low or moderate, and permeability is slow or very slow. The dense claypan subsoil releases moisture slowly to plants and restricts roots. The shrink-swell potential is high. Runoff is slow. The water table is below a depth of 6 feet in most years.

Most areas of this soil remain in native grass and are used for grazing. The soil has poor potential for farming, tame pasture and hay, range, trees and shrubs, wildlife, recreation uses, and most engineering uses.

This soil is best suited to range. The natural plant cover is a mixture of mid and short grasses. If the range is overgrazed, the mid grasses lose vigor and are replaced by less productive short grasses and by undesirable plants, such as pricklypear. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range interseeding improves range that is in poor condition.

This soil generally is not suited to crops, tame pasture, and those trees and shrubs in windbreaks that are generally planted by machinery. Trees and shrubs that can tolerate alkalinity and salts are suited if they are planted by hand and given special care.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by the low strength and the shrinking and swelling of the soil. Sewage lagoons and area-type landfills are suitable means of waste disposal, but septic tank absorption fields and trench-type landfills are not feasible.

This soil lacks the strength and stability needed to support vehicular traffic. Roads should be graded to shed water, and suitable base material should be hauled in. Capability unit VIs-1; Thin Claypan range site.

Js—Jerauld-Slickspots complex. This map unit consists of saline-alkali areas and deep, moderately well drained, nearly level soils that have a claypan subsoil. It is on terraces along streams and drainageways. Areas are irregularly shaped and range from 5 to 100 acres in size. Slopes are plane to slightly concave. The surface is uneven because small mounds rise a few inches above intervening low spots.

This map unit is about 55 percent Jerauld silt loam and 40 percent Slickspots. The Jerauld soil and Slickspots are so closely intermingled that it was not possible to separate them in mapping. The Jerauld soil is on mounds and slight rises, and Slickspots are in small low areas.

Typically, the Jerauld soil has a surface layer of gray silt loam about 2 inches thick. The subsoil is firm silty clay about 14 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has accumulations of salts that extend into the underlying material. The underlying material is grayish brown, calcareous silty clay. In some areas, the surface layer is clay and the subsoil contains less sodium than is typical for Jerauld soils.

Typically, the Slickspots are massive clays that have a crust on the surface and have visible accumulations of salts at the surface or within 4 inches of the surface.

Included with this unit in mapping were small low areas of Durrstein soils near drainageways. These poorly drained soils make up less than 5 percent of most mapped areas.

Fertility is low, and tilth is very poor. Available water capacity is low or moderate. The availability of plant nutrients is affected by the shallow salts. Permeability is slow or very slow. The clayey subsoil releases moisture slowly to plants and restricts roots. Runoff is slow. The water table is below a depth of 6 feet in most years.

All areas of this map unit remain in native grass and are used for grazing. This map unit has poor potential for farming, pasture, range, windbreaks, wildlife, recreation uses, and most engineering uses.

This map unit is best suited to range. The natural plant cover is a mixture of mid and short grasses on the Jerauld soil and a very sparse cover of annuals and grasses on the Slickspots. If the range is overgrazed, the mid grasses on the Jerauld soil are replaced by less productive short grasses and pricklypear and the Slickspots are bare or nearly bare. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

This map unit generally is not suited to crops, tame pasture, and windbreaks. Special plantings of trees and shrubs are not feasible because of the intricate pattern of the Slickspots and the Jerauld soil.

If buildings are constructed on this mapping unit, proper design of foundations and footings helps to prevent structure damage caused by shrinking and swelling. Artificial drainage around the buildings helps to keep the soil material from becoming saturated. Sewage lagoons and area-type landfills are suitable means of waste disposal, but septic tank absorption fields and trench-type landfills are not feasible.

The Jerauld soil and the Slickspots lack the strength and stability needed to support vehicular traffic. Roads should be graded to shed water, and suitable base material should be hauled in. Jerauld soil in capability unit VIs-1, Thin Claypan range site; Slickspots in capability unit VIIIs-3, not assigned to a range site.

LaA—Lehr loam, 0 to 2 percent slopes. This somewhat excessively drained, nearly level soil is on upland terraces and outwash plains. Areas are irregularly

shaped and range from 10 to 300 acres in size. Slopes are plane to slightly convex.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil is dark grayish brown, friable loam about 10 inches thick. The underlying material is calcareous sand and gravel. In places the depth to sand and gravel is slightly more than 20 inches.

Included with this soil in mapping were small areas of Divide, Tetonka, and Wabek soils, which make up less than 10 percent of most mapped areas. The moderately well drained to somewhat poorly drained Divide soils are along poorly defined drainageways. The poorly drained Tetonka soils have a clayey subsoil. They are in closed depressions less than 5 acres in size. The excessively drained Wabek soils are less than 14 inches deep over sand and gravel. They are on slight rises.

Fertility is medium, and the content or organic matter is moderate. Available water capacity is low, and the soil is droughty. Permeability is moderately rapid in the subsoil and rapid in the underlying sand and gravel. Runoff is slow.

Many areas of this soil are farmed. Some areas remain in native grass and are used for grazing. The soil has poor potential for farming, pasture, windbreaks, and wildlife; fair potential for range; and good potential for recreation uses and some engineering uses.

This soil is better suited to spring-sown small grain than to a late-maturing crop, such as corn. Droughtiness is the main problem if the soil is used for crops. Controlling soil blowing and maintaining fertility are other management concerns. Stubble mulch, crop residue management, minimum tillage, and wind stripcropping help to conserve moisture, control soil blowing, and maintain fertility. Applying animal manure helps to maintain fertility and the content of organic matter.

Using this soil for pasture helps to control soil blowing, but production is limited by droughtiness. The choice of pasture plants is limited to drought-resistant species, such as crested wheatgrass and pubescent wheatgrass. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is best suited to range. The natural plant cover is a mixture of mid and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding or interseeding improves range that is in poor condition.

Windbreaks and other kinds of trees and shrubs are generally not suited because this soil is droughty. Special plantings of suited species can be made if additional moisture is provided by frequent applications of water.

This soil is well suited as a site for buildings and roads, but cutbanks in shallow excavations cave in easily. Septic tank absorption fields function well on this soil, but the effluent can pollute shallow ground water. Seepage is a problem if this soil is used for sewage lagoons, sanitary landfills, and farm ponds. Choosing alternative sites is generally more satisfactory than applying measures that prevent seepage. This soil is a fair source of sand and gravel for use in construction. It responds well to irrigation, but frequent applications of water are required because the available water capacity is low. Capability unit IVs-1; Shallow to Gravel range site.

LaB—Lehr loam, 2 to 6 percent slopes. This somewhat excessively drained, gently sloping to undulating soil is on upland terraces and outwash plains. Areas are irregularly shaped and range from 10 to 400 acres in size. Slopes are convex and range from smooth to short and irregular.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown, friable loam about 9 inches thick. Calcareous sand and gravel is at a depth of about 14 inches. In places the depth to sand and gravel is slightly more than 20 inches, and in a few small areas the soil is more silty than is typical.

Included with this soil in mapping were small areas of Tetonka and Wabek soils, which make up less than 10 percent of any one mapped area. The poorly drained Tetonka soils have a clayey subsoil. They are in closed depressions less than 5 acres in size. The excessively drained Wabek soils are less than 14 inches deep over sand and gravel. They are on the tops of knolls.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is low, and the soil is droughty. Permeability is moderately rapid in the subsoil and rapid in the underlying sand and gravel. Runoff is slow.

Many areas of this soil are farmed. Some remain in native grass and are used for grazing. The soil has poor potential for farming, pasture, windbreaks, and wildlife; fair potential for range; and good potential for recreation uses and some engineering uses.

This soil is too droughty for a late-maturing crop, such as corn. Spring-sown small grain is the best suited crop. Controlling erosion and soil blowing and conserving moisture are the main problems if this soil is used for crops. Stubble mulch, crop residue management, minimum tillage, and contour farming help to control erosion and soil blowing, conserve moisture, and maintain fertility. Wind stripcropping also helps to control soil blowing. Applying animal manure helps to maintain fertility and the content of organic matter.

Using this soil for pasture helps to control erosion and soil blowing, but production is limited by the droughtiness. The choice of pasture plants is limited to drought-resistant species, such as crested wheatgrass and pubescent wheatgrass. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is best suited to range. The natural plant cover is a mixture of mid and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A

planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding or interseeding improves range that is in poor condition.

Windbreaks and other kinds of trees and shrubs generally are not suited because this soil is droughty. Special plantings of suited species can be made if additional moisture is provided by frequent applications of water.

This soil is well suited as a site for buildings and roads, but cutbanks in shallow excavations cave in easily. Septic tank absorption fields function well, but the effluent can pollute shallow ground water. Seepage is a problem if the soil is used for sewage lagoons, sanitary landfills, and farm ponds. Choosing alternative sites generally is more satisfactory than applying measures that prevent seepage. This soil is a fair source of sand and gravel for use in construction. It responds well to irrigation if the water is applied at frequent intervals. Capability unit IVe-6; Shallow to Gravel range site.

LbB—Lehr-Bowdle loams, 2 to 9 percent slopes. This map unit consists of somewhat excessively drained and well drained, gently sloping to gently rolling soils on uplands. These soils are underlain by outwash sand and gravel. Areas are irregularly shaped and range from 10 to 250 acres in size. Slopes are short and convex on the higher parts of the landscape.

In most areas this map unit is about 60 percent Lehr soil and 30 percent Bowdle soil, but in a few areas the proportion of the two soils is almost equal. In most areas the pattern of these soils is so intricate that it was not practical to separate the soils in mapping. The Lehr soil generally is on the higher parts of the landscape above areas of the Bowdle soil.

Typically, the Lehr soil is calcareous at or near the surface. It has a surface layer of dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown, friable loam about 9 inches thick. Sand and gravel is at a depth of about 14 inches. In places sand and gravel is at a depth of less than 14 inches.

Typically, the Bowdle soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, friable loam about 14 inches thick. The underlying material to a depth of 25 inches is dark grayish brown, calcareous gravelly loam. In places the soil is more silty than is typical for Bowdle soils.

Included with these soils in mapping were small areas of Highmore, Mobridge, and Tetonka soils, which make up about 10 percent of most mapped areas. The Highmore soils are on foot slopes, the Mobridge soils are in swales, and the poorly drained Tetonka soils are in closed depressions less than 5 acres in size. None of these included soils have sand and gravel within a depth of 40 inches.

Fertility is medium to high, and the content of organic matter is moderate to high. Available water capacity is low in the Lehr soil and moderate in the Bowdle soil. Permeability is moderately rapid to moderate in the upper part of both soils and rapid in the underlying sand and gravel. Runoff is slow to medium.

Many areas of these soils are farmed. Some areas remain in native grass and are used for grazing. The soils have poor potential for farming, tame pasture, windbreaks, and wildlife because Lehr soil is droughty. They have fair to good potential for range and for recreation uses. The potential for some engineering uses is good.

These soils are best suited to range. The natural plant cover is a mixture of mid and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range.

Some areas of these soils are used for corn, small grain, and alfalfa, but the Lehr soil is droughty and is subject to severe risks of erosion and soil blowing if it is cropped. Where the Bowdle soil is dominant, the soils can be farmed. Spring-sown small grain is better suited than late-maturing row crops. Stubble mulch, crop residue management, minimum tillage, contour farming, and wind stripcropping help to control erosion and soil blowing and conserve moisture.

These soils are poorly suited to tame pasture. The droughtiness of the dominant Lehr soil affects forage production and limits the choice of pasture plants to drought-resistant species. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

The Lehr soil generally is not suited to windbreaks. The Bowdle soil, however, can be used for farmstead windbreaks and other kinds of trees and shrubs if optimum growth and survival are not expected or required. Providing additional moisture improves the growth and survival of the trees and shrubs.

These soils are good sites for buildings and roads, but cutbanks in shallow excavations cave in easily. Septic tank absorption fields function well, but the effluent can pollute shallow ground water. Sewage lagoons can be located on the Bowdle soil if the bottom and sides of the lagoons are sealed to reduce the hazard of seepage. Control of roadside erosion generally is needed where cuts are made through the more sloping parts of the landscape. These soils are a fair source of sand and gravel for use in construction. If the soils are irrigated, frequent applications of water are needed because the amount of available water is limited. Lehr soil in capability unit VIe-5, Shallow to Gravel range site; Bowdle soil in capability unit IVe-5, Silty range site.

LoA—Lowry silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands and terraces near Lake Oahe. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is very friable silt loam about 16 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 32 inches is light

brownish gray, calcareous silt loam. Grayish brown, calcareous very fine sandy loam is at a depth of 32 inches. In places the subsoil contains more clay than is typical for Lowry soils. In shallow swales the surface layer and subsoil are thicker than is typical.

Included with this soil in mapping were small areas of Sully and Tally soils on the crests of very slight rises. These included soils make up about 10 percent of any one mapped area. The Sully soils are light colored and are calcareous at or near the surface. The Tally soils have a fine sandy loam surface layer and a fine sandy loam subsoil.

Fertility is medium, and the content or organic matter is moderate. Available water capacity is high. The soil is easy to work, but it is susceptible to soil blowing if the surface is unprotected. Permeability is moderate. Runoff is slow.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing or hay. The soil has good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, openland and rangeland wildlife, and recreation uses. The potential for most engineering uses is good to fair.

This soil is well suited to all crops commonly grown in the county. Small grain, corn, and alfalfa are the main crops. Controlling soil blowing and conserving moisture are major concerns if the soil is used for crops. Stubble mulch, crop residue management, minimum tillage, wind stripcropping, and field windbreaks help to control soil blowing, conserve moisture, and maintain fertility and tilth.

Using this soil for tame pasture helps to control soil blowing. All climatically suited pasture plants grow well. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range. Range seeding improves range that is in poor condition.

This soil is well suited to windbreaks and other kinds of trees and shrubs. All climatically suited species of trees and shrubs can grow well. A year of fallow prior to planting helps to store needed moisture.

If buildings are constructed, proper design of foundations and footings helps to overcome the low strength of this soil. The soil is well suited to septic tank absorption fields and sanitary landfills. The hazard of seepage from sewage lagoons and farm ponds can be reduced by sealing the bottom and sides of the lagoons and by treating the reservoir area of ponds.

Local roads can be constructed if they are graded to shed water and the base material is strengthened or replaced. This soil is well suited to irrigation because available water capacity is high and the water intake rate is moderate. Capability unit IIe-1; Silty range site.

LoB—Lowry silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands and terraces near Lake Oahe. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are long, smooth, and slightly convex.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is very friable silt loam about 15 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 32 inches is light brownish gray, calcareous silt loam. Grayish brown, calcareous very fine sandy loam is at a depth of 32 inches. In places the subsoil contains more clay than is typical for Lowry soils. In swales and on foot slopes, the surface layer and subsoil are thicker than is typical.

Included with this soil in mapping were small areas of Sully and Tally soils on the higher parts of the landscape. These included soils make up about 10 percent of any one mapped area. The Sully soils are light colored and are calcareous at or near the surface. The Tally soils have a fine sandy loam surface layer and a fine sandy loam subsoil.

Fertility is medium, and the content or organic matter is moderate. Available water capacity is high. The soil is easy to work, but it is highly susceptible to soil blowing if the surface is unprotected. Permeability is moderate. Runoff is medium.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing or hay. The soil has good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, openland and rangeland wildlife, and most recreation uses. The potential for most engineering uses is good to fair.

This soil is well suited to all crops commonly grown in the county. Small grain, corn, and alfalfa are the main crops. The hazards of erosion and soil blowing are moderate if the soil is used for crops. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Wind stripcropping and field windbreaks help to control soil blowing.

Using this soil for tame pasture helps to control erosion and soil blowing. All climatically suited pasture plants grow well. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding improves range that is in poor condition.

This soil is well suited to windbreaks and other kinds of trees and shrubs. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to store needed moisture.

If buildings are constructed, proper design of foundations and footings helps to overcome the low strength of this soil. The soil is well suited to most methods of waste disposal. The hazard of seepage from sewage lagoons and farm ponds can be reduced by sealing the bottom and sides of the lagoons and by treating the reservoir area of ponds.

Local roads can be constructed if they are graded to shed water and the base material is stregthened or replaced. Control of roadside erosion generally is needed where cuts are made through the higher parts of the landscape. This soil is well suited to irrigation. Capability unit IIe-1; Silty range site.

LoC—Lowry silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are long, smooth, and convex.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is very friable silt loam about 12 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of about 32 inches is light brownish gray, calcareous silt loam. Grayish brown, calcareous very fine sandy loam is at a depth of 32 inches. In places the subsoil contains more clay than is typical for Lowry soils. In swales and on foot slopes, the surface layer and subsoil are thicker than is typical.

Included with this soil in mapping were small areas of Sully and Tally soils, which make up 15 percent of some mapped areas. The calcareous Sully soils are on the tops and upper sides of knolls and ridges. In cultivated areas they are easily identified because of their light color. The Tally soils generally are intermingled with Lowry soils. They have a fine sandy loam surface layer and a fine sandy loam subsoil.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is high. The soil is easy to work, but it is subject to erosion and soil blowing. Permeability is moderate. Runoff is medium.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing or hay. The soil has good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, rangeland wildlife, and most recreation uses. The potential for most engineering uses is good to fair.

This soil is well suited to all crops commonly grown in the county. Small grain, corn, and alfalfa are the main crops. The erosion hazard is severe, especially if row crops are grown. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing.

Using this soil for tame pasture helps to control erosion and soil blowing. All climatically suited pasture plants grow well, but bunch-type species should not be planted alone because of the erosion hazard. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding improves range that is in poor condition.

This soil is well suited to windbreaks and other kinds of trees and shrubs. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting conserves needed moisture. Planting the trees on the contour conserves moisture.

If buildings are constructed, proper design of foundations and footings helps to overcome the low strength of this soil. The soil is well suited to most methods of waste disposal. Sewage lagoons are best located on foot slopes where slopes are less steep. The hazard of seepage from lagoons and farm ponds can be reduced by sealing the bottom and sides of the lagoons and by treating the reservoir area of the ponds.

Local roads can be constructed if they are graded to shed water and the base material is strengthened or replaced. Control of roadside erosion is generally needed. Gravity irrigation is difficult because this soil is moderately sloping, but the soil responds favorably to sprinkler irrigation. Capability unit IIIe-1; Silty range site.

Ma—Macken silty clay. This deep, poorly drained to very poorly drained, level soil is in closed depressions. Areas are circular or irregularly shaped and range from 5 to 700 acres in size. Slopes are less than 1 percent. They are dominantly plane, but in some small, low areas they are concave.

Typically, the surface layer is dark gray silty clay about 3 inches thick. The subsoil is dark gray and gray, very firm silty clay about 35 inches thick. It is calcareous below a depth of 12 inches. The underlying material to a depth of 47 inches is gray, calcareous silty clay. Light brownish gray, calcareous silty clay loam is at a depth of 47 inches. Near Blue Blanket Lake, the lower part of subsoil and the underlying material are stratified with thin layers of silty or sandy material.

Included with this soil in mapping were small areas of Durrstein, Egas, and Regan soils, which make up about 15 percent of some mapped areas. The Durrstein and Egas soils are in low areas. They contain sodium and other salts at a shallow depth. The calcareous silty Regan soils are on the edges of some mapped areas.

Fertility is medium, and the content of organic matter is moderate. Tilth is poor. Available water capacity is moderate or high, but the clayey subsoil releases moisture slowly to plants and restricts roots. Permeability is slow. The shrink-swell potential is high. The surface of this soil is ponded during the early part of the growing season in most years.

Most areas of this soil are in native grass and are used for grazing or hay. A few areas along Blue Blanket Lake are farmed. The soil has poor potential for farming, tame pasture and hay, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses. It has good potential for range and fair potential for wetland wildlife.

This soil is well suited to range. The natural plant cover is mainly western wheatgrass and sedges. The plant cover lacks stability, however, because of alternating wet and dry periods. Overgrazing when the soil is wet results in an increase of sedges and undesirable plants, such as smartweed. Overgrazing during dry periods causes an increase in less productive short grasses. A planned grazing system that includes proper grazing use and a timely deferment of grazing helps to maintain or improve the range condition.

This soil generally is not suitable for cultivation. Small grain is grown, however, in some areas adjacent to Blue Blanket Lake. As a result of wetness and the dense clay subsoil, most crops grow poorly. Artificial drainage generally is not feasible. The soil can be used for tame pasture plants, but the choice of species is limited to those than can tolerate wetness, for example, creeping foxtail, reed canarygrass, and western wheatgrass.

Windbreaks that are commonly planted by machinery are not suited to this soil. Water-tolerant trees and shrubs are suited if they are planted by hand and given special care.

This soil generally is not suited as a site for buildings because of wetness, the high shrink-swell potential, and low strength. It is suited to sewage lagoons if the lagoons are protected against flooding. Alternative sites are more satisfactory than this soil for other methods of waste disposal. Local roads can be constructed if they are graded above flood levels and suitable base material is hauled in. Capability unit Vw-1; Closed Depression range site.

MdB—Maddock fine sandy loam, 0 to 6 percent slopes. This deep, well drained, nearly level to undulating soil is on terraces and uplands. Areas are irregularly shaped and range from 10 to 125 acres in size. In areas where the soil is undulating, slopes are convex and short.

Typically, the surface layer is very dark gray fine sandy loam about 15 inches thick. The next layer is dark brown, loose fine sand about 15 inches thick. The underlying material to a depth of 41 inches is light brownish gray, calcareous fine sand. Grayish brown, calcareous fine sandy loam is at a depth of 41 inches. In places fine sandy loam extends to a depth of more than 30 inches. On the crests of some undulating hills, the surface layer is 9 inches or less thick.

Included with this soil in mapping were small areas of Hecla soils, which make up less than 10 percent of any one mapped area. These moderately well drained soils are in low areas. They have a seasonal high water table within a depth of 6 feet.

Fertility is medium, and the content of organic matter is moderate. The soil is easy to work, but it is highly susceptible to soil blowing. Available water capacity is low or moderate, and the soil is somewhat droughty. Permeability is rapid. Runoff is slow.

Many areas of this soil are farmed. Some are in native grass and are used for grazing or hay. The soil has poor potential for farming, fair potential for tame pasture and hay and openland and rangeland wildlife, and good potential for range, windbreaks and other trees and shrubs, and some engineering uses. The potential for recreation uses is fair to good.

Controlling soil blowing and conserving moisture are major concerns if this soil is farmed. Small grain and corn are the main crops. Spring-sown small grain is better suited than winter wheat and rye because the soil blowing hazard is severe. Stubble mulch, crop residue management, wind stripcropping, and field windbreaks help to control soil blowing, conserve moisture, and maintain fertility and tilth. Grasses and legumes in the cropping system, green manure crops, and animal manure help to maintain or improve fertility and organic-matter content.

Using this soil for tame pasture and hay is effective in controlling soil blowing. A nurse crop or a mulch of crop residue helps to control soil blowing while the pasture is being established. Proper stocking rates, rotation grazing, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant community is mainly tall and mid grasses. The major problem of range management is the severe hazard of soil blowing. If the range is overgrazed, the taller, more desirable grasses are thinned out and are replaced by less desirable plants or the ground is bare. As a result, the risk of soil blowing is increased. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding helps to restore the natural plant community in areas where the range is in poor condition.

Windbreaks are well suited to this soil. Most climatically suited trees and shrubs can grow well. A cover crop or a mulch of crop residue helps to control soil blowing until the trees or shrubs are established.

This soil is well suited as a site for buildings and local roads. Disturbed areas should be revegetated as soon as possible in order to control soil blowing. Cutbanks can cave in if the soil is used for shallow excavations. The soil is well suited to septic tank absorption fields, but the effluent can pollute ground water. Seepage is a problem if the soil is used for sanitary landfills and sewage lagoons. Lining the cuts of the sanitary landfills and sealing the bottom and sides of the sewage lagoons help to prevent seepage. Alternative sites are generally more practical than the sites on this soil for these methods of waste disposal. Capability unit IVe-9; Sands range site.

MdC—Maddock fine sandy loam, 6 to 15 percent slopes. This deep, well drained, gently rolling to rolling soil is on uplands. Areas are irregularly shaped and range

from 5 to 100 acres in size. Slopes are mostly short and convex.

Typically, the surface layer is very dark gray fine sandy loam about 12 inches thick. The next layer is dark brown, loose fine sand about 11 inches thick. The underlying material to a depth of 41 inches is light brownish gray, calcareous fine sand. Grayish brown, calcareous fine sandy loam is below a depth of 41 inches. In places fine sandy loam extends to a depth of more than 30 inches. On the tops and upper sides of some knolls and ridges, the surface layer is 9 inches or less thick.

Included with this soil in mapping were small areas of Hecla soils in swales and on foot slopes. These soils make up about 5 percent of most mapped areas. They are moderately well drained and have a seasonal high water table within a depth of 6 feet.

Fertility is medium, and the content or organic matter is moderate. Available water capacity is low or moderate, and the soil is somewhat droughty. Permeability is rapid. Runoff is slow.

Most areas remain in native grass and are used for grazing or hay. Some small areas of this soil and areas of adjacent soils are farmed. The soil has poor potential for farming and for windbreaks and other kinds of trees and shrubs; fair potential for tame pasture and hay, rangeland wildlife, and most recreation uses; and good potential for range. The potential for most engineering uses is fair to poor.

This soil is well suited to range. The natural plant community is mainly tall and mid grasses. The major problem of range management is the very severe hazard of soil blowing. If the range is overgrazed, the taller, more desirable grasses are thinned out and are replaced by less desirable plants or the ground is bare. As a result, the risk of soil blowing is increased and sand blowouts form. A planned grazing system that includes proper grazing use and deferred grazing helps to control soil blowing and maintains or improves the range condition.

In cultivated areas soil blowing is best controlled by seeding native range grasses or tame pasture plants. Seeding in areas covered by a mulch of crop residue helps to control soil blowing until the plants are established. Proper stocking rates, rotation grazing, clipping, and weed control help to keep the pasture in good condition.

This soil is poorly suited to windbreaks and other kinds of trees and shrubs because of the hazards of soil blowing and erosion. Selected trees and shrubs that are planted for special purposes are suited if they are scalp planted or planted by hand and are given special care.

This soil can be used as a site for buildings and local roads, but disturbed areas should be revegetated as soon as possible in order to control soil blowing. Cutbanks may cave in if the soil is used for shallow excavations. Septic tank absorption fields function well on this soil, but the effluent may pollute shallow ground water. Alternative sites for other methods of waste disposal generally are more practical than this soil. Capability unit VIe-7; Sands range site.

Mo—Mobridge silt loam. This deep, moderately well drained, nearly level soil is in swales on uplands. Areas are long or irregularly shaped and range from 5 to 200 acres in size. Slopes are smooth and concave and range to 3 percent.

Typically, the surface layer is dark gray silt loam about 11 inches thick. The subsoil is friable silty clay loam about 19 inches thick. It is dark grayish brown in the upper part and light brownish gray and calcareous in the lower part. The underlying material is light brownish gray, calcareous silty clay loam. In places the subsoil is lighter colored within a depth of 20 inches than is typical for Mobridge soils.

Included with this soil in mapping were small areas of Demky and Tetonka soils, which make up less than 15 percent of any one mapped area. Demky soils contain sodium in some part of the subsoil or underlying material. They commonly are on the edges of mapped areas. The poorly drained Tetonka soils have a clayey subsoil. They are in closed depressions less than 5 acres in size.

Fertility and the content of organic matter are high. Available water capacity is high, and permeability is moderate. The shrink-swell potential is moderate. Runoff is slow, and in most years the soil receives additional moisture as runoff from adjacent soils.

Most areas of this soil are farmed. A few areas remain in native grass and are used for grazing or hay. The soil has good potential for farming, tame pasture and hay, range, windbreaks and other trees and shrubs, and openland wildlife. It has fair to poor potential for most recreation and engineering uses.

This soil is well suited to all crops commonly grown in the county. It is slightly limited for crops, mainly because of moisture shortages late in the growing season during dry years. Spring planting may be delayed by wetness during wet years, but in most years the additional moisture received in the swales is beneficial to crops. Stubble mulch, crop residue management, and minimum tillage help to conserve moisture, control soil blowing, and maintain fertility and tilth. Grassed waterways help to prevent the formation of gullies.

All climatically suited pasture plants grow well on this soil. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is mainly tall and mid grasses. If the range is overgrazed, tall grasses are replaced by less productive mid grasses. A planned grazing system that includes proper grazing use helps to maintain or improve the range condition. Range seeding helps to restore range that is in poor condition. In some areas the soil is well suited to water spreading.

This soil is well suited to windbreaks. All climatically suited trees and shrubs grow well because the moisture regime of this soil is favorable. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings reduce structure damage caused by shrinking and swelling. Dwellings with basements are not suited because of the flood hazard. The soil can be used for waste disposal systems only if it is protected against flooding. A slow percolation rate is a limitation if the soil is used for septic tank absorption fields. This limitation can be overcome by enlarging the absorption area. The hazard of seepage from sewage lagoons can be reduced by sealing the bottom and sides of the lagoons.

Local roads can be built if they are graded above potential flood levels and the base material is strengthened or replaced. Diverting water away from the subgrade helps to minimize the adverse effects of potential frost action. Capability unit IIc-3; Overflow range site.

OpC—Opal clay, 2 to 9 percent slopes. This moderately deep, well drained, gently sloping to moderately sloping soil is on uplands. Areas are irregularly shaped and range from 10 to 200 acres in size. Slopes are moderately long and convex. A few scattered glacial stones are on the surface in some areas.

Typically, the surface layer is dark gray clay about 5 inches thick. The subsoil is grayish brown, calcareous, firm clay about 15 inches thick. The underlying material to a depth of 30 inches is grayish brown, calcareous clay and gray, calcareous shaly clay. Bedded soft shale is at a depth of about 30 inches (fig. 8). The depth to shale is more than 40 inches in some areas on the middle and lower parts of the landscape.

Included with this soil in mapping were small areas of Hurley, Sansarc, and Swanboy soils, which make up less than 10 percent of most mapped areas. The Hurley and Swanboy soils are on foot slopes and in swales. They contain more salts than Opal soils. The shallow Sansarc soils are on the tops and upper sides of ridges.

Fertility is medium, and the content of organic matter is moderate. The soil is in poor tilth and is difficult to work. Available water capacity is low, and the clayey subsoil releases moisture slowly to plants and restricts roots. Roots are also restricted by the moderate depth to bedded shale. The soil shrinks markedly when dry and swells markedly when wet. Permeability is very slow. Runoff is medium.

Many areas of this soil remain in native grass and are used for grazing or hay. Some areas are farmed. The soil has fair potential for farming, tame pasture and hay, and windbreaks and other kinds of trees and shrubs. It has good potential for range and rangeland wildlife and poor potential for recreation uses and most engineering uses.

This soil is well suited to range. The natural plant cover is a mixture of mid and short grasses. Management that maintains an adequate plant cover and ground mulch helps to prevent excessive soil losses and improves the moisture supply for plants by reducing runoff. If the range is overgrazed, the protective cover is reduced and the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Pasture furrowing or range pitting and range seeding improve range that is in poor condition.

Controlling erosion and soil blowing and conserving moisture are major concerns if this soil is farmed. Small grain and alfalfa generally are better suited than row crops. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing. Timely tillage helps to maintain tilth, and chiseling or subsoiling improves water intake. Grasses and legumes in the cropping system help to maintain fertility and tilth.

Using this soil for tame pasture and hay is effective in controlling erosion and soil blowing. Forage production and the choice of pasture plants are limited by the moderate depth to shale and the low available water capacity. Bunch-type species of grass generally should not be planted alone because of the erosion hazard in areas where the slope is 6 percent or more. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is moderately well suited to windbreaks and other kinds of trees and shrubs. The height of the suited species, however, is less than optimum. A year of fallow prior to planting helps to eliminate grass and weeds and conserves needed moisture. Planting the trees on the contour also conserves moisture.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soil and by the unstable nature of the underlying shale. Sewage lagoons and area-type landfills are suitable means of waste disposal. Septic tank absorption fields generally are unsuited because the soil is somewhat shallow over shale.

Local roads can be built if they are graded to shed water and suitable base material is hauled in. Control of roadside erosion generally is needed to prevent gullying in borrow areas. Capability unit IVe-4; Clayey range site.

OsD—Opal-Sansarc clays, 6 to 15 percent slopes. This map unit consists of moderately deep and shallow, well drained, moderately sloping to rolling soils on upland ridges and along entrenched drainageways (fig. 9). Areas are irregularly shaped and range from 5 to 700 acres in size. A few scattered glacial stones are on the surface in some areas.

This map unit is about 60 percent Opal soil and 30 percent Sansarc soil. These soils are so intricately mixed that it was not practical to separate them in mapping. The Opal soil is on the middle and lower parts of the landscape where slopes are plane to slightly convex and on some of the broader ridgetops. The Sansarc soil is on nar-

row ridges, sharp slope breaks, and the shoulders of entrenched drainageways, in areas where slopes are short and convex.

Typically, the Opal soil has a surface layer of dark gray clay about 5 inches thick. The subsoil is grayish brown, calcareous, firm clay about 13 inches thick. The underlying material to a depth of about 28 inches is grayish brown, calcareous clay and gray very shaly clay. Bedded soft shale is at a depth of about 28 inches. In some areas on the lower parts of the landscape, the depth to shale is more than 40 inches.

Typically, the Sansarc soil has a surface layer of grayish brown, calcareous clay about 3 inches thick. The underlying material to a depth of 13 inches is grayish brown, calcareous clay and very shaly clay. Bedded soft shale is at a depth of 13 inches.

Included with these soils in mapping were small areas of Gettys, Hurley, Swanboy, Sully, and Wabek soils, which make up about 10 percent of any one mapped area. The loamy Gettys soils, the silty Sully soils, and the gravelly Wabek soils are on ridgetops. The Hurley and Swanboy soils are on foot slopes and in swales. They contain more salts than Opal soils.

Fertility is medium to low, and the content of organic matter is moderate to low. Available water capacity is low to very low. Tilth is poor. These soils release moisture slowly to plants. The root zone is limited because the soils are moderately deep and shallow over shale. Both soils shrink markedly when dry and swell markedly when wet. Permeability is very slow or slow. Runoff is medium to rapid.

Most areas of these soils remain in native grass and are used for grazing. The soils have poor potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses. They have good to fair potential for range and rangeland wildlife.

These soils are best suited to range. The natural plant cover is a mixture of mid and short grasses. The stands of grass are thin on the Sansarc soil. The major problems of managing these soils for range are the severe erosion hazard and the droughtiness. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses are replaced by less productive short grasses and undesirable plants and considerable areas of Sansarc soil are bare of vegetation. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition and control erosion. Range seeding helps to restore the plant cover where the range condition is poor or the soil has been disturbed. Potential pond reservoir sites generally are plentiful.

Where slopes are less than 9 percent, the Opal soil can be farmed if it is protected against excessive soil losses. The Sansarc soil, however, is not suitable for cultivation. In most areas the two soils are so intermingled that farming is not feasible. The Opal soil can be used for tame pasture. As a result of the pattern of the two soils, however, range seeding is the preferred method of establishing a plant cover in most cultivated or disturbed areas.

These soils generally are not suited to windbreaks commonly planted by machinery. Selected trees and shrubs that are planted for special purposes are suited if they are planted by hand and given special care.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling of the soils and by the unstable nature of the shale. Sewage lagoons and area-type landfills are suitable methods of waste disposal in the areas of Opal soil on the lower parts of the landscape.

Local roads can be built if they are graded to shed water and suitable base material is hauled in. Control of roadside erosion is needed in borrow areas. Capability unit VIe-4; Opal soil in Clayey range site, Sansarc soil in Shallow range site.

Pa—Parnell clay loam, wet. This deep, very poorly drained, level soil is in closed depressions on uplands. Areas are circular or irregularly shaped and range from 5 to 100 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is very dark gray and dark gray clay loam about 10 inches thick. The subsoil is dark gray, very firm clay about 26 inches thick. The underlying material to a depth of 48 inches is gray clay that contains threads and nests of salts. Gray, calcareous clay loam is at a depth of 48 inches. On the edges of some depressions, the soil has a gray or light gray subsurface layer just above the subsoil. In some areas the depth to calcareous soil material is less than is typical.

Included with this soil in mapping were small areas of Bowbells soils, which make up less than 5 percent of any one mapped area. These moderately well drained soils have a subsoil that is less clayey than that of this Parnell soil. They are on the edges of some of the depressions.

Fertility and the content of organic matter are high. Available water capacity is high. The surface of this soil ponds, and the water table is at or within 2 feet of the surface during part of the growing season in most years. Permeability is slow. The shrink-swell potential is high.

Most areas remain in native vegetation and are used for grazing, hay, or wildlife. Some small areas of this soil and areas of adjacent soils are farmed. The soil has poor potential for farming, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses. It has good potential for range and fair potential for tame pasture and hay and for rangeland and wetland wildlife.

This soil is well suited to range. The natural plant cover is mainly tall, water-tolerant grasses and slough sedge. The soil is too poorly aerated for big bluestem. If the range is overgrazed, tall grasses are replaced by less palatable and less productive sedges and rushes. A planned grazing system that includes proper grazing use

and deferred grazing during periods of extreme wetness helps to maintain or improve the range condition.

This soil generally is not suited to farming and to windbreaks because drainage is not adequate and artificial drainage is not feasible in most areas. Suitable pasture plants are limited to water-tolerant species.

Fences that keep livestock out of areas of this soil and shallow excavations and dikes that provide areas of shallow water improve the habitat for wetland wildlife.

This soil generally is not suited as a site for buildings and waste disposal systems because of wetness. Local roads can be built if they are graded above flood levels and suitable base material is hauled in. In most areas alternative sites are better suited than the sites on this soil. This soil is a suitable site for dugout ponds that provide livestock water in grazed areas. Capability unit Vw-4; Wetland range site.

PrA—Parshall fine sandy loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces. Areas are long or irregularly shaped and range from 5 to 150 acres in size. Slopes are plane to slightly concave.

Typically, the surface layer is very dark grayish brown fine sandy loam about 12 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, very friable fine sandy loam in the upper part and brown, calcareous loamy sand in the lower part. The underlying material is brown, calcareous loamy sand. In some small areas the soil is more sandy than is typical for Parshall soils.

Fertility is medium, and the content or organic matter is moderate. Available water capacity is moderate or high. The soil is easy to work, but it has poor tilth and is highly susceptible to soil blowing. Permeability is moderately rapid. Runoff is slow.

Most areas of this soil are farmed. Some areas remain in native grass and are used for grazing or hay. The soil has good potential for tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, rangeland wildlife, and recreation uses. It has fair potential for farming and good potential for most engineering uses.

This soil is moderately well suited to most crops commonly grown in the county. Spring-sown small grain is better suited than winter wheat because of the soil blowing hazard. Controlling soil blowing and conserving moisture are the main concerns if the soil is used for crops. Stubble mulch, crop residue management, wind stripcropping, field windbreaks, and minimum tillage help to control soil blowing, conserve moisture, and maintain fertility and tilth.

Using this soil for tame pasture and hay is effective in controlling soil blowing. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding improves range that is in poor condition.

Windbreaks are well suited to this soil. All climatically suited trees and shrubs can grow well. Keeping a mulch of crop residue on the surface during site preparation helps to control soil blowing until the trees or shrubs are established.

This soil is well suited as a site for buildings. Septic tank absorption fields function well as means of waste disposal. Seepage is a problem if the soil is used for sewage lagoons. The hazard of seepage can be reduced by sealing the bottom and sides of the lagoons. Roads and streets can be built if they are designed to reduce potential frost action. Capability unit IIIe-7; Sandy range site.

PrB—Parshall fine sandy loam, 2 to 6 percent slopes. This deep, well drained, undulating soil is on terraces. Areas are long or irregularly shaped and range from 5 to 100 acres in size. Slopes are short and convex.

Typically, the surface layer is very dark grayish brown fine sandy loam about 12 inches thick. The subsoil is about 25 inches thick. It is dark grayish brown, very friable fine sandy loam in the upper part and brown, calcareous loamy sand in the lower part. The underlying material is brown, calcareous loamy sand. In some small areas the soil is more sandy than is typical for Parshall soils. On the tops and upper sides of knolls, the subsoil is light colored within a depth of 16 inches.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is moderate or high. The soil is easy to work, but it is in poor tilth and is highly susceptible to soil blowing after it is farmed. Permeability is moderately rapid. Runoff is slow.

Many areas of this soil are farmed. Other areas remain in native grass and are used for grazing or hay. The soil has good potential for tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, and rangeland wildlife. It has fair potential for farming and recreation uses and good potential for most engineering uses.

This soil is moderately well suited to most crops commonly grown in the county. Spring-sown small grain is better suited than winter wheat because of the soil blowing hazard. Controlling soil blowing and erosion, conserving moisture, and maintaining fertility and tilth are management concerns if the soil is used for crops. Stubble mulch, crop residue management, wind stripcropping, field windbreaks, minimum tillage, and grassed waterways help to control soil blowing and erosion, conserve moisture, and maintain fertility and tilth. In areas where slopes are moderately long and smooth, contour farming helps to control erosion and conserves moisture.

Using this soil for tame pasture and hay helps to control soil blowing and erosion. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A

planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding improves range that is in poor condition.

Windbreaks are well suited to this soil. All climatically suited trees and shrubs can grow well. Keeping a mulch of crop residue on the surface during site preparation helps to control soil blowing until the trees or shrubs are established.

This soil is well suited as a site for buildings. Septic tank absorption fields function well as a means of waste disposal. Seepage is a severe limitation if this soil is used for sewage lagoons, sanitary landfills, and ponds. Sealing the bottom and sides of the lagoons and treating the pond reservoir areas reduce the hazard of seepage. Roads and streets can be built if they are designed to reduce potential frost action. On the higher parts of the landscape, seeding road cuts soon after grading reduces the risks of soil blowing and erosion. Capability unit IIIe-8; Sandy range site.

PsA—Promise clay, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands, terraces, and fans. Areas are irregularly shaped and range from 10 to 600 acres in size. Slopes are slightly concave to slightly convex.

Typically, the surface layer is dark grayish brown clay about 6 inches thick. The subsoil is calcareous, extremely firm clay about 20 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material is grayish brown, calcareous clay. On some slight rises on uplands, the depth to bedded soft shale is slightly less than 40 inches.

Included with this soil in mapping were small areas of Hurley and Swanboy soils in low areas and on fans. These soils make up less than 10 percent of most mapped areas. They contain more salts than Promise soils.

Fertility is medium, and the content of organic matter is moderate. Tilth is poor, and the soil is difficult to work. Available water capacity is low or moderate. The clay subsoil releases moisture slowly to plants and restricts roots. The soil shrinks markedly when dry and swells markedly when wet. When dry, the soil takes in water rapidly because it has cracks. After it is moistened, however, it is very slowly permeable. Runoff is slow.

Many areas of this soil remain in native grass and are used for grazing or hay. Some areas are farmed. This soil has good potential for range and rangeland wildlife and fair potential for farming, tame pasture and hay, windbreaks and other kinds of trees and shrubs, and openland wildlife. It has poor potential for recreation uses and most engineering uses.

This soil is well suited to range. The natural plant cover is a mixture of mid and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding improves range that is in poor condition. Some areas of this soil are suitable sites for water-spreading systems.

This soil is moderately well suited to most crops grown in the county. It is better suited to small grain and alfalfa than to corn. Conserving moisture, controlling soil blowing, and maintaining fertility and tilth are concerns of management if this soil is used for crops. Stubble mulch, crop residue management, minimum tillage, and wind stripcropping help to conserve moisture and control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, tilth, and fertility.

Seeding cultivated areas of this soil to tame pasture plants is an effective way to control soil blowing. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is moderately well suited to windbreaks unless the expected or required height is more than 25 feet. Suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and stores needed moisture.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. The soil is well suited to sewage lagoons and area-type sanitary landfills. A slow percolation rate is a limitation if this soil is used for septic tank filter fields. Enlarging the absorption area helps to overcome this limitation. Local roads can be built if they are graded to shed water and suitable base material is hauled in. Capablity unit IIIs-3; Clayey range site.

PsB—Promise clay, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands and terraces. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are long, smooth, and plane to slightly convex.

Typically, the surface layer is dark grayish brown clay about 6 inches thick. The subsoil is calcareous, extremely firm clay about 18 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material is grayish brown, calcareous clay. In some areas on the higher parts of the landscape, the depth to bedded soft shale is slightly less than 40 inches.

Included with this soil in mapping were small areas of Hurley and Swanboy soils, which make up less than 10 percent of any one mapped area. The Hurley soils are on foot slopes and along drainageways. The Swanboy soils are on fans. Both soils contain more salts than Promise soils.

Fertility is medium, and the content of organic matter is moderate. Tilth is poor, and the soil is difficult to work. Available water capacity is low or moderate. The clay subsoil releases moisture slowly to plants and restricts roots. This soil shrinks markedly when dry and swells markedly when wet. When dry, the soil takes in water rapidly because it has cracks. After it is moistened, however, it is very slowly permeable. Runoff is medium.

Most areas of this soil remain in native grass and are used for grazing or hay. A few areas are farmed. The soil has good potential for range and rangeland wildlife and fair potential for farming, tame pasture and hay, and windbreaks and other kinds of trees and shrubs. It has poor potential for recreation uses and most engineering uses.

This soil is well suited to range. The natural plant cover is a mixture of mid and short grasses. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Pasture furrowing or range pitting and range seeding improve range that is in poor condition.

This soil is moderately well suited to most crops grown in the county. Small grain and alfalfa are better suited than row crops. Controlling erosion and soil blowing, conserving moisture, and maintaining fertility and tilth are the major concerns if this soil is used for crops. Stubble mulch, crop residue management, minimum tillage, contour farming, terracing, and grassed waterways help to control erosion and soil blowing and conserve moisture. Wind stripcropping also helps to control soil blowing. Grasses and legumes in the cropping system, timely tillage, and chiseling or subsoiling improve water intake, tilth, and fertility.

Seeding cultivated areas to tame pasture plants is effective in controlling erosion and soil blowing. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is moderately well suited to windbreaks and other kinds of trees and shrubs unless the expected or required height is more than 25 feet. A year of fallow prior to planting helps eliminate grass and weeds and conserves needed moisture. Planting on the contour also conserves moisture.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. Sewage lagoons and area-type landfills are the best suited means of waste disposal. Suitable sites for sewage lagoons are on the lower parts of the landscape where slopes are more gentle. A slow percolation rate is a limitation if this soil is used for septic tank filter fields. Enlarging the absorption area helps to overcome this limitation. Local roads can be built if they are graded to shed water and suitable base material is hauled in. Control of roadside erosion is needed in borrow areas. Capability unit IIIe-4; Clayey range site.

RaB—Raber loam, 2 to 6 percent slopes. This deep, well drained, undulating soil is on uplands. Areas are irregularly shaped and range from 5 to 75 acres in size. Slopes are mostly short and convex. In some areas on the higher parts of the landscape, scattered stones are on the surface.

Typically, the surface layer is dark gray loam about 4 inches thick. The subsoil is firm clay loam about 24 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam. In places the subsoil contains less clay than is typical for Raber soils. Where slopes are smooth, the soil is silty.

Included with this soil in mapping were small areas of Bowbells and Demky soils, which make up about 10 percent of any one mapped area. These soils are moderately well drained. The Demky soil contains more sodium than Raber soils.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is moderate or high, and permeability is moderately slow or slow. The shrink-swell potential is high. This soil has fair tilth when it is farmed, but it tends to crust after hard rains. Runoff is medium.

Some areas of this soil are farmed, and some remain in native grass and are used for grazing. The soil has fair potential for farming and good potential for tame pasture, range, windbreaks and other kinds of trees and shrubs, and openland and rangeland wildlife. It has fair to good potential for recreation uses and fair to poor potential for most engineering uses.

This soil is well suited to cultivation. Small grain, corn, and alfalfa are the main crops. Controlling erosion and soil blowing and conserving moisture are the major concerns if the soil is used for crops. Stubble mulch, crop residue management, minimum tillage, wind stripcropping, field windbreaks, and grassed waterways help to control erosion and soil blowing, conserve moisture, reduce crusting, and maintain fertility. If slopes are regular, contour farming and terracing can also help to control erosion and conserve moisture.

Using this soil for tame pasture is effective in controlling erosion. All climatically suited pasture plants can grow on this soil. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is mainly mid and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition, conserve moisture, and control erosion. Pasture furrowing or range pitting and range seeding improve range that is in poor condition.

This soil is well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and stores moisture.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. Septic tank filter fields can function properly if the absorption area is enlarged to overcome the slow percolation rate of the soil. The soil is well suited to other methods of waste disposal. The underlying material, however, is somewhat clayey for trench-type landfills. Local roads can be built if they are graded to shed water and base material is strengthened or replaced in order to support vehicular traffic. Capability unit IIe-2; Clayey range site.

RaC—Raber loam, 6 to 9 percent slopes. This deep, well drained, gently rolling soil is on upland ridges and knolls. Areas are irregularly shaped and range from 5 to 125 acres in size. Slopes generally are short and convex. Some small stony areas are on the higher parts of the landscape.

Typically, the surface layer is dark gray loam about 3 inches thick. The subsoil is firm clay loam about 21 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam. In places the subsoil contains less clay than is typical for Raber soils. In some areas where slopes are smooth, the soil is silty.

Included with this soil in mapping were small areas of Bowbells, Demky, and Gettys soils, which make up about 10 percent of any one mapped area. The moderately well drained Bowbells and Demky soils are on foot slopes and in swales. The Gettys soils are on the tops and upper sides of ridges and knolls. They are calcareous at or near the surface and are low in fertility.

Fertility in this Raber soil is medium, and the content of organic matter is moderate. Available water capacity is moderate or high, and permeability is moderately slow or slow. The shrink-swell potential is high. Tilth is fair, but the soil tends to crust after hard rains. Runoff is medium.

Some areas of this soil are farmed, and some remain in native grass and are used for grazing. The soil has fair potential for farming and good potential for tame pasture, range, windbreaks and other kinds of trees and shrubs, and rangeland wildlife. It has fair potential for most recreation uses and poor potential for most engineering uses.

This soil is moderately well suited to farming. Small grain, corn, and alfalfa are the main crops. Controlling erosion and soil blowing and conserving moisture are the major concerns if the soil is used for crops. Unless slopes are prohibitive, contour farming, terracing, and grassed waterways are effective in controlling erosion and conserving moisture. If slopes are too irregular, stubble mulch, crop residue management, close-sown crops, and minimum tillage help to reduce excessive soil losses, conserve moisture, reduce crusting, and maintain fertility and tilth. Wind stripcropping and field windbreaks help to control soil blowing.

Using this soil for tame pasture is also effective in controlling erosion and soil blowing. Including tame pasture in the cropping sequence helps to maintain fertility and tilth. All climatically suited pasture plants grow well on this soil, but bunch-type species should not be planted alone because of the erosion hazard. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

This soil is well suited to range. The natural plant cover is mainly mid and short grasses. A good plant cover and ground mulch help to control erosion and conserve moisture for range plants. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Pasture furrowing or range pitting and range seeding improve range that is in poor condition.

This soil is well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grasses and weeds and stores needed moisture. Planting on the contour helps to conserve moisture and control erosion until the trees and shrubs are established.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. A slow percolation rate is a limitation if the soil is used for septic tank filter fields, but this limitation can be overcome by enlarging the absorption area. This soil can be used for other types of waste disposal. It contains too much clay, however, for trench-type landfills. Sewage lagoons can be located on the lower parts of the landscape where slopes are more gentle.

Local roads can be built if they are graded to shed water and the base material is strengthened or replaced in order to support vehicular traffic. Control of roadside erosion is needed to prevent gullying in borrow areas. Capability unit IIIe-2; Clayey range site.

RbD—Raber-Gettys complex, 6 to 15 percent slopes. This map unit consists of deep, well drained, gently rolling to rolling soils on upland ridges and along entrenched drainageways. Areas are irregularly shaped and range from 10 to 200 acres in size. Slopes are short and convex. Glacial stones commonly are on the surface.

This map unit is about 60 percent Raber soil and 35 percent Gettys soil. These soils are so intricately mixed that it was not practical to separate them in mapping. The Raber soil is on the middle and lower parts of the landscape. The Gettys soil is on the tops and upper sides of ridges.

Typically, the Raber soil has a surface layer of dark gray loam about 3 inches thick. The subsoil is firm clay loam about 19 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has spots and streaks of lime

that extend into the underlying material. The underlying material is grayish brown, calcareous clay loam. In places the subsoil contains less clay and the soil is more silty than is typical for Raber soils.

Typically, the Gettys soil has a surface layer of dark gray clay loam about 3 inches thick. The next layer is grayish brown, calcareous, friable clay loam about 8 inches thick. The underlying material is grayish brown, calcareous clay loam. On some ridgetops the soil is more silty than is typical for Gettys soils.

Included with these soils in mapping were small areas of Wabek soils on the tops of rounded ridges and knolls. These Wabek soils make up about 5 percent of any one mapped area. They are excessively drained and are underlain by sand and gravel within a depth of 14 inches.

Fertility is medium to low, and the content of organic matter is moderate to low. Available water capacity is moderate or high. If farmed, these soils have fair tilth but tend to crust after hard rains. Permeability is moderately slow to slow. The soils shrink markedly when dry and swell markedly when wet. Runoff is medium to rapid.

Most areas of these soils remain in native grass and are used for grazing. A few areas are farmed. The soils have poor potential for farming, but they have good to fair potential for tame pasture, range, windbreaks and other kinds of trees and shrubs, and rangeland wildlife. They have fair potential for most recreation uses and fair to poor potential for most engineering uses.

These soils are best suited to range. The natural plant cover is mainly mid and short grasses. An adequate plant cover and ground mulch help to prevent excessive soil losses and conserve moisture for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding helps to restore the plant cover in areas that have been disturbed or are in poor condition.

The Raber soil can be farmed if close-sown crops are grown or erosion is otherwise controlled. The Gettys soil is not suitable for farming because of the very severe erosion hazard and low fertility. In many areas the two soils are so intermingled that farming is not practical.

Seeding these soils to tame pasture plants is an effective way of controlling erosion and soil blowing in areas that have been farmed or otherwise disturbed. Bunch-type pasture plants should not be planted alone because of the erosion hazard, and the choice of plants is somewhat limited by the low fertility and high lime content of the Gettys soil. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

The Raber soil is suited to windbreaks and other kinds of trees and shrubs. A year of fallow prior to planting helps to eliminate grass and weeds and stores moisture. Planting the trees and shrubs on the contour conserves moisture and helps to control erosion. The Gettys soil is not suited to windbreaks, but it is suited to other kinds of plantings if the trees and shrubs are hand planted and given special care.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. The slow percolation rate is a limitation if these soils are used for septic tank filter fields, but this limitation can be overcome by enlarging the absorption area. These soils can be used for other methods of waste disposal despite the limitation imposed by the slope. Sewage lagoons can be located on the lower parts of the landscape where slopes are more gentle and require less leveling.

These soils lack sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the base material. Local roads can be built if they are graded to shed water. Control of roadside erosion is needed to prevent gullying in borrow areas. Raber soil in capability unit IVe-1, Clayey range site; Gettys soil in capability unit VIe-3, Thin Upland range site.

Re—Regan silt loam. This deep, very poorly drained, level soil is along sluggish drainageways on uplands. In most areas it is subject to flooding. Areas are irregularly shaped and range from 10 to 150 acres in size. Slopes are less than 1 percent and are plane to slightly concave.

Typically, the surface layer is about 10 inches thick. It is dark gray silt loam in the upper part and gray, friable silty clay loam in the lower part. The underlying material to a depth of 49 inches is gray, grayish brown, and olive silty clay loam. Pale olive sand and gravel is at a depth of 49 inches. The profile is calcareous throughout. It is most calcareous between depths of between 10 and 30 inches. In places sand and gravel is at a depth of slightly less than 40 inches. The soil is not so poorly drained on the edges of some areas. In some low areas the soil contains less lime than is typical and has a clay subsoil.

Fertility is medium, and the content of organic matter is moderate. The availability of plant nutrients, however, is affected by the high content of lime. Available water capacity is high, and permeability is moderate to moderately slow. The shrink-swell potential is moderate. Runoff is slow, and water ponds in low spots. The water table, which is near the surface early in the growing season, limits root growth.

Almost all areas of this soil remain in native vegetation and are used for grazing and hay. The soil has good potential for range, fair potential for wetland wildlife, and poor potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses.

Under natural conditions, this soil can support a luxuriant stand of tall, water-tolerant grasses. If range is overgrazed, tall grasses are replaced by less palatable sedges, rushes, and water-tolerant weeds. A planned grazing system that includes proper grazing use and deferment of grazing during periods of extreme wetness helps to maintain or improve the range condition.

Unless it is drained, this soil is not suitable for farming or for tame pasture because of wetness. In most areas artificial drainage is not feasible because outlets are not available. Tall wheatgrass and western wheatgrass are suitable pasture plants for seeding in disturbed areas. This soil is not suited to windbreaks, but water-tolerant species can grow if they are planted by hand and given special care.

If this soil is used as habitat for wetland wildlife, the habitat can be enhanced by shallow excavations and dikes that provide small bodies of open water.

This soil generally is not suited to buildings and waste disposal systems because of the high water table. Local roads can be built if they are raised above flood levels and suitable base material is hauled in to support vehicular traffic. The soil is a suitable site for dugout ponds that provide livestock water. Capability unit Vw-4; Wetland range site.

SaE—Sansarc-Opal clays, 15 to 40 percent slopes. This map unit consists of shallow and moderately deep, well drained, hilly to steep soils on uplands. These soils are on buttes and ridges and along entrenched drainageways. Areas range from 10 to more than 1,000 acres in size. Slopes are mostly convex, but some are sharp and angular. In places scattered stones of glacial origin are on the surface.

This map unit is about 50 percent Sansarc soil and 40 percent Opal soil. These soils are so intricately mixed that it was not practical to separate them in mapping. The Sansarc soil commonly is on the higher parts of the landscape. The Opal soil commonly is below the Sansarc soil, but in some areas it is on the broader ridgetops.

Typically, the Sansarc soil has a surface layer of grayish brown clay about 3 inches thick. The next 10 inches is grayish brown, friable clay over very shaly clay. Light brownish gray shale is at a depth of 13 inches (fig. 10). The soil and the underlying shale are calcareous in most areas.

Typically, the Opal soil has a surface layer of dark gray clay about 5 inches thick. The subsoil is grayish brown, calcareous, very firm clay about 11 inches thick. The underlying material to a depth of 30 inches is grayish brown, calcareous clay over gray shaly clay. Gray, soft shale is at a depth of 30 inches. In some areas on the lower parts of the landscape, the depth to shale is more than 40 inches.

Included with these soils in mapping were small areas of Gettys, Sully, Swanboy, and Wabek soils, which make up about 10 percent of any one mapped area. The loamy Gettys soils, the silty Sully soils, and the gravelly Wabek soils are on some of the ridges that are thinly mantled with glacial till, loess, or gravel. The Swanboy soils are on foot slopes. They contain more salts than Opal soils.

Fertility is medium to low, and the content of organic matter is moderate to low. Available water capacity is low or very low, and permeability is slow or very slow. Both soils shrink markedly when dry and swell markedly when wet. The root zone for plants is limited by the depth to shale. Runoff is rapid.

Almost all areas of these soils remain in native grass and are used for grazing. The soils have poor potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses. They have fair to good potential for range and rangeland wildlife (fig. 11).

These soils are best suited to range. The natural plant cover is a mixture of mid and short grasses. The major problems of range management are the very severe erosion hazard and the low to very low available water capacity. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses are replaced by less productive short grasses. Overgrazing on the Sansarc soil is especially critical because of the increase in bare areas of ground and the risk of erosion. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Potential pond reservoir sites are plentiful on these soils.

These soils are not suited to cultivation and tame pasture because of the steep slopes, the very severe erosion hazard, the low fertility, and the droughtiness. They are also not suited to windbreaks. Selected trees and shrubs that are planted for special purposes are suited if they are planted by hand and given special care.

If buildings are constructed on these soils, proper design of foundations and footings helps to prevent damage caused by shrinking and swelling. The underlying shale is unstable and susceptible to slippage. Artificial drainage around the buildings helps to keep the soil and the shale from becoming saturated and reduces the risk of slippage. Sewage lagoons can be located on the lower parts of the landscape in some areas where the soils are moderately deep and hilly. Other types of waste disposal generally are not suitable because of the steep slopes, the shallowness over shale, and the clayey texture.

These soils lack sufficient strength and stability to support vehicular traffic. This limitation can be partly corrected by hauling in suitable base material. Local roads can be built if they are graded to shed water. Measures that control roadside erosion and prevent gullying in borrow areas are needed. Careful selection of road routes is essential because the road grades can slide in areas where these soils are steep. Capability unit VIIe-8; Sansarc soil in Shallow range site, Opal soil in Clayey range site.

SuC—Sully silt loam, 2 to 9 percent slopes. This deep, well drained, gently sloping to moderately sloping soil is on uplands. Areas are irregularly shaped and range from 5 to 100 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick (fig. 12). The underlying material is light brownish gray, calcareous, very friable silt loam. In some areas on the middle and lower parts of the landscape, the surface layer is more than 5 inches thick and the soil is calcareous at a greater depth than is typical for Sully soils.

Included with this soil in mapping were small areas of Mobridge soils and Parshall fine sandy loam and Tally fine sandy loam. These included soils make up less than 10 percent of any one mapped area. Parshall fine sandy loam and the moderately well drained Mobridge soils are in swales. They have a thick, dark colored surface layer. Tally fine sandy loam is on rises. It has a thicker surface layer and a higher content of fine sand than Sully soils and is deeper over lime.

Fertility and the content of organic matter are low. Available water capacity is high. The soil is easy to work, but it is highly susceptible to soil blowing if it is farmed. The content of lime at a shallow depth affects the availability of plant nutrients. Permeability is moderate. Runoff is medium.

Most areas of this soil are in native grass and are used for grazing or hay. A few areas are farmed. The soil has poor potential for dryland farming, but it has good potential for irrigated crops and irrigated pasture. It has fair potential for pasture, range, windbreaks and other kinds of trees and shrubs, and rangeland wildlife and good to fair potential for most recreation and engineering uses.

This soil is best suited to range. The natural plant cover is a mixture of mid and short grasses. A good plant cover and ground mulch help to control erosion and soil blowing and improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable plants are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

Small grain, alfalfa, and tame grasses are the main crops. Close-sown crops are better suited than row crops where slopes are more than 6 percent. Controlling erosion and soil blowing, conserving moisture, and improving fertility and the content of organic matter are the major problems if this soil is farmed. Stubble mulch, crop residue management, contour farming, terracing, and grassed waterways help to reduce excessive soil losses, conserve moisture, and maintain fertility. Wind stripcropping and field windbreaks help to control soil blowing. Grasses and legumes in the cropping system, green manure crops, and animal manure improve fertility and the content of organic matter.

Using this soil for tame pasture is effective in controlling erosion and soil blowing. The choice of pasture plants is affected by the content of lime at a shallow depth, and production is limited by low fertility. Because of the erosion hazard, bunch-type species should not be planted alone in areas where slopes are more than 6 percent. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition after it is established.

This soil is moderately well suited to windbreaks and other kinds of trees and shrubs if the expected or required height is no more than 25 feet. A year of fallow prior to planting generally is a part of site preparation, but a liberal use of crop residue is necessary to control soil blowing. Planting the trees on the contour helps to conserve moisture and control erosion.

If buildings without basements are constructed on this soil, proper design of foundations and footings helps to overcome the low strength of this soil. Limitations are slight for buildings with basements and for most methods of waste disposal. The hazard of seepage from sewage lagoons and farm ponds can be reduced by sealing the bottom and sides of the lagoons and the reservoir area of the ponds.

This soil lacks sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening the base material. Roads should be graded to shed water. Erosion and soil blowing can be problems unless measures that control roadside erosion are applied in borrow areas immediately after grading. Capability unit IVe-3; Thin Upland range site.

SuD—Sully silt loam, 9 to 15 percent slopes. This deep, well drained, strongly sloping soil is on uplands. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 3 inches thick. The underlying material is light brownish gray, very friable, calcareous silt loam. In places on the lower parts of the landscape, the surface layer is more than 5 inches thick and the soil is calcareous at a greater depth than is typical for Sully soils.

Included with this soil in mapping were small areas of Gettys, Sansarc, and Tally soils, which make up less than 15 percent of any one mapped area. The loamy Gettys soils are on the tops of some ridges and knolls. They are underlain by glacial till. The shallow clayey Sansarc soils are on the tops of some ridges and on the lower sides of entrenched drainageways. The Tally soils contain more sand than Sully soils and are intermingled with those soils in some areas.

Fertility and the content of organic matter are low. Available water capacity is high, and permeability is moderate. Runoff is medium. Disturbed areas are highly susceptible to erosion and soil blowing.

Almost all areas of this soil remain in native grass and are used for grazing. The soil has poor potential for farming, windbreaks and other kinds of trees and shrubs, and most recreation uses. It has fair potential for pasture, range, rangeland wildlife, and most engineering uses.

This soil is best suited to range. The natural plant cover is a mixture of mid and short grasses. A good plant cover and ground mulch help to control erosion and soil blowing and improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

This soil is not suited to cultivated crops because the erosion hazard is very severe. Disturbed areas can be seeded to tame pasture plants, but the choice of species is limited by the low fertility and the high content of lime.

Bunch-type species should not be planted alone because of the erosion hazard. Proper stocking rates, rotation grazing, applications of fertilizer, and weed control help to keep the pasture in good condition after it is established.

Windbreaks are not suited to this soil. Other kinds of trees can be grown if suited species are scalp planted or planted by hand and are given special care.

Disturbed areas at all buildings sites are subject to erosion and soil blowing unless they are revegetated as soon as possible. Septic tank filter fields and sanitary landfills are suited if they are designed properly for a strongly sloping soil. The hazard of seepage from farm ponds can be reduced by sealing the reservoir area.

This soil lacks sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening the base material. Roads should be graded to shed water. Control of roadside erosion helps to prevent gullying in borrow areas. Capability unit VIe-3; Thin Upland range site.

SuE—Sully silt loam, 15 to 40 percent slopes. This deep, well drained, hilly to steep soil is on the upper sides of upland ridges and river bluffs and breaks near Lake Oahe. Areas range from 25 to 200 acres in size. Sloughs and gullied drainageways are in most areas. Slopes are short and convex. Stones of glacial origin are on some of the ridges.

Typically, the surface layer is dark grayish brown silt loam about 2 inches thick. The underlying material is light brownish gray, very friable, calcareous silt loam. In places clayey shale or firm glacial till is at a depth of about 40 inches.

Included with this soil in mapping were small areas of Gettys, Sansarc, and Wabek soils, which make up less than 15 percent of most mapped areas. The loamy Gettys soils and the gravelly Wabek soils are on the tops of some of the ridges. The shallow clayey Sansarc soils are on the lower parts of the landscape, along drainageways that cut back into areas of this soil.

Fertility and the content of organic matter are low. Available water capacity is high, and permeability is moderate. Runoff is rapid in disturbed areas. The soil is highly susceptible to erosion and soil blowing.

All areas of this soil remain in native grass and are used for grazing. Clumps of native trees and shrubs cover some of the draws, and the soil has fair potential for rangeland wildlife. The soil has poor potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses.

This soil is best suited to range. The natural plant cover is a mixture of mid and short grasses. Especially critical on this soil are a good plant cover and ground mulch, which help to prevent excessive soil losses. If the range is overgrazed, the taller, more desirable grasses are replaced by less productive short grasses. As a result of livestock paths or trails, gullies form in overgrazed pastures. A planned grazing system that includes proper grazing use and deferred grazing helps to control erosion and maintains or improves the range condition.

This soil is not suited to crops, tame pasture, or windbreaks because of the steep slopes and the very severe erosion hazard. In disturbed areas it is best suited to native grass. Selected trees and shrubs that are planted for special purposes are suited if they are planted by hand and given special care.

Buildings are difficult to build on this soil because of the steep slopes and the very severe erosion hazard. Septic tank filter fields and sanitary landfills can be located in the less steep areas if they are designed for the slope.

This soil lacks sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening the base material. The routes of roads and trails should be carefully selected. Control of roadside erosion generally is needed to prevent gullying if the roads are graded. Capability unit VIIe-3; Thin Upland range site.

SwA—Swanboy clay, 0 to 6 percent slopes. This deep, moderately well drained to well drained, nearly level to gently sloping soil is on foot slopes and fans along upland drainageways and on terraces. Areas are irregularly shaped and range from 5 to 100 acres in size. Slopes are plane to slightly concave.

Typically, the surface layer is grayish brown clay about 1 inch thick (fig. 13). The subsoil is grayish brown, extremely firm clay about 18 inches thick. The lower part has spots and streaks of salts and lime that extend into the underlying material. The underlying material is grayish brown clay. The profile is calcareous throughout. In places the subsoil contains more sodium and less clay than is typical for Swanboy soils.

Included with this soil in mapping were small areas of Egas and Promise soils, which make up about 10 percent of any one mapped area. The very poorly drained Egas soils are in low areas near drainageways. The well drained Promise soils are on convex rises above areas of Swanboy soils. They contain less salts than Swanboy soils.

Fertility and the content of organic matter are low. Tilth is very poor, and the soil is difficult to work when farmed. Available water capacity is low or moderate, and the dense clay subsoil releases moisture slowly to plants. Permeability is very slow. The soil shrinks markedly when dry and swells markedly when wet. Runoff is medium to rapid.

Almost all areas of this soil remain in native grass and are used for grazing. The soil has fair potential for range and poor potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, wildlife, recreation uses, and most engineering uses.

This soil is best suited to range. The natural plant cover is a sparse stand of mid grasses. There are no sod-forming short grasses in the understory, and management that fails to maintain the best possible plant cover and ground mulch results in excessive soil losses and increased runoff. If the range is overgrazed, the mid grasses are replaced by forbs and weeds. In dry years there are considerable areas of bare ground. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range

condition. Because forage production varies widely between favorable years and unfavorable years, flexible stocking rates are especially critical on this soil.

This soil is not suited to cultivated crops, tame pasture, and windbreaks because tilth is very poor and the dense clay subsoil contains salts.

This soil is poorly suited as a site for buildings, roads, and most methods of waste disposal. If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to reduce possible structure damage caused by shrinking and swelling. Sewage lagoons are the only suitable means of waste disposal. Local roads should be graded to shed water, and suitable base material should be hauled in. Capability unit VIs-5; Dense Clay range site.

TaA—Tally fine sandy loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregularly shaped and range from 50 to 250 acres in size. Slopes are mostly smooth and slightly convex, but are gently undulating in some areas.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 9 inches thick. The underlying material is light brownish gray, calcareous fine sandy loam. In some low areas the upper 16 inches or more is dark colored.

Included with this soil in mapping were small areas of Lowry and Maddock soils, which make up as much as 15 percent of some mapped areas. The silty Lowry soils are on the edges of some mapped areas. The sandy Maddock soils are on the crests of low rises.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is low or moderate. The soil is easy to work. It takes in water readily and has moderately rapid permeability. Runoff is slow.

Most areas of this soil are farmed. The soil has good potential for farming, tame pasture, range, windbreaks and other kinds of trees and shrubs, rangeland wildlife, and recreation uses. It has fair potential for openland wildlife and most engineering uses.

This soil is well suited to all crops commonly grown in the county. Spring-sown small grain is better suited than winter wheat because of the soil blowing hazard. Controlling soil blowing, conserving moisture, and maintaining fertility are the main concerns of management if the soil is used for crops. Stubble mulch, crop residue management, wind stripcropping, field windbreaks, and minimum tillage help to control soil blowing, conserve moisture, and maintain fertility. Grasses and legumes in the cropping system and applications of animal manure and fertilizer improve fertility and tilth.

Seeding this soil to suited pasture plants is an effective means of controlling soil blowing. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition after it is established.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. An adequate plant cover and ground mulch help to control soil blowing and conserve moisture. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

Windbreaks are well suited to this soil. All climatically suited species of trees and shrubs can grow well. A cover of crop residue during site preparation helps to control soil blowing until the trees or shrubs are established.

This soil is well suited as a site for buildings. Septic tank absorption fields function well. Seepage is a problem if the soil is used for sewage lagoons. The hazard of seepage can be reduced by sealing the bottom and sides of the lagoons. The soil lacks sufficient strength to support vehicular traffic. This limitation can be overcome by strengthening the base material. Capability unit IIIe-7; Sandy range site.

TaB—Tally fine sandy loam, 2 to 6 percent slopes. This deep, well drained, undulating soil is on uplands. Areas are irregularly shaped and range from 5 to 100 acres in size. Slopes generally are short and convex, but some are smooth.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 9 inches thick. The underlying material is light brownish gray, calcareous fine sandy loam. In some swales and on some foot slopes, the upper 16 inches or more is dark colored.

Included with this soil in mapping were small areas of Lowry, Maddock, and Williams soils, which make up as much as 15 percent of some mapped areas. The silty Lowry soils are intermingled with Tally soils in some areas. The sandy Maddock soils are on the higher parts of the landscape. The loamy Williams soils are underlain by glacial till. They are in areas that are not mantled with sandy outwash material.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is low or moderate. The soil is easy to work. It takes in water readily and has moderately rapid permeability. Runoff is slow to medium.

Most areas of this soil are farmed. The soil has good potential for farming, tame pasture, range, windbreaks and other kinds of trees and shrubs, rangeland wildlife, and most recreation uses. It has fair potential for openland wildlife and most engineering uses.

This soil is well suited to all crops commonly grown in the county. Spring-sown small grain is better suited than winter wheat because of the soil blowing hazard. Controlling soil blowing and erosion, conserving moisture, and maintaining fertility are management concerns if the soil is farmed. Stubble mulch, crop residue management, wind stripcropping, field windbreaks, and minimum tillage help to control soil blowing and erosion, conserve moisture, and maintain fertility. Contour farming, terracing, and grassed waterways help to control erosion in areas where

soil washing is a problem. Grasses and legumes in the cropping system and applications of animal manure and fertilizer improve fertility and tilth.

Seeding this soil to suited pasture plants is an effective means of controlling soil blowing and erosion. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition after it is established.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. An adequate plant cover and ground mulch help to control erosion and soil blowing and conserve moisture. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

Windbreaks are well suited to this soil. All climatically suited trees and shrubs can grow well. A cover of crop residue on the surface during site preparation helps to control soil blowing and erosion until the trees or shrubs are estabished.

This soil is well suited as a site for buildings. Septic tank absorption fields function well, but seepage is a problem if the soil is used for other methods of waste disposal. The hazard of seepage from sewage lagoons can be reduced by sealing the bottom and sides of the lagoons. This soil lacks sufficient strength to support vehicular traffic. This limitation can be overcome by strengthening the base material. Capability unit IIIe-8; Sandy range site.

TaC—Tally fine sandy loam, 6 to 9 percent slopes. This deep, well drained, gently rolling soil is on upland ridges and knolls. Areas are irregularly shaped and range from 5 to 150 acres in size. Slopes generally are short and convex.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 9 inches thick. The underlying material is light brownish gray, calcareous fine sandy loam. In some swales and on some foot slopes, the upper 16 inches or more is dark colored.

Included with this soil in mapping were small areas of Lowry, Maddock, and Williams soils, which make up as much as 15 percent of some mapped areas. The silty Lowry soils are intermingled with Tally soils in some areas. The sandy Maddock soils are on the crests and upper sides of ridges and knolls. The loamy Williams soils are underlain by glacial till. They are in areas that are not mantled with sandy outwash material.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is low or moderate. The soil is easy to work. It takes in water readily and has moderately rapid permeability. Runoff is medium.

Many areas of this soil remain in native grass and are used for grazing or hay. Some areas are farmed. The soil has fair potential for farming and good potential for tame pasture, range, windbreaks and other kinds of trees and shrubs, rangeland wildlife, and for most recreation uses. It has fair to poor potential for most engineering uses.

This soil is well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. An adequate plant cover and ground mulch help to control erosion and soil blowing and conserve moisture. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding helps to restore the plant cover in disturbed areas or on range that is in poor condition.

Small grain and alfalfa are the main crops. They are better suited than row crops because of the hazards of erosion and soil blowing. Spring-sown small grain is better suited than winter wheat. Controlling erosion and soil blowing, conserving moisture, and maintaining fertility are the main management concerns if this soil is farmed. Contour farming, terracing, and grassed waterways help to control erosion and conserve moisture. If slopes are too irregular for those measures, stubble mulch, crop residue management, minimum tillage, and close-sown crops help to prevent excessive soil losses. Wind stripcropping and field windbreaks help to control soil blowing. Returning crop residue to the soil, growing grasses and legumes in the cropping system, and applying animal manure and fertilizer improve fertility and tilth.

Seeding this soil to suited pasture plants is an effective means of controlling erosion and soil blowing. Bunch-type pasture plants should not be planted alone because of the erosion hazard. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition after it is established.

This soil is well suited to windbreaks. All climatically suited trees and shrubs can grow well. Maintaining a cover of crop residue during site preparation helps to control erosion and soil blowing until the trees or shrubs are established. Planting on the contour conserves moisture needed by the trees and shrubs.

Land shaping generally is needed if this soil is used for commercial buildings, but the soil is well suited as a site for dwellings. Septic tank absorption fields function well, but seepage and the slope are problems if the soil is used for other methods of waste disposal. This soil lacks sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening the base material. If roads are graded, control of roadside erosion and soil blowing in borrow areas is needed. Capability unit IVe-8; Sandy range site.

Te—Tetonka silt loam. This deep, poorly drained, level soil is in closed depressions in uplands. Areas are circular or irregularly shaped and range from 4 to 150 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is dark gray silt loam about 6 inches thick. The subsurface layer is light brownish gray and grayish brown silt loam about 5 inches thick. Below this is a transition layer of dark grayish brown

silty clay loam and gray silt about 2 inches thick. The subsoil is about 28 inches thick. It is dark gray, firm to very firm silty clay in the upper part and dark gray silty clay loam in the lower part. The underlying material is light brownish gray, calcareous silty clay loam. In places, the surface layer and subsurface layer are thinner than is typical for Tetonka soils and the subsoil contains more sodium.

Included with this soil in mapping were small areas of Bowbells and Mobridge soils on fans and foot slopes on the edges of the depressions. These soils make up less than 5 percent of any one mapped area. They are moderately well drained and contain less clay in the subsoil than Tetonka soils.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is high, and permeability is very slow. The subsoil shrinks markedly when dry and swells markedly when wet. Runoff is ponded, and water remains on the surface until it evaporates. This soil generally is wet during the early part of the growing season.

Most of the larger areas remain in native grass and are used for grazing or hay. Many of the smaller areas of this soil are farmed together with adjacent soils. The soil has good potential for range and fair potential for wetland wildlife. It has poor potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses.

This soil is well suited to range. The natural plant cover is a mixture of water-tolerant tall and mid grasses and sedges. Sedges and rushes tend to increase during wet cycles. If the range is overgrazed, the taller grasses are replaced by western wheatgrass. If the range is grazed when the soil is wet, less desirable plants increase. A planned grazing system that includes proper grazing use and deferment of grazing during wet periods helps to maintain or improve the range condition.

This soil is poorly suited to cultivated crops and tame pasture. In most areas artificial drainage is not feasible because suitable outlets are not available. Because of wetness, late-planted crops are better suited than spring-sown small grain. Creeping foxtail, reed canarygrass, and western wheatgrass are suitable for seeding in disturbed areas.

Windbreaks that are commonly planted by machinery are generally not suited to this soil. Water-tolerant species that are planted for special purposes are suited if they are planted by hand and given special care.

The potential of this soil for wetland wildlife can be improved if shallow excavations are designed so that open water surrounded by rushes and other aquatic plants is provided for longer periods.

This soil generally is not suited to buildings or to most methods of waste disposal because of wetness. It is suitable for sewage lagoons if embankments adequately protect the lagoons against flooding. It is a poor site for roads because of the wetness, a high shrink-swell potential, the low strength, and the potential frost action. Grading the road above the flood level and hauling in suitable base material help to overcome these limitations, but alternative sites are generally more practical. Capability unit IVw-1; Closed Depression range site.

Us—Ustifluvents, channeled. This map unit consists of deep, moderately well drained, nearly level soils on bottom land. Areas are long and narrow and range from 25 to 300 acres in size. They are dissected by meandering stream channels and meander scars. Slopes generally are less than 2 percent. These soils are subject to flooding.

Typically, the soils have mixed textures and colors. In some areas the surface layer and underlying alluvium are dominantly clay loam, but in others the surface layer ranges from fine sandy loam to clay. The underlying material commonly is stratified and has thin layers of sand and gravel. In places the underlying material contains fine chips of weathered shale. A light colored layer commonly is at or near the surface, but in places the soil is dark colored to a depth of more than 10 inches.

Included with these soils in mapping were small areas of Durrstein, Egas, Jerauld, and Swanboy soils, which make up as much as 15 percent of some mapped areas. These included soils contain more salts than Ustifluvents. They occur throughout the map unit in an erratic pattern.

Fertility is medium, and the content of organic matter is moderately low to moderate. Available water capacity is moderate or high, and permeability is moderately slow or moderate. In most areas the shrink-swell potential is moderate. Runoff is slow.

Most areas of these soils remain in native vegetation and are used for grazing or hay. The soils have good potential for pasture, range, and special tree and shrub plantings; fair potential for rangeland wildlife; fair to poor potential for recreation uses; and poor potential for farming, windbreaks, and most engineering uses.

These soils are best suited to range. The natural plant cover is mainly tall and mid grasses. Clumps of native trees and shrubs are adjacent to stream channels in most areas. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

The meandering stream channels dissect areas of these soils into such small parcels that farming is not practical. Disturbed areas can be seeded to suited pasture plants if the areas are accessible to machinery. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

In the narrow areas of these soils, windbreaks commonly planted by machinery are not suited. Selected trees and shrubs can be planted for wildlife and for beautification.

These soils are not suitable for buildings unless costly diversions and dikes provide protection against flooding. If buildings are constructed, the site selected should be in the higher areas of these soils. All methods of waste disposal can result in pollution of shallow ground water or

surface water in streams. Sewage lagoons are feasible if they are protected against flooding and the bottom and sides of the lagoons are sealed to reduce the hazard of seepage.

Local roads can be built if they are graded above flood levels and the base material is strengthened to support vehicular traffic. Capability unit VIw-1; Overflow range site.

VdD—Vida stony loam, 3 to 15 percent slopes. This deep, well drained, undulating to rolling soil is on upland ridges and knolls. Areas are irregularly shaped and range from 10 to 150 acres in size. Slopes generally are short and convex, but some are long and smooth. Many glacial stones ranging to as much as 2 feet in diameter are on the surface or partly imbedded in the soil.

Typically, the surface layer is dark grayish brown stony loam about 2 inches thick. The subsoil is about 19 inches thick. The upper 6 inches is dark grayish brown, firm clay loam, and the lower 13 inches is grayish brown, calcareous clay loam that has spots and streaks of lime. The underlying material is light brownish gray, calcareous clay loam. In places, the surface is calcareous and the subsoil is not well defined.

Included with this soil in mapping were small areas of Lehr, Raber, Wabek, and Williams soils, which make up less than 15 percent of any one mapped area. The Lehr and Wabek soils are on the crests of knolls. They are shallow over sand and gravel. The Raber and Williams soils are on the lower parts of the landscape. They generally have fewer stones on the surface than this Vida soil and are deeper to lime.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is high. The soil is difficult to work because of the numerous imbedded stones. Permeability is moderate in the subsoil and moderately slow in the underlying material. The shrink-swell potential is moderate. Runoff is medium.

Almost all areas of this soil remain in native grass and are used for grazing. The soil has good potential for range and rangeland wildlife; poor potential for farming, pasture, windbreaks and other kinds of trees and shrubs, and most recreation uses; and fair potential for most engineering uses.

This soil is best suited to range. The natural plant cover is mainly mid and short grasses. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Range seeding and mechanical measures that improve the range are difficult to apply because the surface is stony.

This soil is too stony for cultivated crops, for tame pasture, and for windbreaks planted by machinery. Removal of stones generally is not feasible and is costly. Selected trees that are planted for special purposes are suited if they are planted by hand and given special care.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. A slow percolation rate is a limitation if this soil is used for septic tank filter fields. Enlarging the absorption area helps to overcome this limitation. Sewage lagoons can be located on the lower part of the landscape where slopes are less steep and stones are fewer.

Local roads can be built if they are graded to shed water and the base material is strengthened to support vehicular traffic. If roads are graded, control of roadside erosion helps to prevent gullying in borrow areas. Capability unit VIIs-6; Silty range site.

VzD—Vida-Zahl loams, 6 to 15 percent slopes. This map unit consists of deep, well drained to excessively drained, gently rolling to rolling soils on upland ridges and along entrenched drainageways. Areas are irregularly shaped and range from 10 to 300 acres in size. Slopes are short and convex. Glacial stones are on the surface in some areas on the higher parts of the landscape.

This map unit is about 55 percent Vida soil and 30 percent Zahl soil. These soils are so intricately mixed that it is not practical to separate them in mapping. The Vida soil is on the middle and lower parts of the landscape where slopes generally are less than 9 percent. The Zahl soil is on the tops and upper sides of ridges and knolls.

Typically, the Vida soil has a surface layer of dark grayish brown loam about 2 inches thick. The subsoil is about 19 inches thick. The upper 6 inches is dark grayish brown, firm clay loam, and the lower 13 inches is grayish brown, calcareous clay loam that has spots and streaks of lime. The underlying material is light brownish gray, calcareous clay loam. In some areas on foot slopes, the depth to lime is more than 10 inches. In places the soil is silty.

Typically, the Zahl soil has a surface layer of dark grayish brown loam about 5 inches thick. The underlying material is light brownish gray, friable clay loam. The entire profile is calcareous. In cultivated areas, the soil is eroded and the surface layer is light colored because it has been mixed with the underlying material by plowing.

Included with these soils in mapping were small areas of Bowbells, Parnell, and Tetonka soils, which make up less than 15 percent of any one mapped area. The moderately well drained Bowbells soils are in swales. The poorly drained Tetonka soils and the very poorly drained Parnell soils are in closed depressions.

Fertility is medium to low, and the content of organic matter is moderate to moderately low. Available water capacity is high. Permeability is moderate in the upper part of the soils and moderately slow in the underlying glacial till. The shrink-swell potential is moderate. Runoff is medium to rapid.

Most areas of these soils remain in native grass and are used for grazing or hay. The soils have good to fair potential for pasture, range, and rangeland wildlife and fair to poor potential for farming, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses.

These soils are best suited to range. The natural plant cover is mainly a mixture of mid and short grasses. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Pasture furrowing or range pitting and range seeding improve range that is in poor condition.

Where slopes are less than 9 percent, the Vida soil can be farmed if it is protected against excessive soil losses. The Zahl soil is not suitable for cultivation. Close-sown crops are better suited than row crops. Stubble mulch, crop residue management, minimum tillage, grasses and legumes in the cropping system, and grassed waterways help to control erosion, conserve moisture, and maintain fertility. Slopes generally are too irregular for contour farming and terracing. In many areas the two soils are so intermingled that farming is not practical.

Seeding these soils to tame pasture is an effective means of controlling erosion in areas that have been farmed or otherwise disturbed. Bunch-type species should not be planted alone because the erosion hazard is severe. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition after it is established.

Where slopes are less than 9 percent, the Vida soil is suited to windbreaks and other kinds of trees and shrubs. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture. Planting on the contour also conserves moisture. The Zahl soil is not suited to windbreaks.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. A slow percolation rate is a limitation if these soils are used for septic tank filter fields. Enlarging the absorption area helps to overcome this limitation. Sewage lagoons can be located on the lower part of the landscape where slopes are more gentle. The soils are suitable for sanitary landfills.

Local roads can be built if they are graded to shed water. Control of roadside erosion generally is needed in borrow areas. Strengthening the base material enables the soils to support vehicular traffic. Vida soil in capability unit IVe-3, Silty range site; Zahl soil in capability unit VIe-3, Thin Upland range site.

WaE—Wabek loam, 9 to 40 percent slopes. This excessively drained, rolling to steep soil is on upland ridges and knolls, terrace remnants, and terrace escarpments. Areas are long and narrow and range from 5 to 150 acres in size. Slopes are short and convex. Scattered pebbles and a few stones are on the surface in many areas.

Typically, the surface layer is dark grayish brown loam about 5 inches thick (fig. 14). The next layer is dark grayish brown, loose, calcareous gravelly sandy loam about 4 inches thick. The underlying material is varicolored, calcareous sand and gravel. In places the depth to sand and gravel is slightly more than 14 inches. In the western part of the county, fine chips of weathered shale are in the soil and the underlying material and in places the sand and gravel is underlain by loamy to clayey material within a depth of 40 inches.

Included with this soil in mapping were small areas of Bowdle, Gettys, Sansarc, and Sully soils, which make up less than 15 percent of most mapped areas. The Bowdle soils are on foot slopes. They are more than 20 inches deep over sand and gravel. The loamy Gettys soils and the silty Sully soils are mainly in the western part of the county. They are underlain by glacial till or loess. The shallow clayey Sansarc soils are in the western part of the county, on the lower parts of the landscape where drainageways cut back into areas of this soil.

Fertility is low, and the content of organic matter is moderately low. Available water capacity is low, and permeability is rapid. Runoff is slow.

Almost all areas of this soil remain in native grass and are used for grazing. The soil has poor potential for farming, tame pasture, range, windbreaks and other trees and shrubs, wildlife, and most recreation and engineering uses.

This soil is best suited to range. The natural plant cover is mainly a sparse stand of mid and short grasses. The best possible plant cover and ground mulch are essential in controlling soil blowing and in improving the moisture supply for plants. If the range is overgrazed, the more desirable grasses are replaced by sedges, forbs, and weeds. Severely overgrazed pastures have considerable areas of bare ground. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

This soil generally is not suited to farming, tame pasture, and windbreaks because of droughtiness and steep slopes. If trees and shrubs are hand planted for special purposes, they require frequent watering and special care.

Buildings can be located in areas where slopes are less than 15 percent, but excavations required during site preparation tend to slough. In many areas this soil is too steep to be a site for buildings. Septic tank absorption fields can be located in areas where the soil is less steep, but the effluent can pollute shallow ground water. This soil generally is not suited to other methods of waste disposal because of seepage and steep slopes. Routes of local roads should be selected carefully because of the steep slopes. Revegetating exposed cuts helps to control soil blowing and erosion. Capability unit VIIe-6; Very Shallow range site.

WbA—Williams-Bowbells loams, 0 to 2 percent slopes. This map unit consists of deep, well drained and moderately well drained, nearly level soils on uplands. Areas are irregularly shaped and range from 5 to 250 acres in size. Slopes are plane to slightly concave.

This map unit is about 50 percent Williams soil and 40 percent Bowbells soil. These soils are so intermingled that it was not practical to separate them in mapping. The Williams soil is on very slight rises. The Bowbells soil is in shallow swales and low areas where slopes are slightly concave.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 6 inches thick. The subsoil is friable clay loam about 20 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray and light olive brown, calcareous clay loam. On some rises the soil is calcareous within a depth of 10 inches, and in a few places the soil is silty.

Typically, the Bowbells soil has a surface layer of very dark gray loam about 10 inches thick. The subsoil is dark grayish brown, firm clay loam about 18 inches thick. The underlying material is light brownish gray, calcareous clay loam.

Included with these soils in mapping were small areas of Hoven, Parnell, and Tetonka soils in closed depressions less than 5 acres in size. These included soils make up less than 10 percent of any one mapped area. They are poorly drained or very poorly drained and have a clay or silty clay subsoil.

Fertility is medium to high, and the content of organic matter is moderate to high. Available water capacity is high. Permeability is moderate in the upper part of the soils and moderately slow in the underlying glacial till. The shrink-swell potential is moderate. Runoff is slow, and water collects on the Bowbells soil.

Most areas of these soils are farmed. A few areas remain in native grass and are used for grazing or hay. The soils have good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, openland wildlife, and most recreation uses. They have fair potential for most engineering uses.

These soils are well suited to all crops commonly grown in the county. Small grain, corn, and alfalfa are the main crops. Except for the periodic shortages of moisture common to the climate of the survey area, these soils have few limitations for crops. Farming is delayed on the Bowbells soil in wet years, but in most years the additional moisture is beneficial. Stubble mulch, crop residue management, and minimum tillage help to conserve moisture, control soil blowing, and maintain fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing.

All climatically suited pasture plants can grow on these soils. Proper stocking rates, rotation grazing, fertilization, clipping, and weed control help to keep the pasture in good condition.

These soils are well suited to range. The natural plant cover is a mixture of tall, mid, and short grasses. The tall grasses are mostly on the Bowbells soil. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

These soils are well suited to windbreaks. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps to eliminate grass and weeds and stores moisture.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. A slow percolation rate is a limitation if these soils are used for septic tank filter fields. Enlarging the absorption area helps to overcome this limitation. The Williams soil is well suited to other methods of waste disposal. Local roads can be built if they are graded to shed water and the base material is strengthened. Capability unit IIc-2; Williams soil in Silty range site, Bowbells soil in Overflow range site.

WbB—Williams-Bowbells loams, 2 to 6 percent slopes. This map unit consists of deep, well drained and moderately well drained, undulating soils on uplands. It is about 55 percent Williams soil and 35 percent Bowbells soil. These soils are so intricately mixed that it was not practical to separate them in mapping. The Williams soil is on the rises and swells where slopes are convex. The Bowbells soil is on foot slopes and in swales where slopes are concave. Areas are irregularly shaped and range from 10 to 800 acres in size.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 4 inches thick. The subsoil is friable clay loam about 18 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray and light olive brown, calcareous clay loam. On the tops of some knolls and ridges, the soil is calcareous within a depth of 10 inches. On some rises it is more silty than is typical for Williams soils.

Typically, the Bowbells soil has a surface layer of very dark gray loam about 10 inches thick. The subsoil is dark grayish brown, firm clay loam about 18 inches thick. The underlying material is light brownish gray, calcareous clay loam.

Included with these soils in mapping were small areas of Demky and Parnell soils, which make up about 10 percent of any one mapped area. The Demky soils are on foot slopes. They contain more sodium than Williams and Bowbells soils. The very poorly drained Parnell soils are in closed depressions less than 5 acres in size.

Fertility is medium to high, and the content of organic matter is moderate to high. Available water capacity is high. Permeability is moderate in the upper part of the soils and moderately slow in the underlying glacial till. The shrink-swell potential is moderate. Runoff is medium, and water tends to collect on the Bowbells soil.

Most areas of these soils are farmed. A few areas remain in native grass and are used for grazing or hay. The soils have good potential for farming, tame pasture and hay, range, windbreaks and other kinds of trees and shrubs, openland wildlife, and most recreation uses. They have fair potential for most engineering uses.

These soils are well suited to all crops commonly grown in the county. Small grain, corn, and alfalfa are the main crops. Controlling erosion and soil blowing and conserving moisture are the main concerns if these soils are used for crops. Slopes generally are too irregular for contour farming and terracing. Stubble mulch, crop residue management, minimum tillage, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Wind stripcropping and field windbreaks also help to control soil blowing.

All climatically suited pasture plants grow well on these soils. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

These soils are well suited to range. The natural plant cover is a mixture of mid and short grasses. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Pasture furrowing, range seeding, and fertilization improve range that is in poor condition.

These soils are well suited to windbreaks. All climatically suited trees and shrubs will grow well. A year of fallow prior to planting helps to eliminate grass and weeds and stores moisture.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. A slow percolation rate is a limitation if these soils are used for septic tank filter fields. Enlarging the absorption area helps to overcome this limitation. Sewage lagoons can be located in areas where slopes are more gentle. The soils have only slight limitations for landfills. Local roads can be built if they are graded to shed water and the base material is strengthened. Capability unit IIe-2; Silty range site.

WdC—Williams-Vida loams, 6 to 9 percent slopes. This map unit consists of deep, well drained, gently rolling soils on uplands. Areas are irregularly shaped and range from 5 to 200 acres in size. Slopes are short and convex. On the higher parts of the landscape, a few scattered glacial stones are on the surface.

This map unit is about 55 percent Williams soil and 35 percent Vida soil. These soils commonly are so intricately mixed that it was not practical to separate them in mapping. The Williams soil is on the middle and lower parts of the landscape. The Vida soil is on the upper sides and tops of ridges and knolls.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 5 inches thick. The subsoil is friable clay loam about 18 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray and light olive brown, calcareous clay loam. In places the soil is more silty than is typical for Williams soils.

Typically, the Vida soil has a surface layer of dark grayish brown loam about 4 inches thick. The subsoil is about 18 inches thick. The upper 5 inches is dark grayish brown, firm clay loam, and the lower 13 inches is grayish brown, calcareous clay loam that has spots and streaks of lime. The underlying material is light brownish gray, calcareous clay loam. In cultivated areas, the soil may be moderately eroded and the surface layer is light colored and calcareous.

Included with these soils in mapping were small areas of Bowbells, Hoven, Parnell, and Tetonka soils, which make up about 10 percent of any one mapped area. The moderately well drained Bowbells soils are on foot slopes and in swales. The poorly drained and very poorly drained Hoven, Parnell, and Tetonka soils are in closed depressions less than 5 acres in size.

Fertility is medium, and the content of organic matter is moderate. Available water capacity is high. Fertility is low in eroded spots. Permeability is moderate in the upper part of the soils and moderately slow in the underlying material. The shrink-swell potential is moderate. Runoff is medium.

Many areas of these soils remain in native grass and are used for grazing or hay. Some areas are farmed. The soils have fair potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, openland wildlife, and most recreation and engineering uses. They have good potential for range and rangeland wildlife.

These soils are suited to most crops commonly grown in the county. A close-sown crop, such as small grain, is better suited than row crops because the erosion hazard is severe. Slopes generally are too irregular for contour farming and terracing. Stubble mulch, crop residue management, minimum tillage, close-sown crops, and grassed waterways help to control erosion and soil blowing, conserve moisture, and maintain fertility and tilth. Grasses and legumes in the cropping system, green manure crops, and applications of animal manure and fertilizer improve fertility in eroded spots. Wind stripcropping and field windbreaks help to control soil blowing.

Seeding these soils to tame pasture is effective in controlling erosion and soil blowing. Bunch-type species should not be planted alone because of the erosion hazard. Proper stocking rates, rotation grazing, applications of fertilizer, clipping, and weed control help to keep the pasture in good condition.

These soils are well suited to range. The natural plant cover is a mixture of mid and short grasses. An adequate plant cover and ground mulch help to control erosion and

improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition. Pasture furrowing and range seeding improve range that is in poor condition.

These soils are moderately well suited to windbreaks and other kinds of trees and shrubs. All climatically suited species will grow well. A year of fallow prior to planting helps to eliminate grass and weeds and conserves moisture. Planting on the contour also conserves moisture.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage caused by shrinking and swelling. A slow percolation rate is a limitation if these soils are used for septic tank filter fields. Enlarging the absorption area helps to overcome this limitation. Sewage lagoons can be located in areas where slopes are more gentle. The slopes generally are not too steep for landfills. Local roads can be built if they are graded to shed water and the base material is strengthened. Control of roadside erosion generally is needed in borrow areas. Capability unit IIIe-2; Silty range site.

YeB—Yecross loamy fine sand, 0 to 6 percent slopes. This deep, excessively drained, nearly level to undulating soil is on uplands. Areas are irregularly shaped and range from 20 to 100 acres in size. Slopes are short and convex.

Typically, the surface layer is about 9 inches thick. The upper part is dark grayish brown loamy fine sand, and the lower part is dark gray, very friable loamy sand. The underlying material is grayish brown, calcareous loamy sand and sand. On the lower parts of the landscape, the dark colored surface layer is more than 10 inches thick. A seasonal high water table is evident in some low spots.

Included with this soil in mapping were small areas of Parshall soils in some of the low areas. These soils make up less than 10 percent of any one mapped area. They are less sandy than Yecross soils.

Fertility is low, and the content of organic matter is moderately low. Available water capacity is low. The soil is easy to work and takes in water readily, but it is highly susceptible to soil blowing. Permeability is rapid. Runoff is very slow.

Most areas of this soil remain in native grass and are used for grazing. A few areas are farmed. The soil has good potential for range; fair potential for tame pasture, windbreaks and other kinds of trees and shrubs, and rangeland wildlife; and poor potential for farming and recreation uses. It has good potential for some engineering uses, but it has poor potential for engineering if seepage is a limiting factor.

This soil is best suited to range. The natural plant cover is mainly tall and mid, warm-season grasses. An adequate grass cover and ground mulch help to control soil blowing. Overgrazing reduces the plant cover and increases the risk of soil blowing. A planned grazing system that includes proper grazing use and deferred grazing maintains or improves the range condition and helps to control soil blowing.

If this soil is farmed, close-sown crops are better suited than row crops because the soil blowing hazard is severe. Spring-sown crops are better suited than fall-sown crops. Stubble mulch, crop residue management, minimum tillage, wind stripcropping, and field windbreaks help to control soil blowing and conserve moisture. Grasses and legumes in the cropping system, green manure crops, and animal manure improve fertility and the content of organic matter.

Seeding this soil to tame pasture plants is effective in controlling soil blowing. A liberal use of crop residue as a mulch on the surface reduces the risk of soil blowing until the pasture is established. Proper stocking rates, rotation grazing, applications of fertilizer, and weed control help to keep the pasture in good condition.

This soil is well suited to windbreaks. Most climatically suited trees and shrubs can grow well. Leaving crop residue on the surface during site preparation or planting a cover crop between the tree rows helps to control soil blowing until the trees or shrubs are established.

This soil has few limitations for buildings and roads. Cutbanks cave if the soil is used for shallow excavations. Revegetating disturbed areas as soon as possible helps to control soil blowing. Septic tank absorption fields function well, but the effluent can pollute shallow ground water. Seepage generally is too severe a limitation for other methods of waste disposal. Capability unit IVe-9; Sands range site.

YeC—Yecross loamy fine sand, 6 to 15 percent slopes. This deep, excessively drained, gently rolling to rolling soil is on uplands. Areas are irregularly shaped and range from 15 to 100 acres in size. Slopes are short and convex.

Typically, the surface layer is about 7 inches thick. It is dark grayish brown loamy fine sand in the upper part and dark gray, very friable loamy sand in the lower part. The underlying material is grayish brown, calcareous loamy sand and sand. In some areas on the lower parts of the landscape, the dark colored surface layer is more than 10 inches thick.

Included with this soil in mapping were small areas of Parshall and Tally soils, which make up less than 10 percent of most mapped areas. The Parshall soils are on the lower parts of the landscape. The Tally soils are intermingled with Yecross soils on the middle and higher parts of the landscape. The Parshall and Tally soils are less sandy than Yecross soils.

Fertility is low, and the content of organic matter is moderately low. Available water capacity is low. The soil takes in water readily. In disturbed areas it is highly susceptible to soil blowing. Permeability is rapid. Runoff is very slow.

Almost all areas of this soil remain in native grass and are used for grazing. The soil has good potential for range, fair potential for rangeland wildlife, and poor potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, and recreation uses. It has fair to poor potential for most engineering uses.

This soil is best suited to range. The natural plant cover is mainly tall and mid, warm-season grasses. An adequate grass cover and ground mulch help to control soil blowing. Overgrazing reduces the plant cover and increases the risk of soil blowing. Sand blowouts can easily form on livestock trails and in other areas where the plant cover has been removed. A planned grazing system that includes proper grazing use maintains or improves the range condition and helps to control soil blowing.

This soil is not suited to cultivated crops because of the very severe hazard of soil blowing, droughtiness, low fertility, and irregular slopes. Seeding disturbed areas to native or tame pasture plants is the best way to control soil blowing. Maintaining a mulch of crop residue on the surface helps to control soil blowing until the planting is established.

Windbreaks and other kinds of trees and shrubs are poorly suited to this soil. Selected trees and shrubs are suited if they are scalp planted in sod or hand planted.

The main limitations of this soil for buildings and roads are the slope and the probable caving of excavations. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. Septic tank absorption fields function well, but the effluent can pollute shallow ground water. Seepage generally is too severe a limitation for other methods of waste disposal. Capability unit VIe-7; Sands range site.

ZaE—Zahl-Williams loams, 15 to 34 percent slopes. This map unit consists of deep, well drained to excessively drained, hilly to steep soils on upland ridges and along entrenched drainageways. Areas are irregularly shaped and range from 10 to 250 acres in size. Slopes are short and convex. Scattered glacial stones are on the surface on some of the ridges.

This map unit is about 55 percent Zahl soil and 40 percent Williams soil. These soils are so intricately mixed that it was not practical to separate them in mapping. The Zahl soil is on the higher parts of the landscape. The Williams soil is on the lower parts of the landcape or on some of the broader ridgetops.

Typically, the Zahl soil has a surface layer of dark grayish brown loam about 5 inches thick. The underlying material is light brownish gray, calcareous clay loam.

Typically, the Williams soil has a surface layer of dark grayish brown loam about 5 inches thick. The subsoil is friable clay loam about 16 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and light brownish gray in the lower part. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is light brownish gray and light olive brown, calcareous clay loam. In some places the depth to calcareous soil material is less than is typical for Williams soils, and in others the soil is silty.

Included with these soils in mapping were small areas of Bowbells soils, which make up about 5 percent of any one mapped area. These moderately well drained soils are on foot slopes and in swales.

Fertility is medium to low, and the content of organic matter is moderately low to moderate. Available water capacity is high. The shallowness over a high content of lime in the Zahl soil affects the availability of plant nutrients. Permeability is moderate in the upper part of the soils and moderately slow in the underlying glacial till. The shrink-swell potential is moderate. Runoff is medium to rapid.

Almost all areas of these soils remain in native grass and are used for grazing. The soils have fair to good potential for range and rangeland wildlife and poor potential for farming, tame pasture, windbreaks and other kinds of trees and shrubs, recreation uses, and most engineering uses.

These soils are best suited to range. The natural plant cover is mainly a mixture of mid and short grasses. An adequate grass cover and ground mulch help to prevent excessive soil losses and improve the moisture supply for plants by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive short grasses. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition.

These soils are not suitable for farming because of a very severe erosion hazard and the irregular, steep slopes. Areas where slopes are less steep can be seeded to pasture. Most disturbed areas, however, are better suited to native grass.

Windbreaks that are commonly planted by machinery are not suited. Selected trees that are planted for recreation and wildlife purposes (fig. 15) are suited if they are planted by hand or scalp planted in sod and are given special care.

If buildings are constructed on these soils, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structure damage caused by shrinking and swelling. Slopes generally are too steep for most methods of waste disposal. Septic tank absorption fields can be located in the areas where the soils are less steep, but the slow percolation rate is a limitation. Enlarging the absorption area helps to overcome this limitation. Local roads can be built if routes are carefully selected to minimize the unstable nature of underlying material and the risk of roadside erosion. Capability unit VIIe-3; Zahl soil in Thin Upland range site, Williams soil in Silty range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It

is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, and as sites for buildings, highways and other transportation systems, sanitary facilities, parks and other recreation facilities, and wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should be developed to maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

By M. SCOTT ARGABRIGHT, conservation agronomist, Soil Conservation Service.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil are discussed; 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 presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the needed management practices. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 270,000 acres in Walworth County was used for crops and pasture in 1967, according to the Conservation Needs Inventory. Of this total, 10,000 acres was used for permanent pasture; 95,000 acres was used for close-sown crops, mainly spring wheat and oats; 43,000 acres was used for row crops, mainly corn harvested for silage or grain; 47,000 acres was summer fallow for small grain; 55,000 acres was permanent hayland; 5,000 acres was used for rotation hay and pasture; and 15,000 acres was in conservation use only.

The potential of the soils in Walworth County for increased crop production is good. About 55,000 acres of potentially good cropland is used as rangeland and about 8,000 acres as pasture. In addition, crop 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.

Soil erosion is the major soil problem on about 57 percent of the cropland and pasture in Walworth County. If the slope is more than 2 percent, erosion is a hazard on such soils as Agar, Eakin, Highmore, Raber, Tally, Williams, and Vida soils.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced if the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on clayey soils, such as Opal and Promise soils, and on soils that have a claypan subsoil, such as Demky soils. Erosion also reduces productivity on soils that tend to be droughty, such as Akaska, Bowdle, and Lehr soils. Second, soil erosion on farmland results in sediment entering streams and lakes. Controlling erosion minimizes the pollution of streams and lakes by sediment and improves water quality for fish and wildlife, recreation, and municipal use.

Erosion control provides protective surface cover, reduces the risk of runoff, and increases the infiltration rate. A cropping system that keeps plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. Some cropping systems, such as spring wheat-fallow, include fallow periods as long as 21 months. If no crop protects the soil, careful management of crop residue is essential. On livestock farms, which require hay and pasture, legume and grass forage crops in the cropping system not only provide nitrogen and improve tilth for the following crop but also reduce the risk of erosion on sloping soils.

In most areas of the sloping Raber, Vida, and Williams soils, slopes are so short and irregular that contour tillage or terracing is not practical. On these soils, cropping systems that provide substantial plant cover are needed to control erosion.

Minimizing tillage and leaving crop residue on the surface increase infiltration and reduce the hazards of runoff and erosion. They can be adapted to most soils in the survey area.

Terraces and diversions reduce the length of slopes and the risks of runoff and erosion. They are most practical on deep, well drained soils that have long, smooth slopes, such as Agar, Eakin, Highmore, Lowry, Promise, and Sully soils. Contouring and contour stripcropping are also well suited to these soils. Many of the other soils in the county are less suitable for terraces and diversions because they have short, irregular slopes or an unfavorable subsoil that would be exposed in terrace channels.

Soil blowing is a slight to severe hazard on almost all the soils in the county. The soil blowing hazard is especially severe on the sandy Hecla, Maddock, and Yecross soils and on Parshall fine sandy loam and Tally fine sandy loam. The clayey Opal and Promise soils and soils that have a high content of lime, such as Divide and Sully soils, are also highly susceptible to soil blowing. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover, crop residue, or rough surfaces through proper tillage minimizes the risk of soil blowing on these soils. Windbreaks of suitable trees and shrubs are also effective in reducing the risk of soil blowing.

Information about the design of erosion-control systems for each kind of soil is contained in the Technical Guide, which is available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on about 1 percent of the acreage used for crops and pasture in the survey area. Under natural conditions, some soils are so wet that the production of crops commonly grown in the survey area is generally not possible. The poorly drained and very poorly drained Arveson, Colvin, Hoven, Macken, Parnell, Regan, and Tetonka soils, which make up about 12,000 acres in the survey area, are examples. Artificial drainage generally is not feasible on these soils.

Demky, Opal, and Promise soils have adequate drainage in most years, but they tend to dry out slowly in spring. The moderately well drained to somewhat poorly drained Bon, Bowbells, Divide, and Mobridge soils, on bottom land and in swales, receive additional moisture from stream flooding or from runoff received from adjacent soils. During wet years, tillage and planting are delayed in spring, but in most years drainage is adequate and the additional moisture is beneficial for crops. Artificial drainage rarely is needed on these soils.

Soil fertility is naturally low in soils that have a high content of lime, such as Sully and Zahl soils. Grasses and legumes in the cropping system help to maintain fertility. On all soils, additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

In Opal and Promise soils, which are clayey, tilth is poor. These soils dry out slowly in spring and are difficult to work. If they are tilled when wet, they tend to be very cloddy when dry and good seedbeds are difficult to prepare. Stubble mulch, crop residue management, grasses and legumes in the cropping system, chiseling, and timely tillage improve soil tilth.

Field crops suited to the soils and climate of the survey area include close-growing crops and row crops. Spring wheat and oats are the main close-growing crops. Barley, flax, rye, and winter wheat are also suited and are grown to a lesser extent. Corn is the main row crop. Sorghum also is grown on a small acreage. On dryland, these row crops commonly are harvested for silage. Sunflowers can be grown on dryland if economic conditions are favorable. Some irrigated navy beans are grown.

All commonly grown and climatically suited crops are suited to the deep, well drained and moderately well drained Agar, Bon, Bowbells, Highmore, Eakin, Lowry, Mobridge, Raber, and Williams soils.

Early maturing, more drought resistant small grain is better suited than deeper rooted corn and alfalfa on soils having porous underlying material that limits rooting depth and water storage capacity, such as Akaska, Bowdle, and Lehr soils. Close-sown crops are also better suited to sandy soils in which available water capacity is low, such as Maddock and Yecross soils.

On Demky, Opal, and Promise soils, winter wheat, other small grain, and alfalfa are better suited than row crops. These soils have a clayey subsoil that retards root growth and restricts the amount of water released to plants.

Pasture plants that are best suited to the climate and to most soils in the survey area include alfalfa, intermediate wheatgrass, and smooth bromegrass. Crested wheatgrass is well suited to soils that tend to be droughty, such as Akaska, Bowdle, and Lehr soils, and to soils that have low fertility and a high content of lime, such as Sully and Zahl soils. Because of the erosion hazard, bunch-type species, such as crested wheatgrass, should not be planted alone if the slope is more than 6 percent.

If the poorly and very poorly drained Arveson, Colvin, Hoven, Macken, Parnell, and Tetonka soils are used for pasture, the choice of pasture plants is limited to water-tolerant species, such as creeping foxtail and reed canarygrass.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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; they 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 landforms 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 too cold or too 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, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability unit is identified in the description of each soil map unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils (*7*). Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-6.

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 5. 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. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils 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 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local of-

fices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Rangeland

By C. M. SCHUMACHER, range conservationist, Soil Conservation Service.

About 34 percent of Walworth County is rangeland. More than half of the farm income is derived from livestock, principally cattle. Cow-calf-steer operations are dominant throughout the county. The average size of farms is 1,600 acres.

On many farms the forage produced on rangeland is supplemented by crop stubble. In winter the native forage is often supplemented by hay and protein concentrate. Creep feeding of calves and yearlings to increase their market weight is practiced on some farms.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once mixed prairie is now covered with short grasses and weeds. The amount of forage produced may be less than half of that originally produced. Productivity of the range can by increased by using management that is effective for specific kinds of soil and range sites.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture 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.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic vegetation of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. Because only major species are listed, percentages do not necessarily total 100. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluaton of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat and protects soil and water resources.

The major management concern on most rangeland is control of grazing so that the kinds and amounts of plants that make up the potential natural plant community are reestablished. Sound range management based on soil survey information and other rangeland inventory information is the basis for maintaining or improving forage production.

Rangeland occurs generally as small scattered tracts throughout the county. Larger tracts are in areas of the Sansarc-Opal map unit near Lake Oahe, the Opal-Promise map unit along Swan Creek, and the Vida-Zahl map unit in the northeastern and southeastern corners of the county. As a result of steep slopes, stoniness, or shallowness, the major soils in these units are poorly suited to cultivation.

Native woods and windbreaks

By DAVID L. HINTZ, forester, Soil Conservation Service.

Less than 2 percent of the acreage of Walworth County is used for native trees and shrubs. The soils that support trees and shrubs are not classified as woodland. The trees and shrubs generally occur on range sites where soil and water relationships are favorable for their establishment and growth. It is likely that the trees and shrubs are spreading from their original sites because prairie fires are no longer common in the survey area.

Scattered individual plants or clumps of American elm, green ash, hackberry, plains cottonwood, American plum, common chokecherry, western snowberry, skunkbush sumac, boxelder, silver buffaloberry, golden currant, bur oak, and several species of wild rose are evident on Bowbells, Gettys, Highmore, Opal, Raber, Sansarc, Williams, Vida, and Zahl soils in drainageways. Scattered plains cottonwood, peachleaf willow, sandbar willow, common chokecherry, and western snowberry grow where Tetonka and Parnell soils adjoin other soils, on the margins of areas of Aquolls, and on Bon soils and Ustifluvents, channeled. Russian-olive, an introduced species, is volunteering in many scattered areas of these soils.

The early settlers in Walworth County valued trees and shrubs as a source of fuel and food. The flood plain of the Missouri River was the chief area of trees and shrubs. This area is now completely under Lake Oahe. Other areas of native trees and shrubs are used mainly as wildlife habitat.

Windbreaks have been planted since the days of the early settlers. The early plantings were established mainly for the protection of farmsteads and livestock. Windbreaks that protect farmsteads and livestock are still needed. In recent years field windbreaks have been planted to help control soil blowing. Thousands of acres in the county are still not protected by windbreaks.

Windbreaks are established to protect livestock, buildings, and yards from winds and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species 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 depending on erodibility of the soil. They protect cropland and crops from wind, hold 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. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition will assure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Wildlife habitat

By JOHN B. FARLEY, biologist, Soil Conservation Service.

Wildlife habitat is a product of the soil and, like other crops, responds to good management. The level of population of suitable wildlife is determined by the essential food and cover provided by the habitat. The nature and adequacy of introduced and native habitat plants depend on the suitability of the soil for growing the plants. The habitat elements needed by wildlife generally require several kinds of soil and combinations of land uses.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 8, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating. Natural habitats can be maintained on these soils, but management is difficult and requires intensive effort.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, sorghum, wheat, oats, and barley. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wet-

ness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are intermediate wheatgrass, smooth bromegrass, sweetclover, and alfalfa. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are grasses, forbs, and sedges. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, and flood hazard. Soil temperature and soil moisture are also considerations.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Examples are American plum, common chokecherry, silver buffaloberry, Russian-olive, and green ash. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are smartweed, wild millet, cattail, saltgrass, and cordgrass and rushes, sedges, and reeds. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness.

Shallow water areas are bodies of water that have an average depth of less than 8 feet and that are created by excavation. Examples are shallow dugouts, level ditches, and blasted ponds. Major soil properties affecting shallow water areas are depth to bedrock, wetness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and planted woodland. Animals attracted to this habitat use other areas, such as naturally wooded tracts and vegetated marshland, but they are most closely associated with cultivated areas. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, mourning dove, meadowlark, robin, cottontail, jackrabbit, red fox, fox squirrel, raccoon, and whitetail deer.

Wetland habitat consists of open, marshy or swampy, shallow-water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, coot, herons, shore birds, redwing blackbird, muskrat, mink, and beaver.

Rangeland habitat consists of extensive areas of native grassland. Wildlife attracted to rangeland include pronghorned antelope, whitetail deer, mule deer, sharp-tailed grouse, lark bunting, prairie chicken, mourning dove, magpie, horned lark, coyote, red fox, bobcat, jackrabbit, and prairie dog.

Engineering

DAVID F. KONECHNE, agricultural engineer, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this section are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to: (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and

water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 9 shows, for each kind of soil, the degree and kind of limitations for building site development; table 10, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemetery plots. Such digging or trenching is influenced by the soil wetness of a high seasonal water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for such uses and for use of the soil as

daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and, if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may become contaminated.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table could be installed or the size of the absorption field could be increased so that performance is satisfactory.

Sewage lagoon areas are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is solid waste (refuse) and soil that is placed in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Seepage into the refuse increases the risk of pollution of ground water.

In the trench type of landfill, ease of excavation also affects the suitability of a soil for this purpose, so the soil must be deep to bedrock and free of large stones and boulders. Where the seasonal water table is high, water seeps into trenches and causes problems in filling.

Unless otherwise stated, the limitations in table 10 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stoniness do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, the most organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Ratings are *good*, *fair*, and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, and stratification are given in table 14. Also, the soil series descriptions provide detailed information on the profiles and information on permeability and other characteristics of the soils.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 12 soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability, texture, depth to bedrock, hardpan, or other layers that affect the rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil

blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

Lake Oahe, on the west side of the county, is a major recreation area. This impoundment, created by the construction of a dam on the Missouri River near the center of the State, provides boating, fishing, and water skiing. Several campgrounds, picnic areas, and other facilities have been constructed along the shores. If the recreation use of this lake increases, additional facilities will be needed.

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 13 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 10, and interpretations for dwellings without basements and for local roads and streets, given in table 9.

Camp areas require such site preparation as shaping and leveling for 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 for this use 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to

determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH; CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 17. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste

disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity 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 the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 15. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing 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, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing 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, but crops can be grown if measures to control soil blowing 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, and 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, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

The *Hydrologic group* is used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 to deep, moderately well drained to 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils 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 is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the soil mapping. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 17.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the South Dakota Department of Highways.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the Amer-

ican Association of State Highway and Transportation Officials. The code for Unified classification is assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-69T); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); and moisture-density, method A (T99-57).

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*5*). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Agar series

The Agar series consists of deep, well drained, moderately permeable soils that formed in silty loess. These soils are on uplands. Slopes range from 0 to 9 percent.

Agar soils are similar to Highmore soils and are near Lowry, Mobridge, and Sully soils. Highmore soils formed in silty drift and have a C horizon that commonly is stratified with thin lenses of very fine sand and fine sand. Lowry soils lack argillic horizons and are coarse-silty. Mobridge soils have a mollic epipedon that is more than 20 inches thick. Sully soils lack a mollic epipedon and are coarse-silty.

Typical pedon of Agar silt loam, 2 to 6 percent slopes, 460 feet west and 140 feet south of the northeast corner of sec. 7, T. 122 N., R. 78 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable, slightly sticky; many roots; neutral; abrupt smooth boundary.

B21t—6 to 9 inches; dark brown (10YR 4/3) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many roots; neutral; gradual smooth boundary.

B22t—9 to 18 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; slightly hard, friable, slightly sticky and slightly plastic; common roots; mildly alkaline; clear wavy boundary.

B3ca—18 to 24 inches; light brownish gray (2.5Y 6/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few roots; common fine segregations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—24 to 40 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—40 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 15 to 36 inches, and depth to free carbonates ranges from 11 to 22 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is 3 to 8 inches thick. The B2t horizon has hue of 10YR or 2.5Y. It is silty clay loam or heavy silt loam averaging between 25 and 35 percent clay. 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 or silty clay loam, but in some pedons it is clay loam at a depth of 40 to 60 inches. The C horizon is mildly alkaline or moderately alkaline.

Akaska series

The Akaska series consists of well drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils formed in silty material that is moderately deep over sand and gravel. They are on glacial outwash plains and stream terraces. Slopes range from 0 to 6 percent.

Akaska soils commonly are near Bowdle, Lehr, and Mobridge soils. Bowdle and Lehr soils contain more sand and less silt in the B horizon than Akaska soils. Mobridge soils have a mollic epipedon that is more than 20 inches thick and do not have sand and gravel within a depth of 40 inches.

Typical pedon of Akaska silt loam, 0 to 2 percent slopes, 1,452 feet north and 132 feet east of the southwest corner of sec. 22, T. 121 N., R. 74 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many roots; neutral; abrupt smooth boundary.

B21t—7 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common roots; neutral; gradual smooth boundary.

B22t—15 to 21 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few roots; mildly alkaline; gradual smooth boundary.

B3ca—21 to 26 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; mildly alkaline; gradual smooth boundary.

C1ca—26 to 34 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; soft, friable, slightly sticky and slightly plastic; common fine segregations of lime; strong effervescence; moderately alkaline; clear smooth boundary.

IIC2—34 to 60 inches; varicolored sand and gravel; single grained; loose; slight effervescence; moderately alkaline.

Depth to sand and gravel ranges from 20 to 40 inches, and depth to free carbonates ranges from 16 to 26 inches. The mollic epipedon is 8 to 17 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral and is 6 to 9 inches thick. The B2t horizon has chroma of 2 or 3. It is silty clay loam or heavy silt loam averaging between 25 and 35 percent clay. The B3ca and Cca horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. The Cca horizon is dominantly silt loam, but it is silty clay loam or loam in some pedons. The IIC horizon is mildly alkaline or moderately alkaline.

Arveson series

The Arveson series consists of deep, poorly drained soils that are moderately rapidly permeable in the upper part and rapidly permeable in the lower part. These soils formed in alluvium. They are on uplands along drainageways. They are high in content of free carbonates. Slopes range from 0 to 2 percent.

Arveson soils are near Hecla and Maddock soils and are similar to Regan soils. Hecla and Maddock soils are better drained than Arveson soils and lack a calcic horizon. Regan soils are fine-silty.

Typical pedon of Arveson sandy loam, wet, 760 feet east and 75 feet south of the northwest corner of sec. 2, T. 124 N., R. 76 W.

A11—0 to 6 inches; dark gray (10YR 4/1) sandy loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; slight effervescence; mildly alkaline; clear wavy boundary.

A12—6 to 13 inches; dark gray (10YR 4/1) sandy loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; slight effervescence; mildly alkaline; gradual smooth boundary.

C1gca—13 to 21 inches; light brownish gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; common fine distinct mottles, light gray (10YR 7/1) moist, and few fine distinct mottles, yellowish brown (10YR 5/6) moist; weak coarse subangular blocky structure; slightly hard, very friable; violent effervescence; moderately alkaline; clear wavy boundary.

C2g—21 to 60 inches; light brownish gray (2.5Y 6/2) sand, grayish brown (2.5Y 5/2) moist; common fine distinct mottles, yellowish brown (10YR 5/6) and light gray (10YR 7/1) moist; single grained; loose; strong effervescence; moderately alkaline.

Depth to loamy fine sand or coarser sediments is 20 inches or more. The mollic epipedon is 7 to 15 inches thick. The calcium carbonate equivalent ranges from 15 to 30 percent within a depth of 15 inches. Reaction in all horizons is mildly alkaline or moderately alkaline.

The A horizon is neutral or has hue of 10YR to 5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or less. It is dominantly sandy loam, but it is fine sandy loam or loam in some pedons. It is 10 to 15 inches thick. The C horizon is neutral or has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. The C1 horizon is fine sandy loam in some pedons. The C2 horizon ranges from sand to fine sandy loam.

Bon series

The Bon series consists of deep, well drained and moderately well drained, moderately permeable soils that formed in alluvium. These soils are on low terraces and bottom land. Slopes range from 0 to 2 percent.

Bon soils are similar to Bowbells and Mobridge soils. Bowbells and Mobridge soils have an argillic horizon. In addition, Mobridge soils have a fine-silty control section.

Typical pedon of Bon loam 100 feet east and 1,980 feet north of the southwest corner of sec. 15, T. 124 N., R. 76 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

A12—8 to 12 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; slightly hard, very friable; few fine segregations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

A13—12 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; few fine segregations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

A14—17 to 27 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; soft, very friable; few fine segregations of lime; strong effervescence; moderately alkaline; clear wavy boundary.

C1ca—27 to 37 inches; grayish brown (10YR 5/2) light clay loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine segregations of lime; strong effervescence; moderately alkaline; clear wavy boundary.

A1b—37 to 50 inches; dark gray (10YR 4/1) clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine segregations of lime; slight effervescence; moderately alkaline; clear wavy boundary.

C2—50 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine segregations of lime; slight effervescence; moderately alkaline.

Typically, depth to free carbonates ranges from 6 to 13 inches, but some pedons are calcareous at the surface. The mollic epipedon is 20 to 38 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 or 2. It is dominantly loam, but it ranges from fine sandy loam to silt loam. It is 20 to 36 inches thick. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7 (4 or 5 moist); and chroma of 2 or 3. It is clay loam, loam, or silt loam and commonly is stratified with thin layers of silty clay loam, fine sandy loam, and loamy fine sand. Some pedons lack a buried A horizon.

Bowbells series

The Bowbells series consists of deep, moderately well drained soils that are moderately permeable in the upper part and moderately slowly permeable in the lower part. These soils formed in alluvium and the underlying glacial till. They are in swales on uplands. Slopes range from 0 to 3 percent.

Bowbells soils in Walworth County are taxadjuncts to the Bowbells series because the A horizon has chroma of less than 1.5. This difference, however, does not alter the use or behavior of the soils.

Bowbells soils are similar to Mobridge soils and are near Williams soils. Mobridge soils have a fine-silty B horizon. Williams soils have a mollic epipedon that is less than 16 inches thick.

Typical pedon of Bowbells loam, 0 to 3 percent slopes, 1,245 feet south and 140 feet west of the northeast corner of sec. 35, T. 124 N., R. 74 W.

A1—0 to 10 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine and medium prismatic structure parting to strong fine granular; soft, friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B21t—10 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm, slightly sticky and slightly plastic; slightly acid; gradual wavy boundary.

B22t—18 to 28 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm, slightly sticky and slightly plastic; neutral; clear wavy boundary.

C1ca—28 to 39 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—39 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common fine faint mottles, yellowish brown (10YR 5/6) and gray (10YR 6/1) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 22 to 33 inches. The mollic epipedon is more than 16 inches thick in all areas and typically is more than 20 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1. It is slightly acid or neutral and is 9 to 15 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3. It is dominantly clay loam, but in places it is loam. The B2t horizon averages between 25 and 35 percent clay. Some pedons have a B3 horizon. The C horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. It is clay loam or loam.

Bowdle series

The Bowdle series consists of well drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils are moderately deep over sand and gravel. They formed in glacial outwash. They are on terraces and uplands. Slopes range from 0 to 15 percent.

Bowdle soils are similar to Akaska, Divide, and Lehr soils and are near Wabek soils. Akaska soils have an argillic horizon and are fine-silty. Divide soils have a calcic horizon within a depth of 16 inches and are wetter than Bowdle soils. Lehr and Wabek soils are less than 20 inches deep over sand and gravel.

Typical pedon of Bowdle loam, 0 to 2 percent slopes, 120 feet south and 93 feet west of the northeast corner of sec. 12, T. 122 N., R. 74 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B21—7 to 15 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.

B22—15 to 21 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

C1ca—21 to 25 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few lime-coated pebbles; few fine shale fragments; few fine and medium brown stains and segregations of iron and manganese oxide; few fine segregations of lime; slight effervescence; neutral; abrupt wavy boundary.

IIC2—25 to 60 inches; varicolored sand and gravel; single grained; loose; few fine shale fragments; strong effervescence; mildly alkaline.

Depth to sand and gravel ranges from 20 to 40 inches. Depth to free carbonates ranges from 15 to 28 inches. The mollic epipedon is 16 to 30 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 2. It is silt loam in some pedons and is 4 to 8 inches thick. The B2 horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 2. In some pedons part of the B2 horizon is light clay loam, but the B2 horizon averages between 18 and 27 percent clay and is more than 15 percent fine sand or coarser sand. Some pedons have a B3 horizon. The C1ca 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 dominantly gravelly loam, but in places it is sandy loam or loam.

Colvin series

The Colvin series consists of deep, poorly drained, moderately slowly permeable soils that formed in alluvium. These soils are in upland swales and basins. Slopes are 0 to 1 percent.

Colvin soils are near Divide and Regan soils. Divide soils are better drained than Colvin soils and have sand and gravel within a depth of 40 inches. Regan soils are very poorly drained.

Typical pedon of Colvin silt loam 130 feet west and 1,716 feet north of the southeast corner of sec. 20, T. 121 N., R. 74 W.

A1—0 to 11 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.

ACca—11 to 24 inches; gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence; moderately alkaline; gradual wavy boundary.

C1gca—24 to 30 inches; light gray (2.5Y 7/1) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine faint mottles, olive (5Y 5/6) and gray (5Y 6/1) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2gca—30 to 43 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles, yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common medium segregations of lime; strong effervescence; moderately alkaline; clear wavy boundary.

C3g—43 to 60 inches; light gray (5Y 7/2) silty clay loam, olive gray (5Y 5/2) moist; common fine prominent mottles, yellowish brown (10YR 5/6) and gray (5Y 6/1) moist; massive; hard, firm, slightly sticky and slightly plastic; common fine dark segregations of iron and manganese oxide; slight effervescence; moderately alkaline.

The mollic epipedon is 7 to 16 inches thick and in some pedons includes the upper part of the calcic horizon. The clay content in the 10- to 40-inch control section averages between 18 and 35 percent. The ACca and Cca horizons have a calcium carbonate equivalent ranging from 20 to 35 percent.

The A horizon is neutral or has hue of 10YR or 2.5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1 or less. It is silty clay loam in some pedons. Some pedons lack an AC horizon. The C horizon is neutral or has hue of 2.5Y or 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 0 to 3. In places it is silt loam. Below a depth of 40 inches, it is stratified with finer or coarser material in some pedons.

Demky series

The Demky series consists of deep, moderately well drained, slowly permeable soils that formed in glacial till. These soils are on uplands. Slopes range from 0 to 6 percent.

Demky soils are near Jerauld, Raber, Tetonka, and Williams soils. Jerauld soils have a thinner A horizon than Demky soils and have salts within 16 inches of the surface. Raber, Tetonka, and Williams soils lack a natric horizon. In addition, Tetonka soils are poorly drained.

Typical pedon of Demky loam, 0 to 2 percent slopes, 2,178 feet south and 30 feet east of the northwest corner of sec. 26, T. 123 N., R. 74 W.

A11—0 to 3 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A12—3 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak fine and medium prismatic structure parting to weak fine and medium subangular blocky; soft, very friable; slightly acid; clear smooth boundary.

B&A—7 to 9 inches; grayish brown (10YR 5/2) clay loam (B), very dark grayish brown (10YR 3/2) moist; thin nearly continuous gray (10YR 6/1) coatings of silt (A) on surfaces of peds; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear smooth boundary.

B2t—9 to 14 inches; dark grayish brown (10YR 4/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B3ca—14 to 23 inches; grayish brown (2.5Y 5/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; many fine and few medium segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C1ca—23 to 34 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; common fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—34 to 60 inches; grayish brown (2.5Y 5/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine shale fragments; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 15 to 31 inches. Depth to free carbonates ranges from 12 to 19 inches. The mollic epipedon is 7 to 16 inches thick. Exchangeable sodium is more than 15 percent in some part of the B or C horizon.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. In places it is silt loam. It is 5 to 9 inches thick. Some pedons have a thin A2 horizon. The B2t horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is clay loam or clay averaging between 35 and 45 percent clay. It is mildly alkaline or moderately alkaline. The B3 and C horizons have value of 5 to 7 (4 to 5 moist) and chroma of 2 to 4. They are moderately alkaline or strongly alkaline.

Divide series

The Divide series consists of somewhat poorly drained and moderately well drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils formed in loamy material that is moderately deep over sand and gravel. They are on terraces along upland streams and drainageways. Slopes range from 0 to 3 percent.

Divide soils are near Bowdle, Colvin, Lehr, and Regan soils. Bowdle and Lehr soils lack a calcic horizon and are better drained than Divide soils. Colvin and Regan soils do not have sand and gravel within a depth of 40 inches and are poorly drained and very poorly drained.

Typical pedon of Divide loam 462 feet east and 90 feet north of the southwest corner of sec. 13, T. 123 N., R. 74 W.

A1—0 to 9 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure parting to moderate fine granular; soft, friable, slightly sticky and slightly plastic; slight effervescence; moderately alkaline; clear irregular boundary.

C1ca—9 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; many fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2ca—14 to 23 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; few fine faint mottles, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine segregations of lime; violent effervescence; moderately alkaline; clear wavy boundary.

IIC3—23 to 60 inches; varicolored sand and gravel; single grained; loose; strong effervescence; moderately alkaline.

Depth to sand and gravel ranges from 20 to 40 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1. It is dominantly loam, but it is silt loam or sandy loam in some pedons. It is 7 to 14 inches thick. The Cca horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. The calcium carbonate equivalent in the Cca horizon ranges from 15 to 30 percent.

Durrstein series

The Durrstein series consists of deep, poorly drained, very slowly permeable and slowly permeable soils that formed in alluvium. These soils are on bottom land. Slopes range from 0 to 2 percent.

Durrstein soils are near Egas, Jerauld, Macken, and Swanboy soils. Egas, Macken, and Swanboy soils lack a natric horizon. Jerauld soils are moderately well drained and do not have a water table within a depth of 6 feet.

Typical pedon of Durrstein silt loam 2,505 feet south and 2,510 feet west of the northeast corner of sec. 4, T. 121 N., R. 75 W.

A2—0 to 2 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak thin platy structure; soft, friable; neutral; abrupt smooth boundary.

B21t—2 to 7 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate fine and medium columnar structure parting to strong

fine blocky and subangular blocky; very hard, very firm, sticky and plastic; moderately alkaline; clear smooth boundary.

B22t—7 to 9 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; few fine nests of salts; strongly alkaline; clear smooth boundary.

B3sa—9 to 14 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; very hard, very firm, sticky and plastic; common fine nests and segregations of salts; slight effervescence; strongly alkaline; clear smooth boundary.

C1casa—14 to 47 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; common fine nests and segregations of salts and lime; strong effervescence; strongly alkaline; clear smooth boundary.

C2—47 to 52 inches; light brownish gray (2.5Y 6/2) sandy clay loam; dark grayish brown (2.5Y 4/2) moist; few fine faint mottles of yellowish brown (10YR 5/4); massive; hard, firm, sticky and plastic; few fine nests and segregations of salts and lime; strong effervescence; moderately alkaline; clear smooth boundary.

IIC3—52 to 56 inches; multicolored sand and gravel; few fine faint mottles of yellowish brown (10YR 5/4); single grained; loose; strong effervescence; moderately alkaline; abrupt smooth boundary.

IIIC4—56 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine and medium distinct mottles, yellowish brown (10YR 5/6) and gray (10YR 6/1) moist; massive; hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

The solum ranges from 10 to 20 inches in thickness. Depth to visible accumulations of salts ranges from 5 to 15 inches.

Some pedons have an A1 horizon less than 2 inches thick. The A2 horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It is loam in some pedons. It is 1 inch to 4 inches thick. The B2t horizon has hue of 10YR or 2.5Y and value of 4 or 5 (2 or 3 moist). It is clay, silty clay, or clay loam averaging between 35 and 60 percent clay and more than 15 percent fine sand or coarser sand. The C horizon commonly has hue of 2.5Y or 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2. Some pedons have no layer of sand and gravel between depths of 40 and 60 inches.

Eakin series

The Eakin series consists of deep, well drained soils that are moderately permeable in the upper part and moderately slowly permeable in the lower part. These soils formed in silty glacial drift and glacial till. They are on uplands. Slopes range from 0 to 9 percent.

Eakin soils are near Highmore, Mobridge, and Raber soils. Highmore soils are more than 40 inches deep over firm glacial till. Mobridge soils have a mollic epipedon that is more than 20 inches thick. Raber soils are fine textured.

Typical pedon of Eakin silt loam, in an area of Highmore-Eakin silt loams, 2 to 6 percent slopes, 1,452 feet south and 130 feet west of the northeast corner of sec. 10, T. 122 N., R. 75 W.

A1—0 to 7 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B2t—7 to 15 inches; brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B3ca—15 to 32 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common medium segregations of lime; strong effervescence; moderately alkaline; clear wavy boundary.

IIC1ca—32 to 40 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few medium segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC2—40 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; slight effervescence; moderately alkaline.

The solum ranges from 19 to 32 inches in thickness. Depth to free carbonates ranges from 12 to 18 inches. The mollic epipedon is 7 to 14 inches thick. Thickness of the silty material overlying glacial till ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. In places it is loam. It is slightly acid or neutral and is 5 to 8 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. Part of the B2t horizon is silt loam in some pedons, but the entire horizon averages between 28 and 35 percent clay and less than 15 percent fine sand or coarser sand. The B2t horizon is slightly acid to mildly alkaline. The IIC horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 1 to 4. It is clay or clay loam and is moderately alkaline or mildly alkaline. Relict mottles are in some pedons.

Egas series

The Egas series consists of deep, very poorly drained, slowly permeable soils that formed in alluvium. These soils are on bottom land. Slopes range from 0 to 2 percent.

Egas soils in Walworth County commonly contain less clay between depths of 10 and 40 inches than is defined in the range for the series. This difference, however, does not significantly alter the use or behavior of these soils.

Egas soils are near Durrstein, Macken, and Swanboy soils and are similar to Regan soils. Durrstein soils have a natric horizon. Macken soils have less salts and more clay in the 10- to 40-inch control section than Egas soils. Regan soils have a calcic horizon within a depth of 15 inches and contain less salts than Egas soils. Swanboy soils are very fine textured and are moderately well drained or well drained.

Typical pedon of Egas silty clay loam 528 feet south and 1,716 feet east of the northwest corner of sec. 17, T. 121 N., R. 74 W.

A11—0 to 2 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; slight effervescence, moderately alkaline; gradual smooth boundary.

A12sa—2 to 5 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine threads and nests of salts; slight effervescence; strongly alkaline; gradual smooth boundary.

ACsa—5 to 13 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine nests of salts; strong effervescence, strongly alkaline; gradual smooth boundary.

C1gsa—13 to 27 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine distinct mottles, yellowish brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine nests of salts; strong effervescence; strongly alkaline; gradual smooth boundary.

C2gsa—27 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct mottles, yellowish brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine nests of salts; strong effervescence; moderately alkaline.

The mollic epipedon is 8 to 24 inches thick. Visible accumulations of salts are at the surface or within 7 inches of the surface. Depth to free carbonates ranges from 0 to 10 inches. The control section between depths of 10 and 40 inches typically averages less than 40 percent clay, but it ranges from 30 to 45 percent clay.

The A12 and AC horizons have hue of 10YR to 5Y and chroma of 1 or 2. They are dominantly silty clay loam, but they range from loam to silty clay. The A horizon is mildly alkaline to strongly alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 1 or 2. It is dominantly silty clay loam, but it is clay loam, clay, or silty clay in some pedons.

Gettys series

The Gettys series consists of deep, well drained to excessively drained, moderately slowly permeable soils that formed in glacial till. These soils are on uplands. Slopes range from 6 to 40 percent.

Gettys soils are near Raber, Vida, and Zahl soils. Raber and Vida soils have an argillic horizon. Zahl soils have a mollic epipedon and are fine-loamy.

Typical pedon of Gettys clay loam, 9 to 40 percent slopes, 1,300 feet south and 790 feet west of the northeast corner of sec. 4, T. 121 N., R. 74 W.

A1—0 to 3 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

AC—3 to 10 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; slight effervescence; moderately alkaline; clear wavy boundary.

C1ca—10 to 24 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine shale fragments; common fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—24 to 39 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine shale fragments; few fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—39 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct relict mottles, yellowish brown (10YR 5/6) moist; massive; hard, firm, sticky and plastic; few fine shale fragments; few fine nests of gypsum; slight effervescence; moderately alkaline.

Free carbonates are at or near the surface. The control section averages between 35 and 50 percent clay and more than 15 percent fine sand or coarser sand. Few to common pebbles and cobbles are throughout some pedons.

The A1 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 or 2. It is neutral or mildly alkaline and is 2 to 4 inches thick. The AC horizon has value of 5 or 6 (4 or 5 moist). It is 5 to 10 inches thick. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. Below a depth of 40 inches, it is stratified with thin layers of fine or coarse textured material in some pedons.

Hecla series

The Hecla series consists of deep, moderately well drained, moderately rapidly permeable to rapidly permeable soils that formed in eolian sands. These soils are on uplands. Slopes range from 0 to 3 percent.

Hecla soils are near Maddock, Parshall, and Yecross soils. Maddock soils do not have a water table within 6 feet of the surface and are well drained. Parshall soils have a thicker mollic epipedon than Hecla soils and are coarse-loamy. Yecross soils lack a mollic epipedon and are well drained.

Typical pedon of Hecla loamy sand, 0 to 3 percent slopes, 2,508 feet east and 264 feet south of the northwest corner of sec. 2, T. 124 N., R. 76 W.

A11—0 to 8 inches; very dark gray (10YR 3/1) loamy sand, black (10YR 2/1) moist; weak medium granular structure; soft, very friable; neutral; gradual smooth boundary.

A12—8 to 19 inches; very dark gray (10YR 3/1) loamy sand, black (10YR 2/1) moist; weak medium granular structure; soft, very friable; neutral; gradual smooth boundary.

AC—19 to 24 inches; very dark grayish brown (10YR 3/2) loamy sand, very dark gray (10YR 3/1) moist; very weak coarse subangular blocky structure; loose, very friable; mildly alkaline; gradual smooth boundary.

C1—24 to 30 inches; dark grayish brown (10YR 4/2) sand, very dark grayish brown (10YR 3/2) moist; single grained; loose; strong effervescence; mildly alkaline; clear smooth boundary.

C2—30 to 60 inches; light brownish gray (10YR 6/2) sand, grayish brown (10YR 5/2) moist; common fine distinct mottles, reddish brown (5YR 5/4) moist; single grained; loose; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 16 to 40 inches. Depth to free carbonates ranges from 20 to 60 inches or more. The mollic epipedon is 10 to 20 inches thick. Horizons below a depth of 20 inches, which have value of less than 5.5 dry and 3.5 moist, are less than 0.6 percent organic carbon. Some pedons have a buried A horizon below a depth of 30 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is loamy fine sand in some pedons. It is neutral or slightly acid and is 16 to 25 inches thick. Some pedons have no AC horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 7 (3 to 5 moist); and chroma of 2 to 4. In some pedons it is fine sand, loamy sand, or loamy fine sand. It is slightly acid to moderately alkaline.

Highmore series

The Highmore series consists of deep, well drained, moderately permeable soils that formed in silty glacial drift. These soils are on uplands. Slopes range from 0 to 9 percent.

Highmore soils are similar to Agar soils and are near Eakin, Mobridge, and Raber soils. Agar soils formed in loess and have less sand in the C horizon than Highmore soils. Eakin soils have a IIC horizon of glacial till within a depth of 40 inches. Mobridge soils have a mollic epipedon that is more than 20 inches thick. Raber soils formed in firm glacial till and are fine textured.

Typical pedon of Highmore silt loam, 0 to 2 percent slopes, 1,990 feet west and 58 feet north of the southeast corner of sec. 36, T. 123 N., R. 77 W.

A1—0 to 5 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

B21t—5 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B22t—10 to 17 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B3ca—17 to 27 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine segregations of lime; strong effervescence; mildly alkaline; clear smooth boundary.

C1—27 to 44 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; mildly alkaline; clear smooth boundary.

C2—44 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, slightly sticky and slightly plastic; thin lenses of very fine sand and fine sand; few fine and very fine segregations and threads of lime; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 17 to 36 inches. The mollic epipedon is 9 to 17 inches thick. Depth to free carbonates ranges from 16 to 26 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but it is light silty clay loam or loam in some pedons. It is slightly acid or neutral and is 5 to 8 inches thick. The B2t horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. It is less than 15 percent fine sand or coarser sand. It is neutral or mildly alkaline. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. It is silt loam, silty clay loam, or very fine sandy loam. Some pedons have a IIC horizon of loam or clay loam glacial till at a depth of 40 to 60 inches.

Hoven series

The Hoven series consists of deep, poorly drained, very slowly permeable soils that formed in local alluvium. These soils are in closed depressions. Slopes are 0 to 1 percent.

Hoven soils are near Demky soils, are similar to Durrstein and Jerauld soils, and are in positions on the landscape that are similar to those of Macken, Parnell, and Tetonka soils. Demky soils have a thicker A horizon than Hoven soils and are moderately well drained. Durrstein and Jerauld soils have visible accumulations of salts within a depth of 16 inches. Macken, Parnell, and Tetonka soils lack a natric horizon.

Typical pedon of Hoven silt loam 130 feet south and 2,245 feet west of the northeast corner of sec. 22, T. 122 N., R. 77 W.

A1—0 to 2 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; medium acid; clear smooth boundary.

A2—2 to 5 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; few fine distinct mottles of yellowish brown (10YR 5/6); weak very thin platy structure parting to weak fine granular; soft, very friable; medium acid; clear wavy boundary.

B21t—5 to 8 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; thin gray (10YR 5/1) coatings on top of columns; moderate medium and coarse columnar structure parting to strong fine and medium blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; slightly acid; clear smooth boundary.

B22t—8 to 16 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to strong fine and medium blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; neutral; gradual smooth boundary.

B3—16 to 25 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; slight effervescence; moderately alkaline; clear smooth boundary.

C1—25 to 39 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine clusters and nests of gypsum; slight effervescence; moderately alkaline; clear smooth boundary.

C2cs—39 to 60 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; massive; hard, firm, sticky and plastic; many fine nests of gypsum; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 15 to 30 inches. Exchangeable sodium is more than 15 percent in some part of the B or C horizon.

The A1 horizon, if it occurs, is 1 inch to 4 inches thick. The A2 horizon has value of 5 to 7 (2 to 4 moist) and chroma of 1 or 2. It is 1 inch to 5 inches thick. The A horizon is silty clay loam in some pedons and is medium acid to neutral. The B2t 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 dominantly silty clay or clay, but it is clay loam or silty clay loam in some pedons. The B2t horizon is slightly acid to moderately alkaline. 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, silty clay loam, or clay loam. It is mildly alkaline to strongly alkaline.

Hurley series

The Hurley series consists of moderately deep, moderately well drained, very slowly permeable soils that formed in fine clay that was transported locally or weathered in place from the underlying shale. These soils are on uplands. Slopes range from 2 to 9 percent.

Hurley soils are similar to Durrstein, Hoven, Jerauld, and Swanboy soils and are near Opal and Promise soils. Durrstein and Hoven soils are poorly drained. Jerauld soils contain less clay than Hurley soils. Opal, Promise, and Swanboy soils lack a natric horizon.

Typical pedon of Hurley silt loam, 2 to 9 percent slopes, 150 feet east of the southwest corner of sec. 32, T. 124 N., R. 77 W.

A2—0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

B2t—2 to 8 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to moderate fine and medium blocky; extremely hard, very firm, sticky and plastic; neutral; clear wavy boundary.

B3casa—8 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine and medium nests and segregations of salts; few fine segregations of lime; strong effervescence; moderately alkaline; clear irregular boundary.

C1casa—16 to 21 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine nests of salts; few fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—21 to 27 inches; gray (5Y 5/1) very shaly clay, dark gray (5Y 4/1) moist; weak fine and medium subangular blocky structure, horizontal bedding planes evident; hard, firm, sticky and plastic; 70 percent fine fragments of soft shale; mildly alkaline; clear wavy boundary.

Cr—27 to 60 inches; gray (5Y 5/1) bedded soft shale, dark gray (5Y 4/1) moist; shale can be dug by spade, but plates are hard and brittle when dry; light olive brown (2.5Y 5/6) and light brownish gray (2.5Y 6/2) coatings on shale plates; neutral.

Depth to bedded shale typically is 26 to 36 inches, but it ranges from 20 to 60 inches. Thickness of the solum ranges from 9 to 20 inches. Depth to free carbonates ranges from 5 to 12 inches. Exchangeable sodium is more than 15 percent within a depth of 16 inches.

Some pedons have a thin A1 horizon. The A2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6 (3 or 4 moist); and chroma of 1 or 2. It is silty clay loam in some pedons. It is slightly acid or neutral. The combined thickness of the A1 and A2 horizons is less than 5 inches. The B2t horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5 (2 or 3 moist); and chroma of 1 or 2. The B2t horizon is more than 60 percent clay. It is neutral to moderately alkaline. The B3 and C1 horizons are moderately alkaline or strongly alkaline. The Cr horizon is slightly acid to moderately alkaline.

Jerauld series

The Jerauld series consists of deep, moderately well drained, very slowly permeable or slowly permeable soils that formed in glacial till or in local alluvium underlain by glacial till. These soils are on uplands and on terraces along drainageways. Slopes range from 0 to 2 percent.

Jerauld silt loam and the Jerauld soil in the Jerauld-Slickspots complex formed in alluvium of mixed origin. The alluvium is more than 5 feet deep over glacial till, but this slight difference from the range defined for the series does not alter the use or behavior of these soils.

Jerauld soils commonly are near Demky and Durrstein soils and are similar to Hoven and Hurley soils. Demky soils have a thicker solum than Jerauld soils and do not have visible salts within a depth of 16 inches. Durrstein and Hoven soils are poorly drained. Hurley soils are very-fine textured and are underlain by bedded shale between depths of 20 and 60 inches.

Typical pedon of Jerauld silt loam 1,452 feet west and 1,392 feet south of the northeast corner of sec. 2, T. 121 N., R. 77 W.

A2—0 to 2 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; medium acid; abrupt smooth boundary.

B21t—2 to 6 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; light brownish gray (10YR 6/2) coatings on tops of columns; moderate medium columnar structure parting to strong fine blocky; very hard, firm, sticky and plastic; neutral; clear wavy boundary.

B22t—6 to 11 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to strong medium blocky; very hard, firm, sticky and plastic; moderately alkaline; clear wavy boundary.

B3saca—11 to 16 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine nests of salts; few fine segregations of lime; slight effervescence; moderately alkaline; gradual smooth boundary.

C1sa—16 to 30 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; common fine nests of salts; slight effervescence; moderately alkaline; gradual smooth boundary.

C2sa—30 to 43 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine nests of salts; slight effervescence; moderately alkaline; gradual smooth boundary.

C3—43 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine nests of salts; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 10 to 20 inches. Depth to free carbonates ranges from 6 to 12 inches. Exchangeable sodium is more than 15 percent in some part of the B or C horizon.

Some pedons have an A1 horizon. This horizon is less than 2 inches thick. The A2 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2. It is loam or silty clay loam in some pedons. It is medium acid to neutral and is 1 inch to 3 inches thick. The B2t 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 clay loam averaging between 35 and 60 percent clay. The B3 and C horizons are mildly alkaline to strongly alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. It is silty clay loam, clay loam, silty clay, or clay.

Lehr series

The Lehr series consists of somewhat excessively drained soils that are moderately rapidly permeable in the upper part and rapidly permeable in the lower part. These soils are shallow over sand and gravel. They formed in loamy material over outwash sand and gravel. They are on upland terraces and outwash plains. Slopes range from 0 to 9 percent.

The Lehr soil in the mapping unit Lehr-Bowdle loams, 2 to 9 percent slopes, is shallower over calcareous soil material than is defined as the range for the series, but this difference does not significantly alter the use or behavior of the soil.

Lehr soils are near Akaska, Bowdle, Divide, and Wabek soils. Akaska and Bowdle soils have sand and gravel at a depth of more than 20 inches. Divide soils have a calcic horizon within a depth of 16 inches and are wetter than Lehr soils. Wabek soils lack a B horizon and have sand and gravel within a depth of 14 inches.

Typical pedon of Lehr loam, 2 to 6 percent slopes, 792 feet north and 60 feet east of the southwest corner of sec. 13, T. 121 N., R. 74 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; soft, very friable; neutral; gradual smooth boundary.

B21—5 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B22—9 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common pebbles coated with lime; neutral; gradual wavy boundary.

IIC1ca—14 to 24 inches; varicolored sand and gravel; single grained; loose; strong effervescence; mildly alkaline; clear wavy boundary.

IIC2—24 to 60 inches; varicolored sand and gravel; single grained; loose; slight effervescence; mildly alkaline.

Thickness of the solum, depth to sand and gravel, and depth to free carbonates range from 14 to 20 inches.

The A horizon has value of 4 or 5. It commonly is loam, but it is silt loam or sandy loam in some pedons. It is 5 to 8 inches thick. The B2 horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is loam or light clay loam averaging between 18 and 30 percent clay. It is neutral or mildly alkaline. The IIC horizon is mildly alkaline or moderately alkaline.

Lowry series

The Lowry series consists of deep, well drained, moderately permeable soils that formed in loess. These soils are on uplands and terraces. Slopes range from 0 to 9 percent.

Lowry soils are near Agar, Mobridge, and Sully soils. Agar and Mobridge soils have an argillic horizon. In addition, Mobridge soils have a mollic epipedon that is more than 20 inches thick. Sully soils lack a mollic epipedon.

Typical pedon of Lowry silt loam, 2 to 6 percent slopes, 120 feet south and 2,244 feet west of the northeast corner of sec. 24, T. 124 N., R. 78 W.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

A12—2 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; clear wavy boundary.

B2—6 to 15 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; moderately alkaline; clear wavy boundary.

B3—15 to 21 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure; slightly hard, very friable; few threads of segregated lime; slight effervescence; moderately alkaline; clear wavy boundary.

C1ca—21 to 32 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common fine segregations of lime; strong effervescence; moderately alkaline; clear wavy boundary.

C2ca—32 to 37 inches; grayish brown (2.5Y 5/2) very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; common fine segregations of lime; strong effervescence; moderately alkaline; clear wavy boundary.

C3—37 to 60 inches; grayish brown (2.5Y 5/2) very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 14 to 28 inches. Depth to free carbonates and thickness of the mollic epipedon range from 8 to 20 inches. Some pedons have a buried A horizon below a depth of 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is loam in some pedons. It is 4 to 8 inches thick. The B2 horizon has chroma of 2 or 3. It is loam in some pedons. The C horizon has hue of 10YR or 2.5Y and chroma of 2 or 3. It is loam in some pedons. In the lower part of the C horizon, the content of fine sand gradually increases with increasing depth.

Macken series

The Macken series consists of deep, poorly drained and very poorly drained, slowly permeable soils that formed in local alluvium. These soils are in closed depressions. Slopes are 0 to 1 percent.

Macken soils are near Durrstein, Egas, and Regan soils and, like Hoven, Parnell, and Tetonka soils, are in closed depressions. Durrstein and Hoven soils have a natric horizon. Egas soils have accumulations of salts within a depth of 7 inches. Parnell and Tetonka soils have an argillic horizon. Regan soils have a calcic horizon and are fine-silty.

Typical pedon of Macken silty clay 760 feet east and 50 feet north of the southwest corner of sec. 8, T. 124 N., R. 77 W.

A1—0 to 3 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; weak fine granular and weak fine subangular blocky structure; hard, friable, sticky and plastic; neutral; clear wavy boundary.

B21—3 to 12 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, very firm, very sticky and very plastic; mildly alkaline; gradual wavy boundary.

B22gca—12 to 29 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; weak coarse prismatic structure parting to weak fine and medium blocky and subangular blocky; very hard, very firm, very sticky and very plastic; few fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

B3gca—29 to 38 inches; gray (5Y 5/1) silty clay, olive gray (5Y 4/2) moist; few fine distinct mottles, light gray (5Y 7/1) moist; weak coarse subangular blocky structure; hard, very firm, sticky and plastic; few fine nests of gypsum; few fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C1gca—38 to 47 inches; gray (5Y 6/1) silty clay, olive gray (5Y 4/2) moist; few fine distinct mottles, brownish yellow (10YR 6/6) moist; massive; hard, firm, sticky and plastic; few fine nests of gypsum; common fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—47 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine distinct mottles, brownish yellow (10YR 6/6) and gray (10YR 6/1) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine nests of gypsum; few fine segregations of lime; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 30 to 50 inches. Depth to free carbonates ranges from 12 to 40 inches. The mollic epipedon is 22 to 34 inches thick.

The A horizon has hue of 10YR or 2.5Y and value of 4 or 5 (2 or 3 moist). It is clay in some pedons. It is neutral or slightly acid and is 2 to 4 inches thick. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5 (2 or 3 moist); and chroma of 1 or less. It is clay in some pedons. It is neutral to moderately alkaline. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 1 to 3. It is silty clay, silty clay loam, or clay and in some pedons is stratified with thin layers of coarser material below a depth of 40 inches.

Maddock series

The Maddock series consists of deep, well drained, rapidly permeable soils that formed in outwash sand that in places is wind worked. These soils are on terraces and uplands. Slopes range from 0 to 15 percent.

Maddock soils are near Arveson, Hecla, Parshall, and Yecross soils. Arveson and Parshall soils are coarse-

loamy. In addition, Arveson soils are poorly drained and Parshall soils have a mollic epipedon that is more than 16 inches thick. Hecla soils have a seasonal water table within a depth of 6 feet and are moderately well drained. Yecross soils lack a mollic epipedon.

Typical pedon of Maddock fine sandy loam, 0 to 6 percent slopes, 100 feet west and 1,780 feet north of the southeast corner of sec. 4, T. 124 N., R. 76 W.

A1—0 to 15 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak coarse subangular blocky structure and single grained; soft, very friable; neutral; clear wavy boundary.

AC—15 to 30 inches; dark brown (10YR 4/3) fine sand, dark brown (10YR 3/3) moist; single grained; loose; mildly alkaline; clear wavy boundary.

C1—30 to 41 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; slight effervescence; moderately alkaline; clear wavy boundary.

C2ca—41 to 53 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; common fine and medium segregations of lime; strong effervescence; moderately alkaline; clear wavy boundary.

C3—53 to 60 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 10 to 32 inches. Depth to free carbonates is 10 inches or more. The mollic epipedon is 10 to 16 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist). It is dominantly fine sandy loam, but it is sandy loam, loamy fine sand, or loamy sand in some pedons. It is neutral or mildly alkaline. The AC horizon has value of 4 to 6 (2 to 4 moist) and chroma of 2 or 3. It is fine sand or loamy fine sand. It is neutral or mildly alkaline. Some pedons have a B2 horizon of fine sandy loam. The C horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3. It is fine sand, loamy fine sand, or loamy sand to a depth of about 40 inches, but it ranges to fine sandy loam below a depth of 40 inches. It is neutral to moderately alkaline.

Mobridge series

The Mobridge series consists of deep, moderately well drained, moderately permeable soils that formed in local alluvium. These soils are in upland swales. Slopes range from 0 to 3 percent.

Mobridge soils are near Agar, Akaska, Eakin, and Highmore soils and are similar to Bowbells soils. Agar, Akaska, Eakin, and Highmore soils have a mollic epipedon that is less than 20 inches thick. Bowbells soils are fine-loamy.

Typical pedon of Mobridge silt loam 70 feet south and 1,192 feet west of the northeast corner of sec. 24, T. 122 N., R. 78 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak coarse subangular and weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; slightly acid; clear smooth boundary.

A12—7 to 11 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B21t—11 to 17 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 fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

B22t—17 to 25 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 fine and medium blocky; hard, friable, slightly sticky and slightly plastic; few very fine segregations of lime; mildly alkaline; clear smooth boundary.

B3ca—25 to 30 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; mildly alkaline; clear smooth boundary.

C1ca—30 to 42 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine distinct mottles, yellowish brown (10YR 5/6) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium and few coarse segregations of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—42 to 60 inches; light brownish gray (2.5Y 6/2) light silty clay loam containing very thin laminae of very fine sand and silt, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles of yellowish brown (10YR 5/6) and few fine distinct mottles, gray (10YR 5/1) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; mildly alkaline.

Thickness of the solum ranges from 24 to 44 inches. Depth to free carbonates ranges from 22 to 34 inches. The mollic epipedon is 20 to 34 inches thick and includes part or all of the B2t horizon.

The A horizon has value of 3 or 4 (2 or 3 moist). It is light silty clay loam in some pedons. It is 7 to 14 inches thick. The B2t horizon has value of 3 or 4 (2 to 4 moist) and chroma of 1 or 2. It typically is silty clay loam, but it is clay loam in some pedons. 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 dominantly silty clay loam, but it is silt loam or clay loam in some pedons. Sand and gravel or glacial till is between depths of 40 and 60 inches in some pedons. The C horizon is mildly alkaline or moderately alkaline.

Opal series

The Opal series consists of moderately deep, well drained, very slowly permeable soils that formed in material weathered from shale. These soils are on uplands. Slopes range from 2 to 40 percent.

Opal soils are near Hurley, Promise, Sansarc, and Swanboy soils. Hurley soils have a natric horizon. Promise soils are more than 40 inches deep over bedded shale. Sansarc soils are less than 20 inches deep over shale. Swanboy soils lack a mollic epipedon and contain more salts in the solum than Opal soils.

Typical pedon of Opal clay, 2 to 9 percent slopes, 1,056 feet west and 264 feet north of the southeast corner of sec. 31, T. 122 N., R. 76 W.

A1—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure parting to moderate fine and medium granular; hard, firm, sticky and plastic; neutral; clear wavy boundary.

B2—5 to 15 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; slight effervescence; moderately alkaline; gradual wavy boundary.

B3ca—15 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C1ca—20 to 24 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular

blocky structure; hard, very firm, sticky and plastic; about 15 percent shale fragments; few fine iron and manganese stains; few fine segregations of lime; strong effervescence; moderately alkaline; clear wavy boundary.

C2—24 to 30 inches; gray (5Y 5/1) shaly clay, dark gray (5Y 4/1) moist; massive; hard, very firm, sticky and plastic; 35 to 50 percent shale fragments; common fine iron and manganese stains; slight effervescence; moderately alkaline; clear wavy boundary.

Cr—30 to 60 inches; gray (5Y 5/1) bedded soft shale, very dark gray (5Y 3/1) moist; shale can be dug by spade; shale plates are very hard and brittle when dry; common fine iron stains in seams; moderately alkaline.

Thickness of the solum ranges from 12 to 27 inches. Depth to bedded shale ranges from 20 to 40 inches. The mollic epipedon is less than 20 inches thick. When the soil is dry, cracks up to 1 inch wide and several feet long extend downward through the solum.

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 is silty clay in some pedons. It is neutral or mildly alkaline and is 4 to 7 inches thick. The B horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. It is mildly alkaline or moderately alkaline. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3. The C1 and C2 horizons are mildly alkaline or moderately alkaline. The Cr horizon is neutral to moderately alkaline.

Parnell series

The Parnell series consists of deep, very poorly drained, slowly permeable soils that formed in local alluvium. These soils are in closed depressions. Slopes are 0 to 1 percent.

Parnell soils are near Bowbells soils and are in positions on landscape that are similar to those of Hoven, Macken, and Tetonka soils. Bowbells soils are moderately well drained and are fine-loamy. Hoven soils have a natric horizon. Macken soils lack an argillic horizon. Tetonka soils have an albic horizon that is more than 4 inches thick.

Typical pedon of Parnell clay loam, wet, 60 feet east and 462 feet south of the northwest corner of sec. 24, T. 124 N., R. 74 W.

A11—0 to 6 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak very fine subangular blocky structure parting to moderate fine and medium granular; slightly hard, firm, slightly sticky and slightly plastic; neutral; clear wavy boundary.

A12—6 to 10 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; very hard, firm, sticky and plastic; neutral; clear wavy boundary.

B2t—10 to 36 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to strong medium and coarse subangular blocky; very hard, very firm, sticky and plastic; few fine threads and nests of salts; neutral; clear wavy boundary.

C1gsa—36 to 48 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; few fine distinct mottles, reddish brown (5YR 5/4) moist; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; common fine threads and nests of salts; neutral; clear wavy boundary.

C2gsa—48 to 60 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; few fine faint mottles, reddish brown (5YR 5/4) moist; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; few fine threads and nests of salts; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 35 to 60 inches or more. The mollic epipedon is 24 to 60 inches thick. Some pedons have an O horizon. This horizon is as much as 3 inches thick.

The A11 horizon in some pedons has neutral hue and has chroma of less than 1. The A1 horizon is 6 to 24 inches thick. It is silt loam in some pedons. It is slightly acid to mildly alkaline. Some pedons have an A2 horizon. This horizon is less than 4 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 or 2. It is dominantly clay or silty clay, but in some pedons part of the B2t horizon is heavy clay loam or heavy silty clay loam. This horizon is neutral or mildly alkaline. The C horizon has value of 5 to 7 (3 to 6 moist) and chroma of 1 or 2. It is loam in some pedons. It is neutral to moderately alkaline.

Parshall series

The Parshall series consists of deep, well drained, moderately rapidly permeable soils that formed in alluvium. These soils are on terraces. Slopes range from 0 to 6 percent.

Parshall soils are near Arveson, Hecla, Maddock, Tally, and Yecross soils. Arveson soils have a calcic horizon and are poorly drained. Hecla, Maddock, and Yecross soils are sandy. Tally soils have a mollic epipedon that is less than 16 inches thick.

Typical pedon of Parshall fine sandy loam, 0 to 2 percent slopes, 2,244 feet west and 1,188 feet north of the southeast corner of sec. 2, T. 124 N., R. 76 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.

A12—8 to 12 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, friable; slightly acid; gradual wavy boundary.

B2—12 to 32 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; soft, very friable; few dark stains on vertical faces of peds; neutral; gradual wavy boundary.

B3ca—32 to 39 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; soft, very friable; few fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C—39 to 60 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) moist; single grained; soft, very friable; few fine segregations of lime; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 24 to 45 inches. Depth to free carbonates ranges from 24 to 40 inches.

The A horizon has value of 3 or 4 (2 or 3 moist). It is sandy loam in some pedons. It is slightly acid to neutral and is 8 to 18 inches thick. The B2 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 to 4. Some pedons lack a B3 horizon. The C horizon is loamy fine sand, sandy loam, or fine sandy loam in some pedons. A buried A horizon is within the C horizon in some pedons.

Promise series

The Promise series consists of deep, well drained, very slowly permeable soils that formed in material weathered from either in-place or locally transported shale. These soils are on uplands and terraces. Slopes range from 0 to 6 percent.

Promise soils commonly are near Hurley, Opal, and Swanboy soils. Hurley soils have a natric horizon. Opal soils have bedded shale within a depth of 40 inches. Swanboy soils lack a mollic epipedon and have accumulations of salts within a depth of 15 inches.

Typical pedon of Promise clay, 0 to 2 percent slopes, 1,190 feet east and 80 feet south of the northwest corner of sec. 34, T. 123 N., R. 78 W.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine and medium granular structure; hard, firm, sticky and plastic; neutral; clear smooth boundary.

A12—2 to 6 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium subangular blocky structure parting to moderate fine granular; very hard, very firm, sticky and plastic; mildly alkaline; clear smooth boundary.

B2—6 to 15 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak very coarse prismatic structure parting to moderate medium and coarse subangular blocky; extremely hard, extremely firm, very sticky and very plastic; slight effervescence; mildly alkaline; gradual smooth boundary.

B3ca—15 to 26 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine segregations of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C1—26 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, very sticky and very plastic; few fine nests of salts; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—33 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; few fine threads and nests of salts and gypsum crystals; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 20 to 40 inches. Free carbonates are at the surface or within 8 inches of the surface. Depth to bedded shale typically is more than 60 inches, but is only 40 inches in some pedons. The mollic epipedon is 7 to 16 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is silty clay in some pedons. It is slightly acid to mildly alkaline and is 4 to 8 inches thick. The B horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. 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 silty clay in some pedons. It is moderately alkaline or strongly alkaline.

Raber series

The Raber series consists of deep, well drained soils that formed in firm glacial till. These soils are on uplands. Permeability is moderately slow or slow. Slopes range from 2 to 15 percent.

Raber soils are near Demky, Eakin, Gettys, and Highmore soils and are similar to Williams soils. Demky soils have a natric horizon. Eakin and Highmore soils are fine-silty. Gettys soils lack a mollic epipedon. Williams soils are fine-loamy.

Typical pedon of Raber loam, 6 to 9 percent slopes, 264 feet west and 528 feet north of the southeast corner of sec. 14, T. 122 N., R. 77 W.

A1—0 to 3 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; soft, friable; neutral; abrupt smooth boundary.

B21t—3 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; shiny coats on faces of peds; neutral; clear smooth boundary.

B22t—8 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; shiny coats on faces of peds; neutral; clear smooth boundary.

B3ca—13 to 24 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; common medium segregations of lime; strong effervescence; mildly alkaline; clear smooth boundary.

C1ca—24 to 36 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; many fine and medium segregations of lime; strong effervescence; mildly alkaline; clear smooth boundary.

C2—36 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 22 to 37 inches. Depth to free carbonates ranges from 12 to 18 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is light clay loam in some pedons. It is slightly acid or neutral and is 3 to 5 inches thick. The B2t 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 clay loam or clay averaging between 35 and 45 percent clay and more than 15 percent fine sand or coarser sand. It is neutral or mildly alkaline. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is clay in some pedons. It is mildly alkaline or moderately alkaline.

Regan series

The Regan series consists of deep, very poorly drained soils that formed in alluvium. These soils are along drainageways. Permeability is moderate to moderately slow. Slopes are 0 to 1 percent.

Regan soils commonly are near Colvin, Divide, and Parnell soils. Colvin and Divide soils are better drained than Regan soils. Also, Divide soils have sand and gravel at a depth of 20 to 40 inches. Parnell soils have an argillic horizon and are fine textured.

Typical pedon of Regan silt loam 90 feet north and 1,050 feet east of the southwest corner of sec. 13, T. 123 N., R. 74 W.

A11—0 to 5 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; slightly hard, very friable; slight effervescence; moderately alkaline; diffuse wavy boundary.

A12—5 to 10 inches; gray (2.5Y 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; gradual, wavy boundary.

C1ca—10 to 14 inches; gray (2.5Y 5/1) silty clay loam, very dark gray (2.5Y 3/1) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence; mildly alkaline; gradual wavy boundary.

C2ca—14 to 26 inches; gray (2.5Y 5/1) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence; mildly alkaline; clear smooth boundary.

C3gca—26 to 30 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles, light olive brown (2.5Y 5/6) and light gray (10YR 7/1) moist; massive; hard, friable, slightly sticky and slightly plastic; violent effervescence; mildly alkaline; clear smooth boundary.

C4g—30 to 49 inches; olive (5Y 5/3) silty clay loam, olive gray (5Y 5/2) moist; common fine distinct mottles, light olive brown (2.5Y 5/6) and light gray (10YR 7/1) moist; massive; hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; clear wavy boundary.

IIC5g—49 to 60 inches; pale olive (5Y 6/3) sand and gravel, olive (5Y 4/3) moist; single grained; loose; slight effervescence; moderately alkaline.

The mollic epipedon is 7 to 16 inches thick. The 10- to 40-inch control section averages between 27 and 35 percent clay.

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 is 6 to 12 inches thick. Some pedons have an AC horizon. The Cca 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 has a calcium carbonate equivalent of more than 15 percent. It is 8 to 25 inches thick. The lower part of the C horizon is silty clay loam, silt loam, or clay loam. It is 60 inches or more deep in some pedons. The C horizon is alkaline to strongly alkaline.

Sansarc series

The Sansarc series consists of shallow, well drained, slowly permeable soils that formed in material weathered from clayey shale. These soils are on uplands. Slopes range from 6 to 40 percent.

Sansarc soils commonly are near Hurley, Opal, and Promise soils, all of which are more than 20 inches deep over shale. Hurley soils have a natric horizon.

Typical pedon of Sansarc clay, in an area of Sansarc-Opal clays, 15 to 40 percent slopes, 400 feet east of the northwest corner of sec. 16, T. 123 N., R. 78 W.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine granular structure; slightly hard, friable, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

C1—3 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak moderate subangular blocky structure parting to weak very fine and fine granular; hard, friable, sticky and plastic; about 20 percent fine shale fragments; common fine distinct stains of yellowish brown; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—8 to 13 inches; grayish brown (2.5Y 5/2) very shaly clay, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; 60 to 70 percent fine shale fragments; common fine distinct stains of yellowish brown; slight effervescence; mildly alkaline; gradual wavy boundary.

Cr—13 to 60 inches; light brownish gray (2.5Y 6/2) bedded shale, dark grayish brown (2.5Y 4/2) moist; common fine distinct stains of yellowish brown; shale can be dug by spade, but plates are hard and brittle when dry; slight effervescence; mildly alkaline.

Depth to soft bedded shale ranges from 6 to 20 inches. The horizons above the shale average between 50 and 65 percent clay. They are neutral to moderately alkaline. Hue is 10YR, 2.5Y, or 5Y.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2. It is clay, shaly clay, or silty clay that is 2 to 4 inches thick. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. The upper part of the Cr horizon contains seams of gypsum, carbonates, and other salts along fracture faces in some pedons. The Cr horizon is medium acid to moderately alkaline.

Sully series

The Sully series consists of deep, well drained, moderately permeable soils that formed in loess. These soils are on uplands. Slopes range from 2 to 40 percent.

Sully soils commonly are near Agar and Lowry soils. Agar and Lowry soils have a mollic epipedon. In addition, Agar soils have an argillic horizon.

Typical pedon of Sully silt loam, 2 to 9 percent slopes, 984 feet west and 60 feet north of the southeast corner of sec. 17, T. 123 N., R. 78 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

C1ca—4 to 16 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common fine segregations of lime; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—16 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; few fine segregations of lime; strong effervescence; mildly alkaline.

Depth to free carbonates is less than 5 inches. The 10- to 40-inch control section is silt loam or very fine sandy loam averaging less than 18 percent clay and less than 15 percent fine sand or coarser sand.

The A horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is neutral or mildly alkaline and is 2 to 5 inches thick. The C 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 mildly alkaline or moderately alkaline. Some pedons have a buried A horizon within the C horizon.

Swanboy series

The Swanboy series consists of deep, moderately well drained and well drained, very slowly permeable soils that formed in dense clay alluvium. These soils are on fans along upland drainageways and on stream terraces. Slopes range from 0 to 6 percent.

Swanboy soils are near Egas, Hurley, Jerauld, Opal, and Promise soils. Egas soils are very poorly drained and contain less clay than Swanboy soils. Hurley and Jerauld soils have a natric horizon. Opal and Promise soils have a mollic epipedon and do not have visible salts within a depth of 15 inches.

Typical pedon of Swanboy clay, 0 to 6 percent slopes, 60 feet south and 2,508 feet west of the northeast corner of sec. 3, T. 121 N., R. 77 W.

A1—0 to 1 inch; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium granular structure; slightly hard, friable, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

B21—1 inch to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure parting to moderate fine and medium blocky; extremely hard, extremely firm, very sticky and plastic; slight effervescence; moderately alkaline; clear wavy boundary.

B22sa—8 to 19 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse and medium subangular blocky structure; extremely hard, extremely firm, sticky and plastic; common very fine nests and segregations of salts and lime; slight effervescence; moderately alkaline; gradual smooth boundary.

C—19 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; few fine nests and segregations of salts and lime; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 10 to 24 inches. When the soil is dry, cracks as much as 2 inches wide and several feet long extend to a depth of more than 20 inches. Hue is 10YR, 2.5Y, or 5Y.

The A horizon has value of 5 to 7 (4 or 5 moist) and chroma of 1 or 2. It is silty clay in some pedons. It is neutral or mildly alkaline and is 1/2 inch to 2 inches thick. The B horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. It is neutral to strongly alkaline. The C horizon is mildly alkaline to strongly alkaline.

Tally series

The Tally series consists of deep, well drained soils that formed in glacial outwash material reworked by wind. These soils are on uplands. Permeability is moderately rapid. Slopes range from 0 to 9 percent.

Tally soils commonly are near Lowry, Maddock, Parshall, and Yecross soils. Lowry soils are coarse-silty and formed in loess. Maddock and Yecross soils are sandy. Parshall soils have a mollic epipedon that is more than 16 inches thick.

Typical pedon of Tally fine sandy loam, 2 to 6 percent slopes, 65 feet south and 2,110 feet east of the northwest corner of sec. 6, T. 123 N., R. 75 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable; neutral; abrupt smooth boundary.

B2—8 to 17 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable; neutral; clear smooth boundary.

C1ca—17 to 27 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; common fine segregations of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—27 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; slight effervescence; moderately alkaline.

The solum is 13 to 18 inches thick. The mollic epipedon is 7 to 15 inches thick. The 10- to 40-inch control section averages less than 18 percent clay and 35 percent or more fine sand or coarser sand.

The A horizon has value of 4 (2 or 3 moist) and chroma of 2 or 3. It is sandy loam in some pedons. It is 7 to 9 inches thick. The B horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is sandy loam in some pedons. It is neutral or mildly alkaline. The C horizon is dominantly fine sandy loam, but it is loamy sand, loamy fine sand, sandy loam, or light loam in some pedons. It is mildly alkaline or moderately alkaline.

Tetonka series

The Tetonka series consists of deep, poorly drained, very slowly permeable soils that formed in local alluvium over glacial till. These soils are in closed depressions on uplands. Slopes are 0 to 1 percent.

Tetonka soils commonly are near Bowbells, Demky, Hoven, and Mobridge soils and are in positions that are similar to those of Macken and Parnell soils. Bowbells and Mobridge soils are moderately well drained. Demky and Hoven soils have a natric horizon. Macken soils lack albic and argillic horizons. Parnell soils are very poorly drained.

Typical pedon of Tetonka silt loam 1,914 feet west and 594 feet south of the northeast corner of sec. 36, T. 123 N., R. 77 W.

A1—0 to 6 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak thin platy structure parting to weak fine granular; slightly hard, very friable; medium acid; clear wavy boundary.

A2—6 to 11 inches; light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; common fine distinct mottles, yellowish brown (10YR 5/6) moist; weak thin platy structure parting to weak fine granular; soft, very friable; medium acid; clear wavy boundary.

B&A—11 to 13 inches; dark grayish brown (10YR 4/2) silty clay loam (B), very dark grayish brown (10YR 3/2) moist; gray (10YR 6/1) coatings of silt (A) on faces of peds, dark gray (10YR 4/1) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B21t—13 to 18 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; shiny coats on faces of peds; slightly acid; clear wavy boundary.

B22t—18 to 33 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; shiny coats on faces of peds; slightly acid; clear wavy boundary.

B3—33 to 41 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Cca—41 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; many fine distinct mottles, yellowish brown (10YR 5/6) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine segregations of lime; violent effervescence; mildly alkaline.

Thickness of the solum ranges from 28 to 66 inches. Depth to free carbonates ranges from 36 to 60 inches. The mollic epipedon is 24 to 50 inches thick.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is silty clay loam in some pedons. It is medium acid to neutral and is 6 to 10 inches thick. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is dominantly silt loam, but it is loam or light silty clay loam in some pedons. It is medium acid to neutral and is 4 to 10 inches thick. Some pedons lack a B&A horizon. The B2t horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5 (2 to 4 moist); and chroma of 1 or 2. It is dominantly silty clay, but it is clay, clay loam, or silty clay loam in some pedons. It is slightly acid or neutral. The C horizon is silty clay, clay, silty clay loam, or clay loam. It is mildly alkaline or moderately alkaline.

Vida series

The Vida series consists of deep, well drained soils that formed in glacial till. These soils are on uplands. Permeability is moderate in the solum and moderately slow in the glacial till. Slopes range from 3 to 15 percent.

Vida soils are near Bowbells, Williams, and Zahl soils. Bowbells soils have a mollic epipedon that is more than 16 inches thick. Williams soils have a B2t horizon that extends to a depth of more than 10 inches. Zahl soils lack an argillic horizon.

Typical pedon of Vida loam, in an area of Vida-Zahl loams, 6 to 15 percent slopes, 100 feet east and 1,980 feet north of the southwest corner of sec. 24, T. 124 N., R. 74 W.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

B2t—2 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

B3ca—8 to 21 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, firm, slightly sticky and slightly plastic; many medium and fine segregations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—21 to 44 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; slightly hard, firm, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C2—44 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine segregations of lime; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 8 to 25 inches. Depth to free carbonates ranges from 6 to 10 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 (2 or 3 moist), and chroma of 1 or 2. It is light clay loam in some pedons. It is mildly alkaline or moderately alkaline and is 2 to 5 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 6 or 7 (4 or 5 moist); and chroma of 1 to 4. It is loam in some pedons. It is mildly alkaline to strongly alkaline.

Wabek series

The Wabek series consists of excessively drained, rapidly permeable soils that are very shallow over sand and gravel. These soils formed in glacial outwash. They are on uplands and terraces. Slopes range from 2 to 40 percent.

Wabek soils commonly are near Bowdle, Lehr, Parshall, and Tally soils. Bowdle and Lehr soils lack carbonates in the upper 9 inches and are deeper over sand and gravel than Wabek soils. Parshall and Tally soils do not have sand and gravel within a depth of 40 inches.

Typical pedon of Wabek loam, 9 to 40 percent slopes, 660 feet west and 70 feet south of the northeast corner of sec. 13, T. 121 N., R. 74 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, friable; neutral; clear smooth boundary.

IIC1—5 to 9 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure and single grained; loose; slight effervescence; mildly alkaline; clear wavy boundary.

IIIC2—9 to 60 inches; varicolored sand and gravel; single grained; loose; strong effervescence; mildly alkaline.

Depth to sand and gravel ranges from 7 to 14 inches. Depth to free carbonates typically ranges from 4 to 9 inches. Some pedons lack free carbonates. The mollic epipedon is 7 to 10 inches thick. The control section is more than 35 percent gravel.

The A horizon has value of 4 or 5 (2 or 3 moist). It is loam, gravelly loam, sandy loam, or gravelly sandy loam and is 4 to 8 inches thick. The IIC1 horizon has value of 4 to 6 (3 or 4 moist). It is gravelly loam or gravelly sandy loam. It is neutral or mildly alkaline.

Williams series

The Williams series consists of deep, well drained soils that formed in glacial till. These soils are on uplands. Permeability is moderate in the solum and moderately slow in the glacial till. Slopes range from 0 to 34 percent.

Williams soils commonly are near Bowbells, Raber, Vida, and Zahl soils and are similar to Eakin soils. Bowbells soils have a mollic epipedon that is more than 16 inches thick. Eakin soils are fine-silty. Raber soils are fine textured. Vida soils are less than 10 inches deep over the base of an argillic horizon. Zahl soils lack an argillic horizon.

Typical pedon of Williams loam, in an area of Williams-Bowbells loams, 2 to 6 percent slopes, 100 feet east and 1,584 feet south of the northwest corner of sec. 36, T. 124 N., R. 74 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, very friable; neutral; clear wavy boundary.

B21t—4 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B22t—8 to 16 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, sticky and plastic; neutral; clear wavy boundary.

B3ca—16 to 22 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium segregations of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—22 to 31 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common medium and coarse segregations of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—31 to 60 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 10 to 30 inches. The mollic epipedon is 7 to 16 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist). It is silt loam or light clay loam in some pedons and is 4 to 7 inches thick. The B2t horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is clay loam or loam averaging between 24 and 35 percent clay. The C horizon has hue of 2.5Y or 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It is loam in some pedons.

Yecross series

The Yecross series consists of deep, excessively drained, rapidly permeable soils that formed in glacial outwash reworked by wind. These soils are on uplands. Slopes range from 0 to 15 percent.

Yecross soils are similar to Hecla and Maddock soils and are near Lehr, Tally, and Wabek soils. Hecla and Maddock soils have a mollic epipedon. Lehr soils are fine-loamy over sandy or sandy-skeletal. Tally soils are coarse-loamy. Wabek soils are sandy-skeletal.

Typical pedon of Yecross loamy fine sand, 0 to 6 percent slopes, 462 feet east and 100 feet south of the northwest corner of sec. 4, T. 124 N., R. 76 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable; neutral; clear smooth boundary.

A12—6 to 9 inches; dark gray (10YR 4/1) loamy sand, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; soft, very friable; mildly alkaline; gradual smooth boundary.

C1—9 to 22 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; single grained; loose; few fine segregations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—22 to 60 inches; grayish brown (10YR 5/2) medium sand, dark grayish brown (10YR 4/2) moist; single grained; loose; strong effervescence; mildly alkaline.

Depth to free carbonates ranges from 0 to 20 inches. The 10- to 40-inch control section is more than 50 percent medium and coarse sand.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is 5 to 9 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 coarse sand in some pedons. In some pedons the lower part of the C horizon is stratified with thin layers of loamy material.

Zahl series

The Zahl series consists of deep, excessively drained soils that formed in glacial till. These soils are on uplands. Permeability is moderate or moderately slow. Slopes range from 6 to 34 percent.

Zahl soils in Walworth County contain more free carbonates in the Cca horizon than is defined as the range for the series. This difference, however, does not significantly alter the use and management of these soils.

Zahl soils commonly are near Vida and Williams soils and are similar to Gettys soils. Gettys soils lack a mollic epipedon and are fine textured. Vida and Williams soils have an argillic horizon.

Typical pedon of Zahl loam, in an area of Zahl-Williams loams, 15 to 34 percent slopes, 200 feet west and 1,320 feet north of the southeast corner of sec. 14, T. 124 N., R. 77 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear wavy boundary.

C1ca—5 to 18 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium segregations of lime; strong effervescence; mildly alkaline; clear smooth boundary.

C2ca—18 to 26 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium segregations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C3—26 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium distinct stains of brownish yellow and yellowish brown; few medium segregations of lime; strong effervescence; moderately alkaline.

Free carbonates are at the surface or within 10 inches of the surface. The calcium carbonate equivalent in the part of the Cca horizon that is within a depth of 15 inches is more than 15 percent.

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. In places it is light clay loam. It is neutral or mildly alkaline and is 5 to 8 inches thick. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 to 4. It is clay loam or loam.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*6*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 18, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol (*Molli*, meaning soft).

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boroll (*Bor*, meaning northern or cool, 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 expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Argiborolls (*Arg*, meaning clay accumulation horizons, plus *boroll*, the suborder of Mollisols that have a cool temperature regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceeding the name of the great

group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Argiborolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed Typic Argiborolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

Soil forms through the physical and chemical weathering of deposited or accumulated geologic material. The characteristics of the soil at any given place are determined by five factors: 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, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors in soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. Parent material also affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the development of horizons. Much or little time may be involved, but some time is always required for the differentiation of soil horizons. The development of distinct horizons generally takes a long time.

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. Many of the processes of soil formation are unknown.

In the following paragraphs, the effect of the factors of soil formation on the soils of Walworth County is described.

Parent material

Many of the soils in Walworth County formed in glacial material derived from preglacial formations of granite, gneiss, limestone, sandstone, and shale. This material was picked up by the glacier, was ground and mixed as it was transported, and was redeposited as the glacier melted. Some deposits are unsorted material, or glacial till; others are material that was sorted by water as it was deposited or by wind and water after it was deposited.

Soils in the Williams-Bowbells and Vida-Zahl map units formed almost entirely in unsorted glacial till. The till ranges from loam to clay in texture and from friable to firm in consistence. Among the soils formed in glacial till are Demky, Gettys, Raber, Vida, Williams, and Zahl soils.

Soils in the Bowdle-Lehr map unit formed in loamy or silty material over sand and gravel or in sandy material deposited by glacier meltwater. Some of the sandy material was sorted by wind after it was deposited. Akaska, Bowdle, Divide, Hecla, Lehr, Maddock, Tally, Wabek, and Yecross soils formed in these materials.

The dominant soils in the Highmore map unit formed in glacial material that was sorted by water and wind. Among the soils that formed in part or entirely in silty glacial drift are Eakin and Highmore soils.

Soils in the Agar-Lowry map unit formed in loess-mantled uplands and terraces in the western part of the county. Agar, Lowry, and Sully soils formed in this wind-deposited material.

The Pierre Formation is the only bedrock exposed in Walworth County. It is marine shale or clay stone of the Cretaceous age. Soils in the Sansarc-Opal and Opal-Promise map units formed in clayey material weathered from the Pierre Formation. Hurley, Opal, Promise, Sansarc, and Swanboy soils are examples.

Bowbells and Mobridge soils formed in alluvium washed in from adjacent sloping soils. Bon, Durrstein, and Egas soils formed in alluvium deposited by streams.

Climate

Walworth County has a continental climate. Winters are cold, and summers are hot. The precipitation is usually light in winter and is heaviest in the period mid-April through September. The climate favors a grassland ecology. The climate of Walworth County is more fully described in the section "General nature of the county."

Plant and animal life

Plants, animals, insects, earthworms, bacteria, and fungi are important in the formation of soils. The soils of Walworth County formed under prairie grasses. Bacteria and fungi in the soil help to decompose residue from the grass. Earthworms, insects, and burrowing animals mix the soil and residue and help to keep the soil open and porous.

Relief

Relief, or lay of the land, influences soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. Gettys, Sansarc, and Zahl soils are examples of sloping to steep soils that lose much rainfall through runoff. Rapid runoff lessens the amount of moisture that enters the soil and increases the amount of soil that is lost through erosion. These soils have a thin surface layer and are calcareous at or near the surface.

Runoff is slower on Highmore, Williams, and similar soils. As a result, more moisture enters the soils and soil formation is more complete. These soils have thicker horizons and accumulate organic matter. Also, lime is leached to a greater depth.

Bowbells and Mobridge soils are in swales that receive runoff from adjacent soils. As a result of the additional moisture, these soils are covered with more grass and have a larger amount of organic matter. In nearly level soils on lowland where drainage is impeded, a fluctuating high water table favors the concentration of salts. Durrstein and Egas soils are examples.

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 form. Most of the soils in Walworth County are on somewhat young landscapes that date back to the glacial period. Soils that formed in the more recent loess are among the younger soils on uplands. Opal and Promise soils, which are on stabler landscapes, are perhaps the oldest soils in the county.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

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. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Crop residue management. A system of retaining crop residue on land between harvest and replanting to help in controlling erosion and to insure future crop production.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock. Bedrock at a depth that adversely affects 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 for 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, as for example in "hillpeats" and "climatic moors."

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

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.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. 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 an average of once or less in 2 years; and *frequent* that it occurs on an average of 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. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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 7.5 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

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 A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock 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.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

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. Inadequate strength for supporting loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

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. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Piping. Moving water from subsurface tunnels or pipelike cavities in the soil.

Planned grazing system. A system in which two or more grazing units are alternately rested from grazing in a planned sequence over a period of years. The rest period may be throughout the year or during the growing season of the key plants.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Proper grazing use. Grazing at an intensity that will maintain enough cover to protect the soil and maintain or improve the quantity and quality of desirable vegetation.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Reaction, soil. The degree 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

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium. The degree of salinity is expressed as—

	Mmho/cm
None	Less than 2.0
Low	2.0 to 4.0
Moderate	4.0 to 8.0
High	8.0 to 16.0
Very high	More than 16.0

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.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

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.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface that 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.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil 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 that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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 or management.

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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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, silt loam, 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. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Wind stripcropping. Growing crops in strips that run crosswise to the general direction of prevailing wind and without strict adherence to the contour of the land.

Illustrations

Figure 1.—Typical landscape of the Sansarc-Opal map unit.

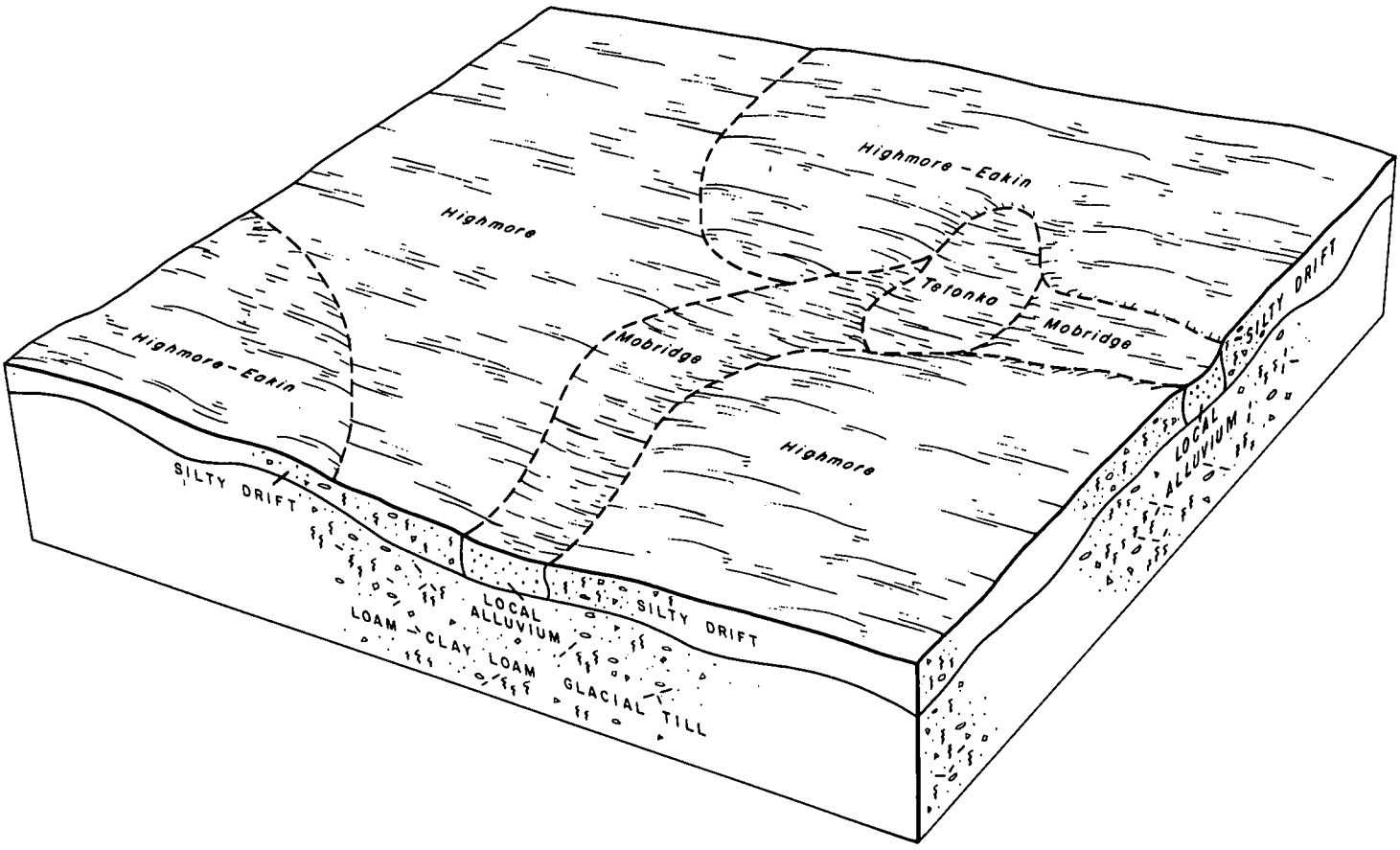

Figure 2.—Typical pattern of soils and underlying material in the Highmore map unit.

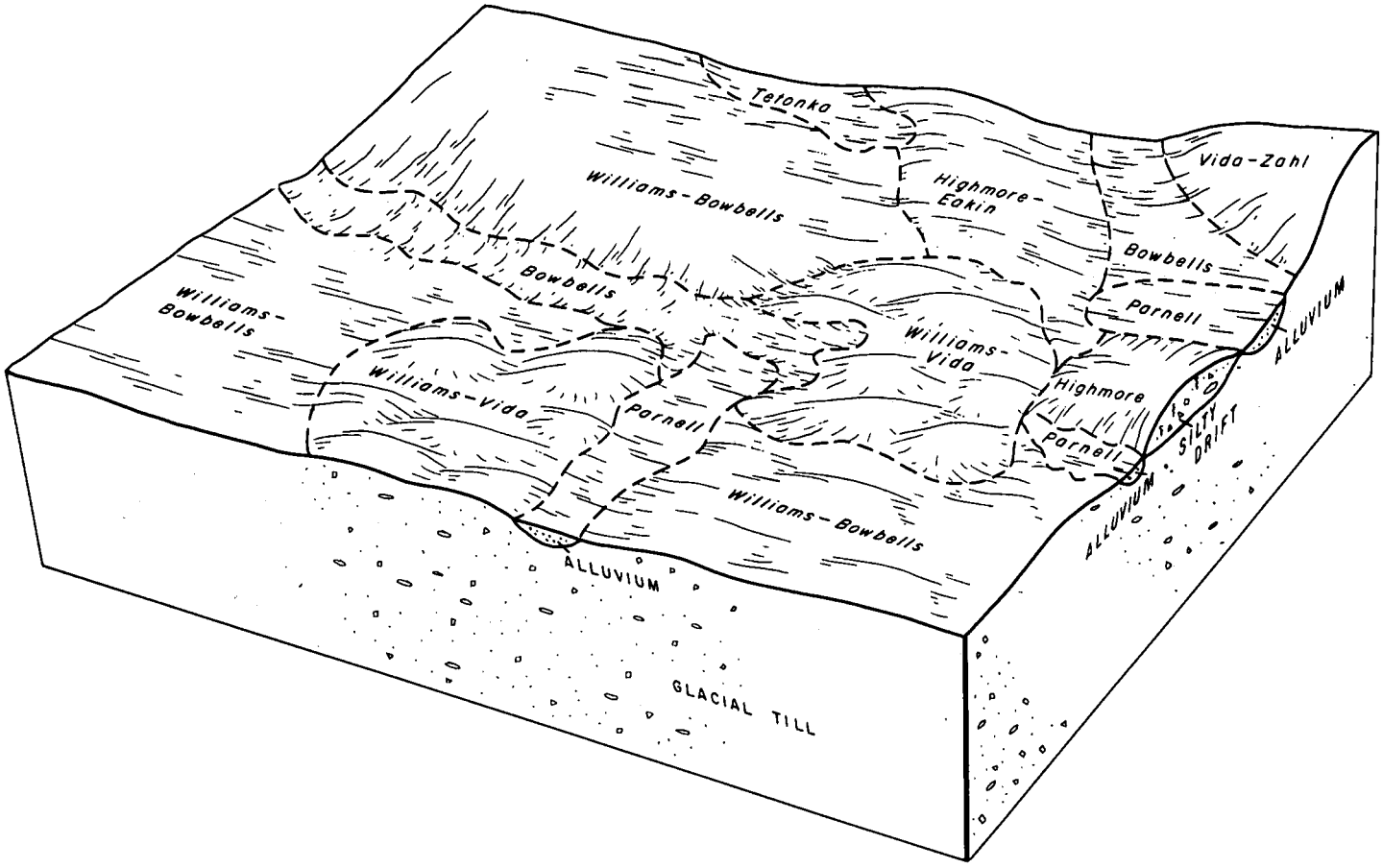

Figure 3.—Typcial pattern of soils and underlying material in the Williams-Bowbells map unit.

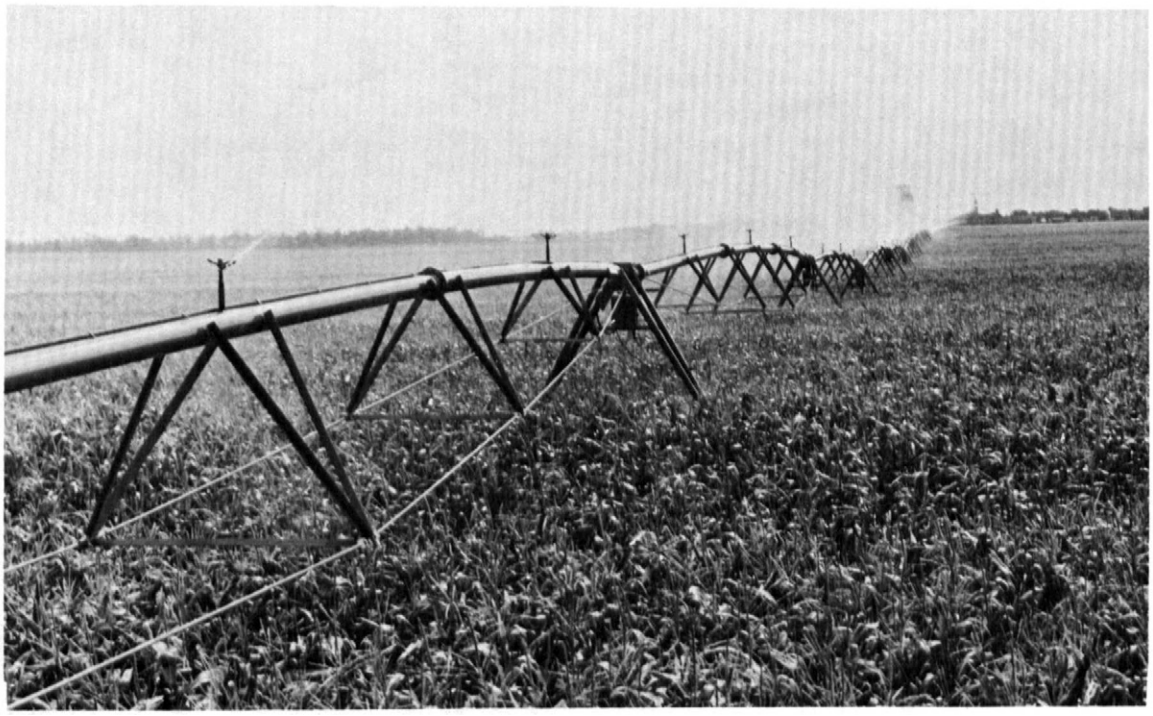

Figure 4.—Sprinkler-irrigated corn on Akaska silt loam, 0 to 2 percent slopes.

Figure 5.—An area of Aquolls.

Figure 6.—An area of Bon loam.

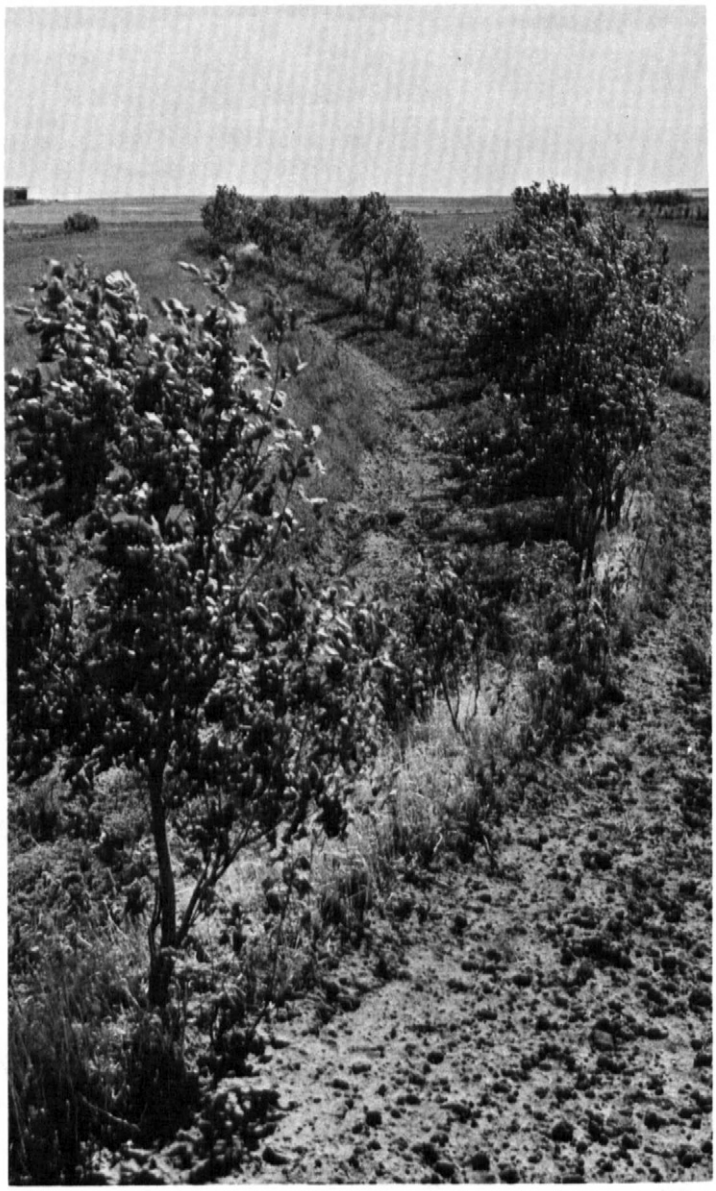

Figure 7.—A newly planted, single-row field windbreak on Highmore silt loam, 2 to 6 percent slopes.

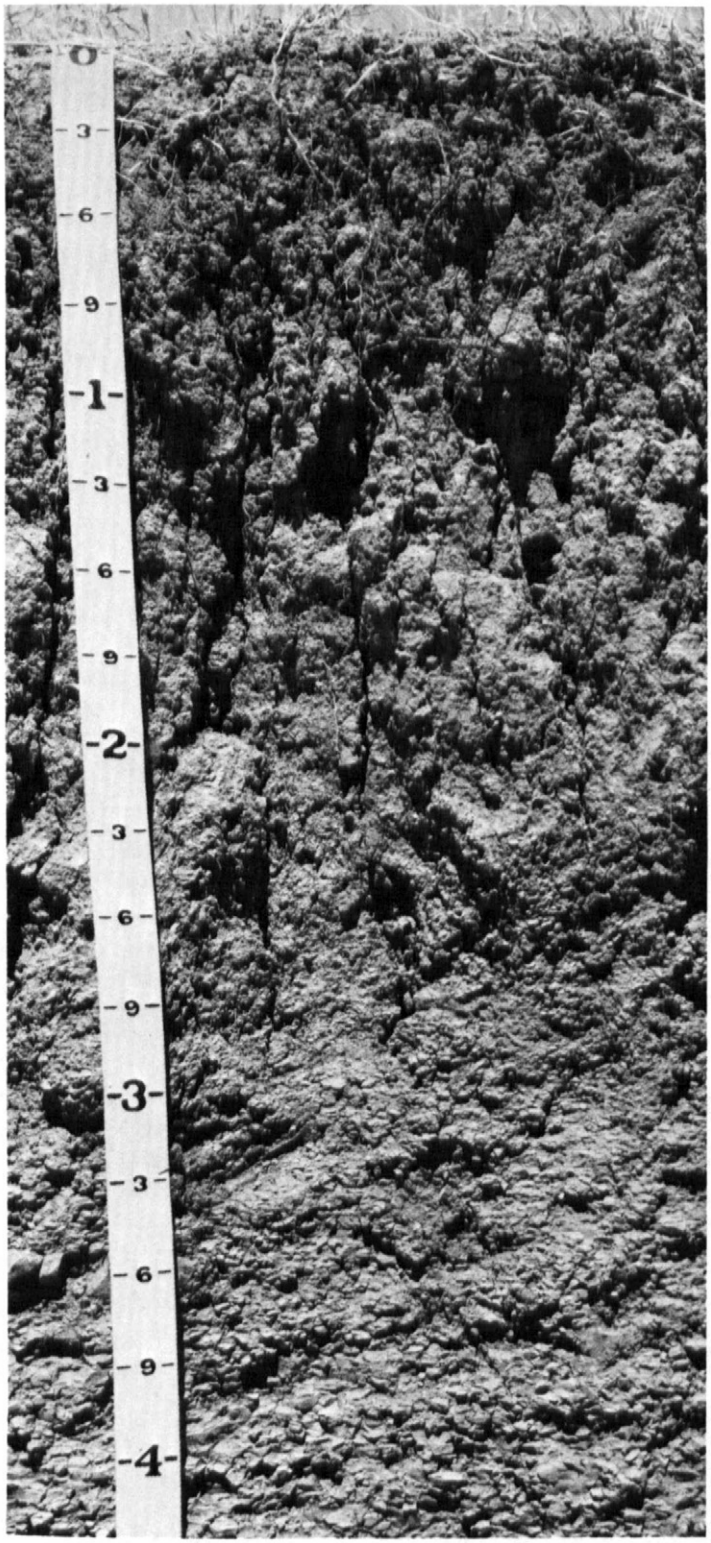

Figure 8.—Profile of Opal clay, 2 to 9 percent slopes. Bedded shale is at a depth of about 30 inches.

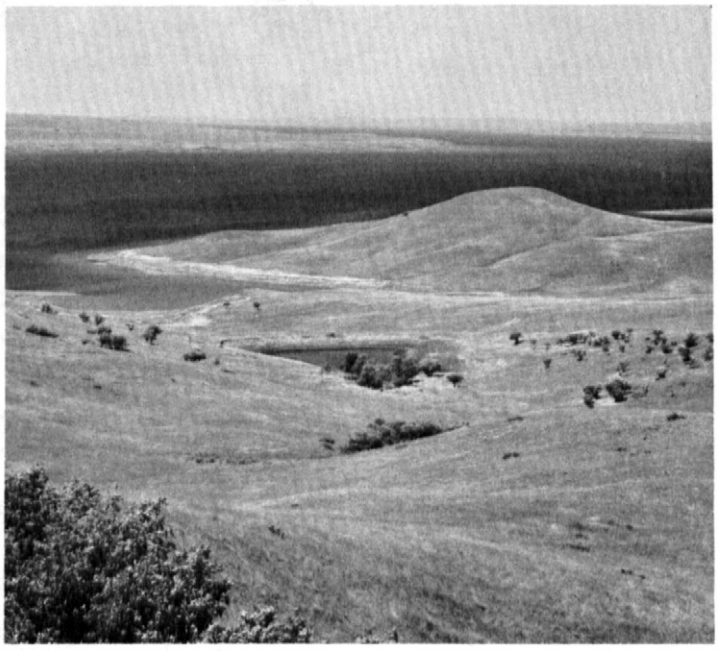

Figure 9.—An area of Opal-Sansarc clays, 6 to 15 percent slopes.

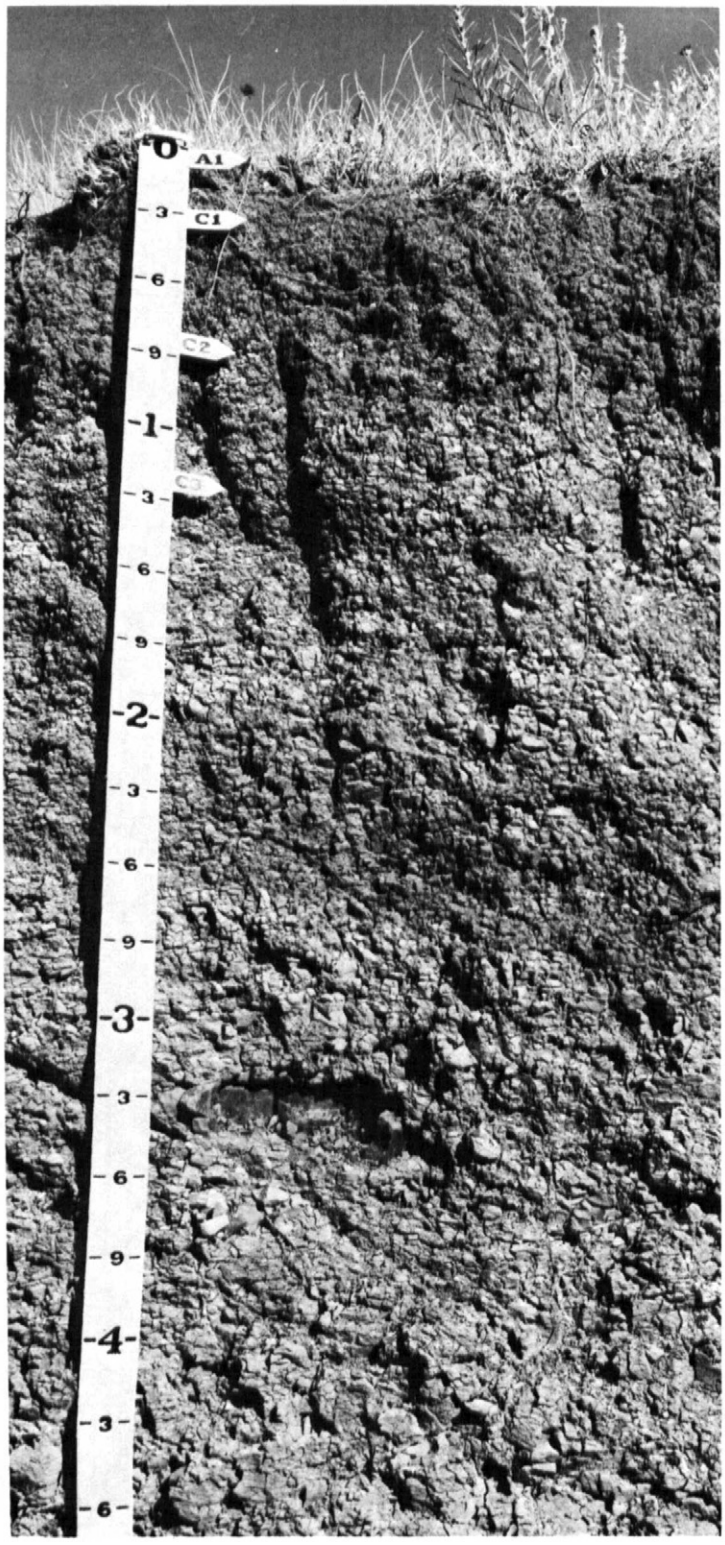

Figure 10.—Profile of Sansarc clay in an area of Sansarc-Opal clays, 15 to 40 percent slopes.

Figure 11.—Brushy draws in an area of Sansarc-Opal clays, 15 to 40 percent slopes. The brush provides variety in the habitat for rangeland wildlife.

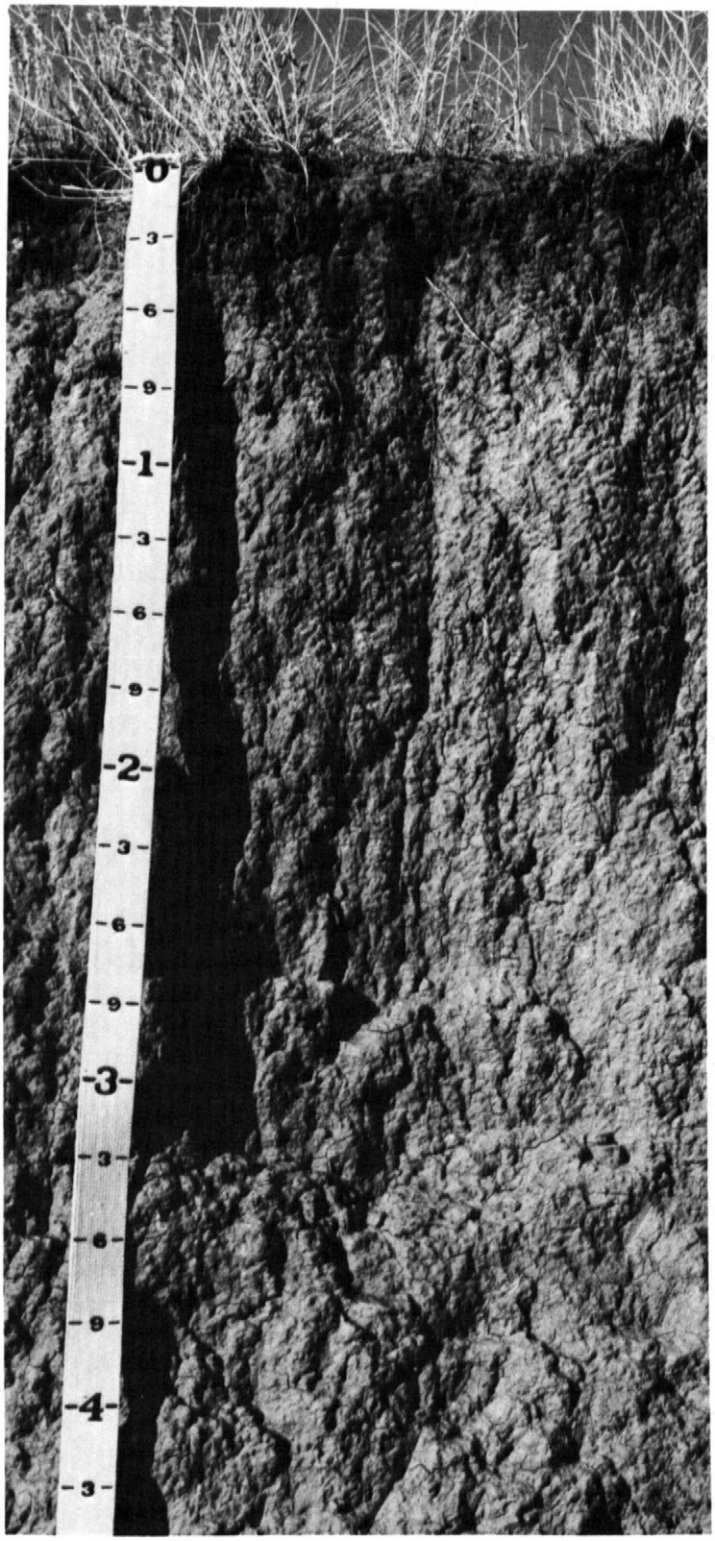

Figure 12.—Profile of Sully silt loam, 2 to 9 percent slopes.

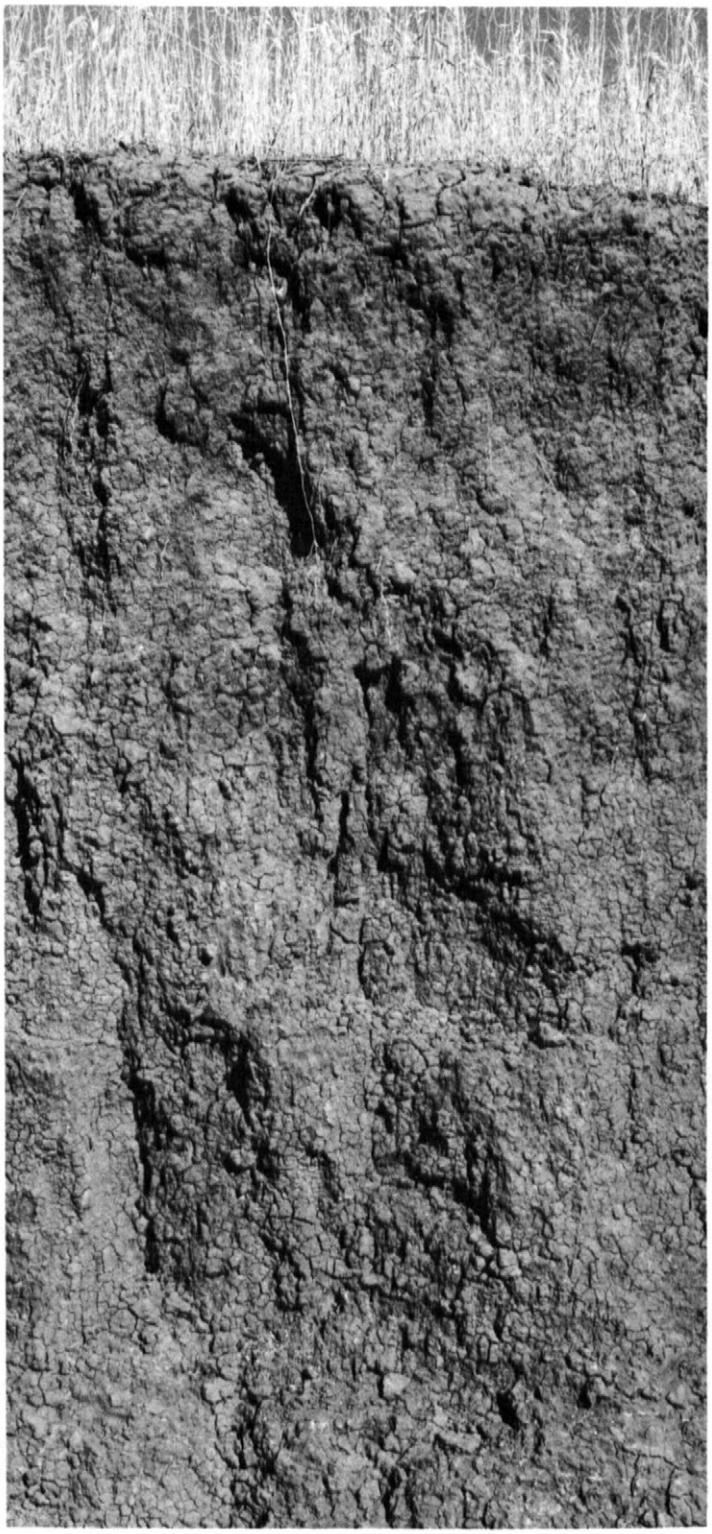

Figure 13.—Profile of Swanboy clay, 0 to 6 percent slopes.

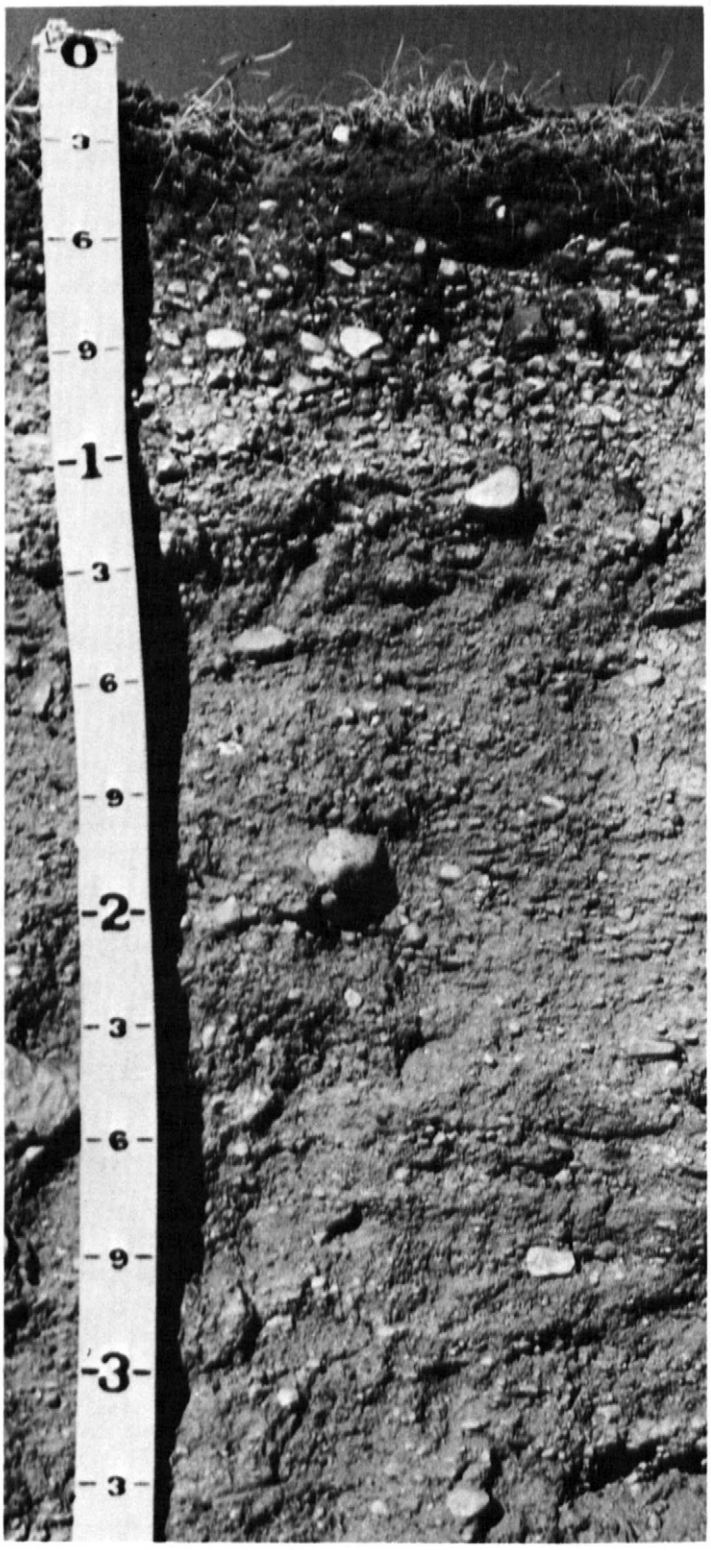

Figure 14.—Profile of Wabek loam, 9 to 40 percent slopes.

Figure 15.—Trees planted for recreation and wildlife uses on Zahl-Williams loams, 15 to 34 percent slopes.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature[1]						Precipitation[1]				
	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[2]	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----	21.3	-.2	10.6	50	-30	0	.31	.09	.48	1	4.3
February---	28.8	6.2	17.5	53	-23	0	.38	.15	.56	1	4.8
March------	41.0	18.2	29.6	74	-15	93	.73	.24	1.13	2	5.8
April------	56.0	32.3	44.2	84	11	164	2.31	.90	3.43	5	5.4
May--------	69.5	43.1	56.3	90	24	505	2.99	1.91	3.95	6	.0
June-------	78.8	53.6	66.3	97	36	789	3.41	1.56	4.92	7	.0
July-------	86.7	58.6	72.7	102	43	1,014	2.26	.88	3.37	5	.0
August-----	86.4	56.8	71.6	103	40	980	1.76	1.10	2.34	4	.0
September--	73.6	45.2	59.4	96	24	582	1.22	.40	1.86	3	.0
October----	63.1	35.3	49.2	87	17	321	.85	.23	1.34	3	.9
November---	42.8	20.9	31.9	69	-4	28	.52	.14	.81	2	4.0
December---	26.5	6.7	16.6	58	-27	0	.52	.21	.77	2	7.7
Year-----	56.2	31.4	43.8	104	-33	4,476	17.26	14.64	19.77	41	32.9

[1]Recorded in the period 1960-74 at Selby, S. Dak.

[2]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° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1]		
	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 20	June 4
2 years in 10 later than--	May 4	May 15	May 29
5 years in 10 later than--	April 24	May 6	May 18
First freezing temperature in fall:			
1 year in 10 earlier than--	September 26	September 18	September 8
2 years in 10 earlier than--	October 2	September 23	September 14
5 years in 10 earlier than--	October 12	October 2	September 25

[1]Recorded in the period 1960-74 at Selby, S. Dak.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1]		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	152	130	111
8 years in 10	158	136	117
5 years in 10	170	148	129
2 years in 10	183	160	141
1 year in 10	189	167	147

[1]Recorded in the period 1960-74 at Selby, S. Dak.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AgA	Agar silt loam, 0 to 2 percent slopes	5,550	1.2
AgB	Agar silt loam, 2 to 6 percent slopes	11,540	2.5
AgC	Agar silt loam, 6 to 9 percent slopes	3,130	0.7
AkA	Akaska silt loam, 0 to 2 percent slopes	2,890	0.6
AkB	Akaska silt loam, 2 to 6 percent slopes	1,655	0.4
Ao	Aquolls	2,250	0.5
Ar	Arveson sandy loam, wet	568	0.1
Bn	Bon loam	2,380	0.5
BoA	Bowbells loam, 0 to 3 percent slopes	3,775	0.8
BwA	Bowdle loam, 0 to 2 percent slopes	6,770	1.5
BwB	Bowdle loam, 2 to 6 percent slopes	3,680	0.8
BxB	Bowdle-Wabek loams, 2 to 6 percent slopes	2,725	0.6
BxC	Bowdle-Wabek loams, 6 to 9 percent slopes	2,760	0.6
BxD	Bowdle-Wabek loams, 9 to 15 percent slopes	500	0.1
Co	Colvin silt loam	1,590	0.3
DeA	Demky loam, 0 to 2 percent slopes	3,470	0.8
DeB	Demky loam, 2 to 6 percent slopes	2,515	0.5
DgA	Demky-Jerauld complex, 0 to 2 percent slopes	1,785	0.4
Dm	Divide loam	455	0.1
Du	Durrstein silt loam	2,400	0.5
Eg	Egas silty clay loam	1,410	0.3
GeE	Gettys clay loam, 9 to 40 percent slopes	8,050	1.8
Gp	Gravel pits	410	0.1
HeA	Hecla loamy sand, 0 to 3 percent slopes	230	(1)
HhA	Highmore silt loam, 0 to 2 percent slopes	22,425	4.9
HhB	Highmore silt loam, 2 to 6 percent slopes	80,830	17.6
HhC	Highmore silt loam, 6 to 9 percent slopes	12,410	2.7
HkA	Highmore-Eakin silt loams, 0 to 2 percent slopes	4,340	0.9
HkB	Highmore-Eakin silt loams, 2 to 6 percent slopes	31,070	6.8
HkC	Highmore-Eakin silt loams, 6 to 9 percent slopes	4,925	1.1
HmB	Highmore-Raber complex, 2 to 6 percent slopes	9,420	2.1
HmC	Highmore-Raber complex, 6 to 9 percent slopes	11,935	2.6
Ho	Hoven silt loam	390	0.1
HuB	Hurley silt loam, 2 to 9 percent slopes	1,800	0.4
Je	Jerauld silt loam	1,900	0.4
Js	Jerauld-Slickspots complex	485	0.1
LaA	Lehr loam, 0 to 2 percent slopes	2,050	0.4
LaB	Lehr loam, 2 to 6 percent slopes	4,140	0.9
LbB	Lehr-Bowdle loams, 2 to 9 percent slopes	640	0.1
LoA	Lowry silt loam, 0 to 2 percent slopes	1,870	0.4
LoB	Lowry silt loam, 2 to 6 percent slopes	3,580	0.8
LoC	Lowry silt loam, 6 to 9 percent slopes	1,560	0.3
Ma	Macken silty clay	3,380	0.7
MdB	Maddock fine sandy loam, 0 to 6 percent slopes	1,855	0.4
MdC	Maddock fine sandy loam, 6 to 15 percent slopes	550	0.1
Mo	Mobridge silt loam	27,410	6.0
OpC	Opal clay, 2 to 9 percent slopes	9,640	2.1
OsD	Opal-Sansarc clays, 6 to 15 percent slopes	15,180	3.3
Pa	Parnell clay loam, wet	1,240	0.3
PrA	Parshall fine sandy loam, 0 to 2 percent slopes	690	0.2
PrB	Parshall fine sandy loam, 2 to 6 percent slopes	330	(1)
PsA	Promise clay, 0 to 2 percent slopes	5,870	1.3
PsB	Promise clay, 2 to 6 percent slopes	6,875	1.5
RaB	Raber loam, 2 to 6 percent slopes	4,470	1.0
RaC	Raber loam, 6 to 9 percent slopes	5,315	1.2
RbD	Raber-Gettys complex, 6 to 15 percent slopes	8,290	1.8
Re	Regan silt loam	1,615	0.4
SaE	Sansarc-Opal clays, 15 to 40 percent slopes	16,950	3.7
SuC	Sully silt loam, 2 to 9 percent slopes	1,860	0.4
SuD	Sully silt loam, 9 to 15 percent slopes	2,770	0.6
SuE	Sully silt loam, 15 to 40 percent slopes	1,700	0.4
SwA	Swanboy clay, 0 to 6 percent slopes	1,785	0.4
TaA	Tally fine sandy loam, 0 to 2 percent slopes	910	0.2
TaB	Tally fine sandy loam, 2 to 6 percent slopes	1,545	0.3
TaC	Tally fine sandy loam, 6 to 9 percent slopes	400	0.1
Te	Tetonka silt loam	10,625	2.3
Us	Ustifluvents, channeled	2,840	0.6
VdD	Vida stony loam, 3 to 15 percent slopes	1,630	0.4
VzD	Vida-Zahl loams, 6 to 15 percent slopes	8,475	1.8
WaE	Wabek loam, 9 to 40 percent slopes	2,220	0.5

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
WbA	Williams-Bowbells loams, 0 to 2 percent slopes	910	0.2
WbB	Williams-Bowbells loams, 2 to 6 percent slopes	22,480	4.9
WdC	Williams-Vida loams, 6 to 9 percent slopes	16,920	3.7
YeB	Yecross loamy fine sand, 0 to 6 percent slopes	570	0.1
YeC	Yecross loamy fine sand, 6 to 15 percent slopes	220	(1)
ZaE	Zahl-Williams loams, 15 to 34 percent slopes	3,000	0.7
	Water less than 40 acres	550	0.1
	Open water greater than 40 acres	20,672	
	Total land area	459,328	100.0
	Total area	480,000	

[1]Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1976. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Oats	Flax	Spring wheat	Grain sorghum	Alfalfa hay	Cool season grass
	Bu	Bu	Bu	Bu	Bu	Ton	AUM[1]
Agar:							
AgA	42	60	17	27	48	2.1	3.5
AgB	40	56	16	25	45	2.0	3.3
AgC	32	50	14	22	37	1.9	3.2
Akaska:							
AkA	30	39	---	20	35	1.5	2.7
AkB	28	37	---	19	33	1.4	2.3
Aquolls:							
Ao.							
Arveson:							
Ar	---	---	---	---	---	---	---
Bon:							
Bn	50	69	19	31	60	3.1	5.2
Bowbells:							
BoA	50	67	19	31	60	2.5	4.2
Bowdle:							
BwA	30	44	15	21	---	1.2	2.0
BwB	28	41	13	19	---	1.1	1.8
[2]BxB	22	35	9	15	---	0.8	1.4
[2]BxC	18	31	---	12	---	0.7	1.2
[2]BxD	---	---	---	---	---	---	---
Colvin:							
Co	---	---	---	---	---	2.2	3.7
Demky:							
DeA	30	49	---	23	36	1.7	2.8
DeB	28	46	---	21	33	1.6	2.7
[2]DgA	---	34	---	15	---	1.3	2.2
Divide:							
Dm	27	42	11	21	---	1.8	3.0
Durrstein:							
Du	---	---	---	---	---	---	---
Egas:							
Eg	---	---	---	---	---	---	---
Gettys:							
GeE	---	---	---	---	---	---	---
Gravel pits:							
Gp.							
Hecla:							
HeA	33	35	12	19	---	1.9	3.2

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Flax	Spring wheat	Grain sorghum	Alfalfa hay	Cool season grass
	Bu	Bu	Bu	Bu	Bu	Ton	AUM[1]
Highmore:							
HhA	41	60	17	26	47	2.1	3.4
HhB	39	58	16	24	44	2.0	3.2
HhC	32	50	14	22	37	1.9	3.2
[2]HkA	40	59	16	26	46	2.0	3.3
[2]HkB	38	57	15	24	43	1.9	3.2
[2]HkC	31	48	14	22	36	1.7	2.8
[2]HmB	36	55	15	24	42	1.9	3.2
[2]HmC	30	48	14	22	36	1.7	2.8
Hoven:							
Ho	---	---	---	---	---	---	---
Hurley:							
HuB	---	---	---	---	---	---	---
Jerauld:							
Je	---	---	---	---	---	---	---
[2]Js	---	---	---	---	---	---	---
Lehr:							
LaA	---	26	8	13	---	---	---
LaB	---	24	7	12	---	---	---
[2]LbB	---	22	---	11	---	---	1.0
Lowry:							
LoA	36	48	16	24	41	2.0	3.3
LoB	33	45	15	22	37	1.9	3.2
LoC	29	41	---	20	30	1.7	2.8
Macken:							
Ma	---	---	---	---	---	---	---
Maddock:							
MdB	31	28	10	14	---	1.3	2.2
MdC	---	---	---	---	---	---	---
Mobridge:							
Mo	52	65	19	30	65	2.9	4.8
Opal:							
OpC	21	33	---	17	24	1.3	2.2
[2]OsD	---	---	---	---	---	---	---
Parnell:							
Pa	---	---	---	---	---	---	---
Parshall:							
PrA	42	48	15	23	---	1.8	3.0
PrB	40	46	14	21	---	1.7	2.8
Promise:							
PsA	28	50	---	24	44	1.5	2.6

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Flax	Spring wheat	Grain sorghum	Alfalfa hay	Cool season grass
	Bu	Bu	Bu	Bu	Bu	Ton	AUM[1]
Promise:							
PsB	26	48	---	23	42	1.5	2.6
Raber:							
RaB	32	48	12	23	44	1.9	3.0
RaC	30	44	---	21	39	1.7	2.8
[2]RbD	---	32	---	15	---	1.2	2.2
Regan:							
Re	---	---	---	---	---	---	---
Sansarc:							
[2]SaE	---	---	---	---	---	---	---
Sully:							
SuC	23	32	---	16	---	1.3	2.2
SuD	---	---	---	---	---	---	---
SuE	---	---	---	---	---	---	---
Swanboy:							
SwA	---	---	---	---	---	---	---
Tally:							
TaA	40	46	14	20	---	1.6	2.7
TaB	38	44	13	17	---	1.6	2.6
TaC	33	40	---	15	---	1.5	2.5
Tetonka:							
Te	---	---	---	---	---	---	---
Ustifluvents:							
Us.							
Vida:							
VdD	---	---	---	---	---	---	---
[2]VzD	---	30	---	13	---	1.0	1.7
Wabek:							
WaE	---	---	---	---	---	---	---
Williams:							
[2]WbA	42	56	17	31	---	2.2	3.6
[2]WbB	40	54	15	28	---	2.1	3.5
[2]WdC	34	50	---	25	---	1.9	3.2
Yecross:							
YeB	27	26	8	12	---	1.3	2.2
YeC	---	---	---	---	---	---	---
Zahl:							
[2]ZaE	---	---	---	---	---	---	---

[1]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 a period of 30 days.

[2]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed do not support rangeland vegetation suited to grazing]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Agar:					
AgA	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
AgB, AgC	Silty	Favorable	3,120	Western wheatgrass	30
		Normal	2,600	Green needlegrass	20
		Unfavorable	1,820	Little bluestem	10
				Needleandthread	10
				Side-oats grama	10
				Big bluestem	5
				Blue grama	5
				Sedge	5
Akaska:					
AkA	Silty	Favorable	3,120	Western wheatgrass	30
		Normal	2,600	Green needlegrass	20
		Unfavorable	1,820	Needleandthread	10
				Big bluestem	10
				Side-oats grama	10
				Blue grama	10
				Little bluestem	5
AkB	Silty	Favorable	2,880	Western wheatgrass	30
		Normal	2,400	Green needlegrass	20
		Unfavorable	1,680	Needleandthread	10
				Little bluestem	10
				Side-oats grama	10
				Blue grama	10
				Big bluestem	5
Arveson:					
Ar	Subirrigated	Favorable	5,060	Big bluestem	25
		Normal	4,600	Reed canarygrass	10
		Unfavorable	3,680	Switchgrass	10
				Indiangrass	10
				Kentucky bluegrass	10
				Sedge	10
				Prairie cordgrass	5
Bon:					
Bn	Overflow	Favorable	4,400	Big bluestem	45
		Normal	4,000	Western wheatgrass	25
		Unfavorable	2,800	Green needlegrass	10
				Side-oats grama	5
				Leadplant	5
				Sedge	5
Bowbells:					
BoA	Overflow	Favorable	4,560	Big bluestem	45
		Normal	3,800	Green needlegrass	15
		Unfavorable	2,660	Western wheatgrass	20
				Needleandthread	5
				Kentucky bluegrass	5
				Porcupinegrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Bowdle:					
BwA, BwB	Silty	Favorable	2,880	Green needlegrass	30
		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,680	Needleandthread	25
				Blue grama	10
[1]BxB:					
Bowdle part	Silty	Favorable	2,880	Green needlegrass	30
		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,680	Needleandthread	25
				Blue grama	10
Wabek part	Very Shallow	Favorable	1,680	Needleandthread	25
		Normal	1,400	Blue grama	30
		Unfavorable	840	Threadleaf sedge	20
[1]BxC:					
Bowdle part	Silty	Favorable	2,880	Green needlegrass	30
		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,680	Needleandthread	25
				Blue grama	10
Wabek part	Very Shallow	Favorable	1,680	Needleandthread	25
		Normal	1,400	Blue grama	30
		Unfavorable	840	Threadleaf sedge	20
[1]BxD:					
Bowdle part	Silty	Favorable	2,880	Green needlegrass	30
		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,680	Needleandthread	25
				Blue grama	10
Wabek part	Very Shallow	Favorable	1,680	Needleandthread	25
		Normal	1,400	Blue grama	30
		Unfavorable	840	Threadleaf sedge	20
Colvin:					
Co	Subirrigated	Favorable	5,280	Big bluestem	50
		Normal	4,800	Prairie cordgrass	15
		Unfavorable	3,840	Sedge	10
				Switchgrass	10
				Indiangrass	5
Demky:					
DeA, DeB	Clayey	Favorable	3,120	Western wheatgrass	30
		Normal	2,600	Green needlegrass	30
		Unfavorable	1,820	Side-oats grama	10
				Blue grama	10
				Little bluestem	5
				Big bluestem	5
				Sedge	5
[1]DgA:					
Demky part	Clayey	Favorable	3,120	Western wheatgrass	30
		Normal	2,600	Green needlegrass	30
		Unfavorable	1,820	Side-oats grama	10
				Blue grama	10
				Little bluestem	5
				Big bluestem	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Demky:					
[1]DgA:					
Jerauld part	Thin Claypan	Favorable	1,440	Blue grama	30
		Normal	1,200	Western wheatgrass	25
		Unfavorable	720	Needleandthread	15
				Buffalograss	10
				Sedge	10
Divide:					
Dm	Silty	Favorable	3,360	Western wheatgrass	25
		Normal	2,800	Needleandthread	15
		Unfavorable	1,960	Blue grama	10
				Green needlegrass	10
				Big bluestem	5
Durrstein:					
Du	Saline Lowland	Favorable	4,400	Cordgrass	50
		Normal	4,000	Nuttall alkaligrass	20
		Unfavorable	3,200	Western wheatgrass	10
				Inland saltgrass	10
Egas:					
Eg	Saline Lowland	Favorable	4,620	Cordgrass	50
		Normal	4,200	Nuttall alkaligrass	20
		Unfavorable	3,360	Western wheatgrass	10
				Inland saltgrass	10
Gettys:					
GeE	Thin Upland	Favorable	2,640	Little bluestem	30
		Normal	2,200	Side-oats grama	20
		Unfavorable	1,540	Needleandthread	10
				Western wheatgrass	10
				Blue grama	10
				Prairie dropseed	5
				Sedge	5
Hecla:					
HeA	Sands	Favorable	3,360	Sand bluestem	25
		Normal	2,800	Little bluestem	25
		Unfavorable	1,960	Prairie sandreed	20
				Needleandthread	10
				Switchgrass	5
				Canada wildrye	5
				Sedge	5
Highmore:					
HhA, HhB, HhC	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
[1]HkA:					
Highmore part	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Highmore:					
[1]HkA:					
Eakin part	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
[1]HkB:					
Highmore part	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
Eakin part	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
[1]HkC:					
Highmore part	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
Eakin part	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
[1]HmB:					
Highmore part	Silty	Favorable	3,360	Western wheatgrass	35
		Normal	2,800	Green needlegrass	20
		Unfavorable	1,960	Big bluestem	10
				Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
Raber part	Clayey	Favorable	2,880	Western wheatgrass	40
		Normal	2,400	Green needlegrass	30
		Unfavorable	1,680	Side-oats grama	10
				Blue grama	10
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Highmore:					
[1]HmC:					
Highmore part---	Silty----------	Favorable	3,360	Western wheatgrass----------	35
		Normal	2,800	Green needlegrass----------	20
		Unfavorable	1,960	Big bluestem----------	10
				Needleandthread----------	10
				Little bluestem----------	5
				Side-oats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Raber part------	Clayey----------	Favorable	2,880	Western wheatgrass----------	40
		Normal	2,400	Green needlegrass----------	30
		Unfavorable	1,680	Side-oats grama----------	10
				Blue grama----------	10
				Sedge----------	5
Hoven:					
Ho----------	Closed Depression----------	Favorable	4,620	Western wheatgrass----------	85
		Normal	4,000	Sedge----------	10
		Unfavorable	2,940		
Hurley:					
HuB----------	Thin Claypan----------	Favorable	1,800	Blue grama----------	30
		Normal	1,500	Western wheatgrass----------	25
		Unfavorable	900	Buffalograss----------	10
				Needleandthread----------	15
				Sedge----------	10
Jerauld:					
Je----------	Thin Claypan----------	Favorable	1,440	Blue grama----------	30
		Normal	1,200	Western wheatgrass----------	25
		Unfavorable	720	Needleandthread----------	15
				Buffalograss----------	10
				Sedge----------	10
[1]Js:					
Jerauld part----	Thin Claypan----------	Favorable	1,440	Blue grama----------	30
		Normal	1,200	Western wheatgrass----------	25
		Unfavorable	720	Needleandthread----------	15
				Buffalograss----------	10
				Sedge----------	10
Slickspots part.					
Lehr:					
LaA, LaB----------	Shallow to Gravel----------	Favorable	2,280	Needleandthread----------	35
		Normal	1,900	Blue grama----------	15
		Unfavorable	1,140	Side-oats grama----------	10
				Little bluestem----------	10
				Plains muhly----------	5
[1]LbB:					
Lehr part-------	Shallow to Gravel----------	Favorable	2,280	Needleandthread----------	35
		Normal	1,900	Blue grama----------	15
		Unfavorable	1,140	Side-oats grama----------	10
				Little bluestem----------	10
				Plains muhly----------	5
Bowdle part-----	Silty----------	Favorable	2,880	Green needlegrass----------	30
		Normal	2,400	Western wheatgrass----------	25
		Unfavorable	1,680	Needleandthread----------	25
				Blue grama----------	10

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Lowry:					
LoA, LoB, LoC	Silty	Favorable	3,120	Western wheatgrass	35
		Normal	2,600	Green needlegrass	20
		Unfavorable	1,820	Needleandthread	10
				Little bluestem	5
				Side-oats grama	5
				Blue grama	5
				Sedge	5
Macken:					
Ma	Closed Depression	Favorable	4,070	Western wheatgrass	80
		Normal	3,700	Sedge	10
		Unfavorable	2,590	Blue grama	5
Maddock:					
MdB, MdC	Sands	Favorable	3,360	Needleandthread	10
		Normal	2,800	Prairie sandreed	20
		Unfavorable	1,960	Sand bluestem	15
				Little bluestem	30
				Switchgrass	5
				Sedge	5
Mobridge:					
Mo	Overflow	Favorable	4,560	Big bluestem	45
		Normal	3,800	Western wheatgrass	20
		Unfavorable	2,660	Green needlegrass	15
				Side-oats grama	5
				Leadplant	5
				Sedge	5
Opal:					
OpC	Clayey	Favorable	2,760	Western wheatgrass	50
		Normal	2,300	Green needlegrass	25
		Unfavorable	1,610	Blue grama	10
				Side-oats grama	5
				Buffalograss	5
[1]OsD:					
Opal part	Clayey	Favorable	2,760	Western wheatgrass	50
		Normal	2,300	Green needlegrass	25
		Unfavorable	1,610	Blue grama	10
				Side-oats grama	5
				Buffalograss	5
Sansarc part	Shallow	Favorable	2,280	Little bluestem	35
		Normal	1,900	Side-oats grama	20
		Unfavorable	1,330	Blue grama	15
				Needleandthread	10
				Green needlegrass	5
				Sedge	5
Parnell:					
Pa	Wetland	Favorable	6,050	Prairie cordgrass	60
		Normal	5,500	Western wheatgrass	20
		Unfavorable	4,400	Sedge	10
				Switchgrass	5
Parshall:					
PrA, PrB	Sandy	Favorable	3,120	Little bluestem	30
		Normal	2,600	Needleandthread	15
		Unfavorable	1,820	Prairie sandreed	20
				Side-oats grama	10
				Blue grama	10

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Promise:					
PsA	Clayey	Favorable	2,880	Western wheatgrass	55
		Normal	2,400	Green needlegrass	30
		Unfavorable	1,680	Side-oats grama	5
				Blue grama	5
PsB	Clayey	Favorable	2,880	Western wheatgrass	50
		Normal	2,400	Green needlegrass	25
		Unfavorable	1,680	Blue grama	10
				Side-oats grama	5
				Buffalograss	5
Raber:					
RaB, RaC	Clayey	Favorable	2,880	Western wheatgrass	40
		Normal	2,400	Green needlegrass	30
		Unfavorable	1,680	Side-oats grama	10
				Blue grama	10
				Sedge	5
[1]RbD:					
Raber part	Clayey	Favorable	2,880	Western wheatgrass	40
		Normal	2,400	Green needlegrass	30
		Unfavorable	1,680	Side-oats grama	10
				Blue grama	10
				Sedge	5
Gettys part	Thin Upland	Favorable	2,880	Little bluestem	20
		Normal	2,400	Side-oats grama	15
		Unfavorable	1,680	Needleandthread	15
				Western wheatgrass	25
				Blue grama	10
				Sedge	5
Regan:					
Re	Wetland	Favorable	6,600	Sedge	25
		Normal	6,000	Northern reedgrass	10
		Unfavorable	4,800	Prairie cordgrass	60
Sansarc:					
[1]SaE:					
Sansarc part	Shallow	Favorable	2,280	Little bluestem	30
		Normal	1,900	Side-oats grama	25
		Unfavorable	1,330	Blue grama	15
				Needleandthread	10
				Green needlegrass	5
				Sedge	5
Opal part	Clayey	Favorable	2,760	Western wheatgrass	50
		Normal	2,300	Green needlegrass	25
		Unfavorable	1,610	Blue grama	10
				Side-oats grama	5
				Buffalograss	5
Sully:					
SuC, SuD	Thin Upland	Favorable	2,760	Little bluestem	20
		Normal	2,300	Needleandthread	20
		Unfavorable	1,610	Western wheatgrass	20
				Side-oats grama	15
				Blue grama	10
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Sully:					
SuE	Thin Upland	Favorable	2,520	Little bluestem	25
		Normal	2,100	Side-oats grama	20
		Unfavorable	1,470	Needleandthread	20
				Western wheatgrass	10
				Blue grama	10
				Sedge	5
Swanboy:					
SwA	Dense Clay	Favorable	2,080	Western wheatgrass	60
		Normal	1,600	Green needlegrass	25
		Unfavorable	960		
Tally:					
TaA, TaB, TaC	Sandy	Favorable	3,000	Little bluestem	25
		Normal	2,500	Needleandthread	15
		Unfavorable	1,750	Prairie sandreed	15
				Blue grama	10
				Side-oats grama	10
Tetonka:					
Te	Closed Depression	Favorable	5,830	Prairie cordgrass	30
		Normal	5,300	Western wheatgrass	55
		Unfavorable	3,710	Sedge	10
Ustifluvents:					
Us	Overflow	Favorable	4,400	Big bluestem	45
		Normal	4,000	Western wheatgrass	25
		Unfavorable	2,800	Green needlegrass	10
				Side-oats grama	5
				Leadplant	5
				Sedge	5
Vida:					
VdD	Silty	Favorable	2,880	Green needlegrass	30
		Normal	2,400	Western wheatgrass	25
		Unfavorable	1,680	Needleandthread	25
				Blue grama	10
				Sedge	5
[1]VzD:					
Vida part	Silty	Favorable	3,120	Western wheatgrass	25
		Normal	2,600	Needleandthread	15
		Unfavorable	1,820	Green needlegrass	20
				Little bluestem	10
				Blue grama	10
Zahl part	Thin Upland	Favorable	2,760	Little bluestem	25
		Normal	2,300	Western wheatgrass	10
		Unfavorable	1,610	Needleandthread	20
				Side-oats grama	20
				Blue grama	10
				Sedge	5
Wabek:					
WaE	Very Shallow	Favorable	1,320	Needleandthread	25
		Normal	1,100	Blue grama	30
		Unfavorable	660	Threadleaf sedge	20
Williams:					
[1]WbA:					
Williams part	Silty	Favorable	3,200	Western wheatgrass	30
		Normal	2,700	Needleandthread	20
		Unfavorable	1,890	Green needlegrass	20
				Little bluestem	10
				Blue grama	10
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Williams:					
[1]WbA:					
Bowbells part---	Overflow----------	Favorable	4,560	Big bluestem----------	45
		Normal	3,800	Green needlegrass----------	15
		Unfavorable	2,660	Western wheatgrass----------	20
				Needleandthread----------	5
				Kentucky bluegrass----------	5
				Porcupinegrass----------	5
[1]WbB:					
Williams part---	Silty----------	Favorable	3,200	Western wheatgrass----------	30
		Normal	2,700	Needleandthread----------	20
		Unfavorable	1,890	Green needlegrass----------	20
				Little bluestem----------	10
				Blue grama----------	10
				Sedge----------	5
Bowbells part---	Silty----------	Favorable	3,600	Western wheatgrass----------	35
		Normal	3,000	Needleandthread----------	10
		Unfavorable	2,100	Green needlegrass----------	20
				Blue grama----------	10
				Little bluestem----------	5
				Sedge----------	5
[1]WdC:					
Williams part---	Silty----------	Favorable	3,200	Western wheatgrass----------	30
		Normal	2,700	Needleandthread----------	20
		Unfavorable	1,890	Green needlegrass----------	20
				Little bluestem----------	10
				Blue grama----------	10
				Sedge----------	5
Vida part-------	Silty----------	Favorable	3,120	Western wheatgrass----------	25
		Normal	2,600	Needleandthread----------	15
		Unfavorable	1,820	Green needlegrass----------	20
				Little bluestem----------	10
				Blue grama----------	10
Yecross:					
YeB, YeC----------	Sands----------	Favorable	3,000	Sand bluestem----------	35
		Normal	2,500	Prairie sandreed----------	20
		Unfavorable	1,750	Little bluestem----------	15
				Needleandthread----------	10
				Sand dropseed----------	5
				Blue grama----------	5
				Sedge----------	5
Zahl:					
[1]ZaE:					
Zahl part-------	Thin Upland----------	Favorable	2,400	Little bluestem----------	25
		Normal	2,000	Western wheatgrass----------	10
		Unfavorable	1,400	Needleandthread----------	20
				Side-oats grama----------	20
				Blue grama----------	10
				Sedge----------	5
Williams part---	Silty----------	Favorable	2,760	Western wheatgrass----------	20
		Normal	2,300	Needleandthread----------	15
		Unfavorable	1,610	Green needlegrass----------	10
				Little bluestem----------	10
				Blue grama----------	10
				Sedge----------	5

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; the symbol > means greater than. Absence of an entry means soil does not normally grow trees of this height class]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Agar: AgA, AgB, AgC	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Akaska: AkA, AkB	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---
Aquolls: Ao.					
Arveson: Ar.					
Bon: Bn	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Bowbells: BoA	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Bowdle: BwA, BwB	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---
[1]BxB: Bowdle part	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, hackberry, Russian-olive, eastern redcedar.	Siberian elm	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Bowdle:					
[1]BxB:					
Wabek part.					
[1]BxC:					
Bowdle part----	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, hackberry, Russian-olive, eastern redcedar.	Siberian elm------	---	---
Wabek part.					
[1]BxD:					
Bowdle part.					
Wabek part.					
Colvin:					
Co----------	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Siberian crabapple.	Hackberry, blue spruce, green ash, ponderosa pine.	Eastern cottonwood, golden willow.
Demky:					
DeA, DeB---------	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
[1]DgA:					
Demky part-----	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
Jerauld part.					
Divide:					
Dm----------	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Durrstein:					
Du.					
Egas:					
Eg.					
Gettys:					
GeE.					
Gravel pits:					
Gp.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Hecla:					
HeA	---	Common chokecherry, Siberian peashrub, lilac, American plum.	Hackberry, blue spruce, green ash, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine.	Eastern cottonwood.
Highmore:					
HhA, HhB, HhC	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
[1]HkA:					
Highmore part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Eakin part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
[1]HkB:					
Highmore part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Eakin part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
[1]HkC:					
Highmore part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Highmore:					
[1]HkC:					
Eakin part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
[1]HmB:					
Highmore part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Raber part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
[1]HmC:					
Highmore part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Raber part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Hoven: Ho.					
Hurley: HuB.					
Jerauld: Je.					
[1]Js: Jerauld part.					
Slickspots part.					
Lehr: LaA, LaB.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Lehr:					
[1]LbB:					
Lehr part.					
Bowdle part----	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, hackberry, Russian-olive, eastern redcedar.	Siberian elm------	---	---
Lowry:					
LoA, LoB, LoC----	Lilac----------	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce-------	---
Macken:					
Ma.					
Maddock:					
MdB----------	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
MdC----------	---	Ponderosa pine, eastern redcedar, Rocky Mt. juniper.	---	---	---
Mobridge:					
Mo----------	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Opal:					
OpC----------	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mt. juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---	---
[1]OsD:					
Opal part.					
Sansarc part.					
Parnell:					
Pa.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Parshall:					
PrA, PrB	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Promise:					
PsA, PsB	American plum, silver buffaloberry, Siberian peashrub, Peking cotoneaster, lilac.	Ponderosa pine, Russian-olive, eastern redcedar, Siberian crabapple, common chokecherry.	Green ash, hackberry.	---	---
Raber:					
RaB, RaC	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
[1]RbD:					
Raber part	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Gettys part.					
Regan:					
Re.					
Sansarc:					
[1]SaE:					
Sansarc part.					
Opal part.					
Sully:					
SuC	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, hackberry, Rocky Mt. juniper, eastern redcedar, Siberian peashrub.	Siberian elm	---	---
SuD, SuE.					
Swanboy:					
SwA.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Tally: TaA, TaB, TaC----	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
Tetonka: Te.					
Ustifluvents: Us.					
Vida: VdD.					
[1]VzD: Vida part------	Lilac----------	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce-------	---
Zahl part.					
Wabek: WaE.					
Williams: [1]WbA: Williams part--	Lilac----------	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce-------	---
Bowbells part--	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
[1]WbB: Williams part--	Lilac----------	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce-------	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Williams:					
[1]WbB:					
Bowbells part--	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
[1]WdC	Lilac	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, hackberry, Russian-olive, Siberian crabapple.	Blue spruce	---
Yecross:					
YeB	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
YeC	---	Ponderosa pine, eastern redcedar, Rocky Mt. juniper.	---	---	---
Zahl:					
[1]ZaE:					
Zahl part.					
Williams part.					

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 8.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Agar:									
AgA, AgB	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
AgC	Fair	Good	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
Akaska:									
AkA	Fair	Good	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
AkB	Fair	Good	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Aquolls:									
Ao.									
Arveson:									
Ar	Very poor	Poor	Fair	Poor	Fair	Fair	Very poor	Fair	Fair.
Bon:									
Bn	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Bowbells:									
BoA	Good	Good	Fair	Good	Very poor	Poor	Good	Very poor	Fair.
Bowdle:									
BwA, BwB	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
[1]BxB:									
Bowdle part	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Wabek part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1]BxC:									
Bowdle part	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
Wabek part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1]BxD:									
Bowdle part	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Wabek part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Colvin:									
Co	Poor	Poor	Fair	Good	Fair	Fair	Poor	Fair	Fair.
Demky:									
DeA, DeB	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
[1]DgA:									
Demky part	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Jerauld part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Divide:									
Dm	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
Durrstein:									
Du	Very poor	Poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
Egas:									
Eg	Very poor	Very poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
Gettys:									
GeE	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Gravel pits: Gp.									
Hecla: HeA	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
Highmore: HhA, HhB	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
HhC	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
[1]HkA: Highmore part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Eakin part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
[1]HkB: Highmore part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Eakin part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
[1]HkC: Highmore part	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Eakin part	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
[1]HmB: Highmore part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Raber part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
[1]HmC: Highmore part	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Raber part	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Hoven: Ho	Very poor	Poor	Poor	Poor	Fair	Fair	Very poor	Fair	Poor.
Hurley: HuB	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Jerauld: Je	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
[1]Js: Jerauld part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Slickspots part.									
Lehr: LaA, LaB	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
[1]LbB: Lehr part	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Bowdle part	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Lowry: LoA, LoB	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
LoC	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Macken: Ma	Very poor	Poor	Poor	Poor	Good	Fair	Very poor	Fair	Poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Maddock:									
MdB	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
MdC	Very poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Mobridge:									
Mo	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Opal:									
OpC	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
[1]OsD:									
Opal part	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Sansarc part	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Parnell:									
Pa	Very poor	Poor	Fair	Poor	Fair	Fair	Very poor	Fair	Fair.
Parshall:									
PrA, PrB	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
Promise:									
PsA, PsB	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Raber:									
RaB	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
RaC	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
[1]RbD:									
Raber part	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Gettys part	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Regan:									
Re	Very poor	Poor	Fair	Poor	Fair	Fair	Very poor	Fair	Fair.
Sansarc:									
[1]SaE:									
Sansarc part	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Opal part	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Sully:									
SuC	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
SuD	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
SuE	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Swanboy:									
SwA	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Tally:									
TaA, TaB	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
TaC	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Tetonka:									
Te	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Fair	Poor.
Ustifluvents:									
Us.									
Vida:									
VdD	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Vida:									
[1]VzD:									
Vida part	Poor	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Zahl part	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Wabek:									
WaE	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Williams:									
[1]WbA:									
Williams part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bowbells part	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
[1]WbB:									
Williams part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bowbells part	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
[1]WdC:									
Williams part	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Vida part	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Yecross:									
YeB	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
YeC	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Zahl:									
[1]ZaE:									
Zahl part	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Williams part	Very poor	Good	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Agar:					
AgA	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
AgB, AgC	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell.	Severe: low strength.
Akaska:					
AkA	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.
AkB	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.
Aquolls:					
Ao.					
Arveson:					
Ar	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: floods, wetness, frost action.
Bon:					
Bn	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Bowbells:					
BoA	Moderate: too clayey.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: shrink-swell, frost action, low strength.
Bowdle:					
BwA	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.
BwB	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: low strength.
[1]BxB:					
Bowdle part	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: low strength.
Wabek part	Moderate: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
[1]BxC:					
Bowdle part	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: low strength.
Wabek part	Moderate: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
[1]BxD:					
Bowdle part	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Bowdle:					
[1]BxD:					
Wabek part	Moderate: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Colvin:					
Co	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.
Demky:					
DeA, DeB	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]DgA:					
Demky part	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Jerauld part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Divide:					
Dm	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
Durrstein:					
Du	Severe: floods, wetness, too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, low strength.
Egas:					
Eg	Severe: floods, too clayey, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: frost action, low strength, wetness.
Gettys:					
GeE	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Gravel pits:					
Gp.					
Hecla:					
HeA	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.
Highmore:					
HhA, HhB, HhC	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
[1]HkA:					
Highmore part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Highmore:					
[1]HkA:					
Eakin part	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
[1]HkB:					
Highmore part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Eakin part	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
[1]HkC:					
Highmore part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Eakin part	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
[1]HmB:					
Highmore part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Raber part	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]HmC:					
Highmore part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Raber part	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Hoven:					
Ho	Severe: too clayey, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, low strength, floods.
Hurley:					
HuB	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Jerauld:					
Je	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]Js:					
Jerauld part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Jerauld: [1]Js: Slickspots part.					
Lehr: LaA	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
LaB	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
[1]LbB: Lehr part	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Bowdle part	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: low strength.
Lowry: LoA	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: frost action, low strength.
LoB	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: frost action, low strength.
LoC	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
Macken: Ma	Severe: floods, too clayey, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, shrink-swell.
Maddock: MdB	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
MdC	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Mobridge: Mo	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Opal: OpC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]OsD: Opal part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Sansarc part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Parnell:					
Pa	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, low strength.
Parshall:					
PrA	Slight	Slight	Slight	Slight	Moderate: frost action.
PrB	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
Promise:					
PsA, PsB	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Raber:					
RaB, RaC	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]RbD:					
Raber part	Moderate: slope, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, low strength.
Gettys part	Moderate: slope, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
Regan:					
Re	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.
Sansarc:					
[1]SaE:					
Sansarc part	Severe: slope, too clayey.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Opal part	Severe: slope, too clayey.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Sully:					
SuC	Slight	Moderate: low strength.	Slight	Moderate: slope.	Moderate: frost action, low strength.
SuD, SuE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Swanboy:					
SwA	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Tally:					
TaA, TaB	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
TaC	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
Tetonka:					
Te	Severe: wetness, floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: frost action, low strength, shrink-swell.
Ustifluvents:					
Us.					
Vida:					
VdD	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Moderate: shrink-swell, frost action, low strength.
[1]VzD:					
Vida part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: slope.	Moderate: frost action, shrink-swell, low strength.
Zahl part	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Moderate: frost action, shrink-swell, slope.
Wabek:					
WaE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Williams:					
[1]WbA:					
Williams part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.
Bowbells part	Moderate: too clayey.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: shrink-swell, frost action, low strength.
[1]WbB:					
Williams part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.
Bowbells part	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, frost action, low strength.
[1]WdC:					
Williams part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Williams:					
[1]WdC:					
Vida part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: slope.	Moderate: frost action, shrink-swell, low strength.
Yecross:					
YeB	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
YeC	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Zahl:					
[1]ZaE:					
Zahl part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Williams part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 10.--SANITARY FACILITIES

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate;" and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Agar:					
AgA	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
AgB	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
AgC	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
Akaska:					
AkA, AkB	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: thin layer, area reclaim.
Aquolls:					
Ao.					
Arveson:					
Ar	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness.	Poor: wetness.
Bon:					
Bn	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Bowbells:					
BoA	Severe: percs slowly, floods.	Slight	Severe: floods.	Severe: floods.	Good.
Bowdle:					
BwA, BwB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
[1]BxB:					
Bowdle part	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Wabek part	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: thin layer.
[1]BxC:					
Bowdle part	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Wabek part	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: thin layer.
[1]BxD:					
Bowdle part	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: thin layer, slope.
Wabek part	Moderate: slope.	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: thin layer.

See footnote at end of table.

TABLE 10.--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
Colvin:					
Co	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Demky:					
DeA	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey, hard to pack.
DeB	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey, hard to pack.
[1]DgA:					
Demky part	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey, hard to pack.
Jerauld part	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Divide:					
Dm	Severe: wetness.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Durrstein:					
Du	Severe: floods, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
Egas:					
Eg	Severe: floods, percs slowly, wetness.	Severe: floods, wetness.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
Gettys:					
GeE	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
Gravel pits:					
Gp.					
Hecla:					
HeA	Moderate: wetness.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Fair: too sandy.
Highmore:					
HhA	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
HhB	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
HhC	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
[1]HkA:					
Highmore part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Eakin part	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 10.--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
Highmore:					
[1]HkB:					
Highmore part	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Eakin part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]HkC:					
Highmore part	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
Eakin part	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]HmB:					
Highmore part	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Raber part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]HmC:					
Highmore part	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
Raber part	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Hoven:					
Ho	Severe: percs slowly, floods.	Slight	Severe: too clayey, floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness, hard to pack.
Hurley:					
HuB	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey, area reclaim.
Jerauld:					
Je	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
[1]Js:					
Jerauld part	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Slickspots part.					
Lehr:					
LaA, LaB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
[1]LbB:					
Lehr part	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Bowdle part	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Lowry:					
LoA	Slight	Moderate: seepage.	Slight	Slight	Good.

See footnote at end of table.

TABLE 10.--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
Lowry:					
LoB	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
LoC	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Macken:					
Ma	Severe: percs slowly, floods.	Severe: floods, wetness.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: hard to pack, too clayey, wetness.
Maddock:					
MdB	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy, seepage.
MdC	Moderate: slope.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy, seepage.
Mobridge:					
Mo	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
Opal:					
OpC	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope.	Poor: too clayey, area reclaim.
[1]OsD:					
Opal part	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope.	Poor: too clayey, area reclaim.
Sansarc part	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Moderate: slope.	Poor: too clayey, area reclaim.
Parnell:					
Pa	Severe: floods, wetness, percs slowly.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness.
Parshall:					
PrA, PrB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Promise:					
PsA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
PsB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Raber:					
RaB	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
RaC	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]RbD:					
Raber part	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.

See footnote at end of table.

TABLE 10.--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
Raber:					
[1]RbD:					
Gettys part	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
Regan:					
Re	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Sansarc:					
[1]SaE:					
Sansarc part	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Opal part	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Sully:					
SuC	Slight	Severe: slope.	Slight	Slight	Good.
SuD	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
SuE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Swanboy:					
SwA	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Tally:					
TaA, TaB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
TaC	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
Tetonka:					
Te	Severe: floods, percs slowly, wetness.	Slight	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Ustifluvents:					
Us.					
Vida:					
VdD	Severe: percs slowly.	Severe: slope, large stones.	Moderate: too clayey.	Slight	Poor: large stones.
[1]VzD:					
Vida part	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
Zahl part	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Wabek:					
WaE	Severe: slope.	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: thin layer.

See footnote at end of table.

TABLE 10.--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
Williams:					
[1]WbA:					
Williams part	Severe: percs slowly.	Slight	Slight	Slight	Good.
Bowbells part	Severe: percs slowly, floods.	Slight	Severe: floods.	Severe: floods.	Good.
[1]WbB:					
Williams part	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
Bowbells part	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
[1]WdC:					
Williams part	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
Vida part	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
Yecross:					
YeB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
YeC	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Zahl:					
[1]ZaE:					
Zahl part	Severe: percs slowly, slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Williams part	Severe: percs slowly, slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 11.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Agar: AgA, AgB, AgC	Poor: low strength.	Unsuited	Unsuited	Good.
Akaska: AkA, AkB	Fair: shrink-swell, low strength.	Fair: excess fines.	Fair: excess fines.	Good.
Aquolls: Ao.				
Arveson: Ar	Poor: wetness, frost action.	Fair: excess fines.	Unsuited	Poor: wetness.
Bon: Bn	Fair: low strength, frost action.	Unsuited	Unsuited	Good.
Bowbells: BoA	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Good.
Bowdle: BwA, BwB	Good	Fair: excess fines.	Fair: excess fines.	Good.
[1]BxB:				
Bowdle part	Good	Fair: excess fines.	Fair: excess fines.	Good.
Wabek part	Good	Fair: excess fines.	Fair: excess fines.	Poor: thin layer, area reclaim.
[1]BxC:				
Bowdle part	Good	Fair: excess fines.	Fair: excess fines.	Good.
Wabek part	Good	Fair: excess fines.	Fair: excess fines.	Poor: thin layer, area reclaim.
[1]BxD:				
Bowdle part	Good	Fair: excess fines.	Fair: excess fines.	Fair: slope.
Wabek part	Good	Fair: excess fines.	Fair: excess fines.	Poor: thin layer, area reclaim.
Colvin: Co	Poor: wetness, frost action.	Unsuited	Unsuited	Poor: wetness.
Demky: DeA, DeB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: excess salt, thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Demky:				
[1]DgA:				
Demky part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: excess salt, thin layer.
Jerauld part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess salt.
Divide:				
Dm	Fair: wetness, frost action.	Poor: excess fines.	Poor: excess fines.	Good.
Durrstein:				
Du	Poor: low strength, shrink-swell, area reclaim.	Unsuited	Unsuited	Poor: thin layer, area reclaim, excess salt.
Egas:				
Eg	Poor: shrink-swell, wetness, low strength.	Unsuited	Unsuited	Poor: too clayey, excess salt, wetness.
Gettys:				
GeE	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope, too clayey.
Gravel pits:				
Gp.				
Hecla:				
HeA	Fair: frost action, area reclaim.	Poor: excess fines.	Unsuited	Poor: too sandy.
Highmore:				
HhA, HhB, HhC	Poor: low strength.	Unsuited	Unsuited	Good.
[1]HkA:				
Highmore part	Poor: low strength.	Unsuited	Unsuited	Good.
Eakin part	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.
[1]HkB:				
Highmore part	Poor: low strength.	Unsuited	Unsuited	Good.
Eakin part	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.
[1]HkC:				
Highmore part	Poor: low strength.	Unsuited	Unsuited	Good.
Eakin part	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.
[1]HmB:				
Highmore part	Poor: low strength.	Unsuited	Unsuited	Good.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Highmore:				
[1]HmB:				
Raber part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer.
[1]HmC:				
Highmore part	Poor: low strength.	Unsuited	Unsuited	Good.
Raber part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer.
Hoven:				
Ho	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, wetness.
Hurley:				
HuB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer.
Jerauld:				
Je	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess salt.
[1]Js:				
Jerauld part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess salt.
Slickspots part.				
Lehr:				
LaA, LaB	Good	Fair: excess fines.	Fair: excess fines.	Fair: thin layer, area reclaim.
[1]LbB:				
Lehr part	Good	Fair: excess fines.	Fair: excess fines.	Fair: thin layer, slope, area reclaim.
Bowdle part	Good	Fair: excess fines.	Fair: excess fines.	Good.
Lowry:				
LoA, LoB	Fair: frost action, low strength.	Unsuited	Unsuited	Good.
LoC	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: slope.
Macken:				
Ma	Poor: low strength, shrink-swell, wetness.	Unsuited	Unsuited	Poor: too clayey, wetness.
Maddock:				
MdB	Good	Fair: excess fines.	Unsuited	Good.
MdC	Good	Fair: excess fines.	Unsuited	Fair: slope.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Mobridge: Mo	Poor: low strength.	Unsuited	Unsuited	Fair: thin layer.
Opal: OpC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
[1]OsD: Opal part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Sansarc part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey, area reclaim.
Parnell: Pa	Poor: wetness, shrink-swell, frost action.	Unsuited	Unsuited	Poor: wetness.
Parshall: PrA, PrB	Fair: frost action.	Poor: excess fines.	Unsuited	Good.
Promise: PsA, PsB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Raber: RaB, RaC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer.
[1]RbD: Raber part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer.
Gettys part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Regan: Re	Poor: wetness, shrink-swell, frost action.	Unsuited	Unsuited	Poor: wetness.
Sansarc: [1]SaE: Sansarc part	Poor: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope, too clayey, area reclaim.
Opal part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope, too clayey.
Sully: SuC	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: excess lime.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Sully:				
SuD	Fair: frost action, low strength.	Unsuited	Unsuited	Poor: slope.
SuE	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Swanboy:				
SwA	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Tally:				
TaA, TaB, TaC	Fair: frost action.	Poor: excess fines.	Unsuited	Good.
Tetonka:				
Te	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: wetness.
Ustifluvents:				
Us.				
Vida:				
VdD	Fair: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Poor: large stones.
[1]VzD:				
Vida part	Fair: frost action, low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer.
Zahl part	Fair: frost action, shrink-swell.	Unsuited	Unsuited	Fair: slope.
Wabek:				
WaE	Fair: slope.	Fair: excess fines.	Fair: excess fines.	Poor: thin layer, area reclaim.
Williams:				
[1]WbA:				
Williams part	Fair: frost action, shrink-swell.	Unsuited	Unsuited	Good.
Bowbells part	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Good.
[1]WbB:				
Williams part	Fair: frost action, shrink-swell.	Unsuited	Unsuited	Good.
Bowbells part	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Good.
[1]WdC:				
Williams part	Fair: frost action, shrink-swell.	Unsuited	Unsuited	Good.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Williams:				
[1]WdC:				
Vida part	Fair: frost action, low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer.
Yecross:				
YeB, YeC	Good	Fair: excess fines.	Poor: excess fines.	Poor: too sandy.
Zahl:				
[1]ZaE:				
Zahl part	Fair: frost action, shrink-swell, slope.	Unsuited	Unsuited	Poor: slope.
Williams part	Fair: frost action, shrink-swell, slope.	Unsuited	Unsuited	Poor: slope.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 12.--WATER MANAGEMENT

["Seepage," and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Agar:						
AgA	Seepage	Low strength	Not needed	Favorable	Not needed	Favorable.
AgB	Slope, seepage.	Low strength	Not needed	Favorable	Favorable	Slope, erodes easily.
AgC	Slope, seepage.	Low strength	Not needed	Slope	Favorable	Slope, erodes easily.
Akaska:						
AkA, AkB	Seepage	Low strength	Not needed	Favorable	Favorable	Favorable.
Aquolls:						
Ao.						
Arveson:						
Ar	Seepage	Piping, seepage.	Favorable	Wetness	Not needed	Not needed.
Bon:						
Bn	Seepage	Low strength, piping.	Floods	Floods	Not needed	Favorable.
Bowbells:						
BoA	Favorable	Favorable	Poor outlets	Slow intake	Poor outlets	Favorable.
Bowdle:						
BwA	Seepage	Seepage	Favorable	Droughty, rooting depth	Not needed	Droughty.
BwB	Seepage	Seepage	Favorable	Droughty, rooting depth	Favorable	Droughty, slope, erodes easily.
[1]BxB:						
Bowdle part	Seepage	Seepage	Favorable	Droughty, rooting depth	Favorable	Droughty, slope, erodes easily.
Wabek part	Seepage	Seepage	Not needed	Droughty, seepage.	Not needed	Droughty, erodes easily.
[1]BxC:						
Bowdle part	Seepage	Seepage	Favorable	Rooting depth, slope, droughty.	Favorable	Droughty, slope, erodes easily.
Wabek part	Seepage	Seepage	Not needed	Droughty, seepage.	Not needed	Droughty, erodes easily.
[1]BxD:						
Bowdle part	Seepage	Seepage	Favorable	Rooting depth, slope, droughty.	Slope	Droughty, slope, erodes easily.
Wabek part	Seepage	Seepage	Not needed	Droughty, seepage.	Not needed	Droughty, erodes easily.
Colvin:						
Co	Favorable	Low strength, compressible.	Poor outlets, wetness, percs slowly.	Floods, wetness, percs slowly.	Not needed	Not needed.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Demky:						
DeA	Favorable	Low strength, compressible, shrink-swell.	Not needed	Slow intake, excess salt, percs slowly.	Not needed	Favorable.
DeB	Slope	Low strength, compressible, shrink-swell.	Not needed	Slow intake, excess salt, percs slowly.	Complex slope	Slope, erodes easily, excess salt.
[1]DgA:						
Demky part	Favorable	Low strength, compressible, shrink-swell.	Not needed	Slow intake, excess salt, percs slowly.	Not needed	Favorable.
Jerauld part	Favorable	Shrink-swell, low strength.	Excess sodium, percs slowly, excess salt.	Slow intake, excess salt, excess sodium	Not needed	Excess salt, excess sodium, percs slowly.
Divide:						
Dm	Seepage	Seepage	Wetness, cutbanks cave	Wetness, seepage.	Not needed	Not needed.
Durrstein:						
Du	Favorable	Low strength, compressible, hard to pack.	Floods, frost action, excess salt.	Floods, excess salt, excess sodium	Not needed	Excess sodium, excess salt, wetness.
Egas:						
Eg	Favorable	Low strength, shrink-swell, compressible.	Poor outlets, percs slowly, wetness.	Slow intake, floods, excess salt.	Not needed	Excess salt.
Gettys:						
GeE	Slope	Shrink-swell, low strength, erodes easily.	Not needed	Slope, slow intake.	Erodes easily, slope, percs slowly.	Percs slowly, slope, erodes easily.
Gravel pits:						
Gp.						
Hecla:						
HeA	Seepage	Seepage, erodes easily, piping.	Not needed	Fast intake, soil blowing.	Not needed	Not needed.
Highmore:						
HhA	Seepage	Low strength, piping.	Not needed	Favorable	Not needed	Favorable.
HhB	Slope, seepage.	Low strength, piping.	Not needed	Favorable	Favorable	Slope, erodes easily.
HhC	Slope, seepage.	Low strength, piping.	Not needed	Slope	Favorable	Slope, erodes easily.
[1]HkA:						
Highmore part	Seepage	Low strength, piping.	Not needed	Favorable	Not needed	Favorable.
Eakin part	Favorable	Low strength, shrink-swell.	Not needed	Percs slowly	Not needed	Favorable.
[1]HkB:						
Highmore part	Slope, seepage.	Low strength, piping.	Not needed	Favorable	Favorable	Slope, erodes easily.
Eakin part	Slope	Low strength, shrink-swell.	Not needed	Percs slowly	Favorable	Slope, erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Highmore:						
[1]HkC:						
Highmore part--	Slope, seepage.	Low strength, piping.	Not needed----	Slope----------	Favorable-----	Slope, erodes easily.
Eakin part-----	Slope----------	Low strength, shrink-swell.	Not needed----	Slope, percs slowly.	Favorable-----	Slope, erodes easily.
[1]HmB:						
Highmore part--	Slope, seepage.	Low strength, piping.	Not needed----	Favorable-----	Favorable-----	Slope, erodes easily.
Raber part-----	Slope----------	Low strength, shrink-swell.	Not needed----	Slow intake, percs slowly.	Percs slowly	Slope, percs slowly, erodes easily.
[1]HmC:						
Highmore part--	Slope, seepage.	Low strength, piping.	Not needed----	Slope----------	Favorable-----	Slope, erodes easily.
Raber part-----	Slope----------	Low strength, shrink-swell.	Not needed----	Slope, slow intake, percs slowly.	Percs slowly	Slope, percs slowly, erodes easily.
Hoven:						
Ho----------	Favorable------	Shrink-swell, low strength, hard to pack.	Percs slowly, poor outlets, excess salt.	Excess salt, floods, slow intake.	Not needed----	Excess salt, wetness.
Hurley:						
HuB----------	Slope, depth to rock.	Shrink-swell, low strength, compressible.	Not needed----	Slow intake, percs slowly, excess salt.	Percs slowly, depth to rock	Slope, excess salt, percs slowly.
Jerauld:						
Je----------	Favorable------	Shrink-swell, low strength.	Excess sodium, percs slowly, excess salt.	Slow intake, excess salt, excess sodium	Not needed----	Excess salt, excess sodium, percs slowly.
[1]Js:						
Jerauld part---	Favorable------	Shrink-swell, low strength.	Excess sodium, percs slowly, excess salt.	Slow intake, excess salt, excess sodium	Not needed----	Excess salt, excess sodium, percs slowly.
Slickspots part.						
Lehr:						
LaA, LaB---------	Seepage--------	Seepage, piping.	Not needed----	Rooting depth, droughty.	Rooting depth, slope.	Not needed.
[1]LbB:						
Lehr part------	Seepage--------	Seepage, piping.	Not needed----	Rooting depth, droughty.	Rooting depth, slope.	Not needed.
Bowdle part----	Seepage--------	Seepage--------	Favorable-----	Droughty, rooting depth	Favorable-----	Droughty, slope, erodes easily.
Lowry:						
LoA----------	Seepage--------	Piping, erodes easily, low strength.	Not needed----	Favorable-----	Not needed----	Favorable.
LoB----------	Slope, seepage.	Piping, erodes easily, low strength.	Not needed----	Favorable-----	Favorable-----	Slope, erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Lowry:						
LoC	Slope, seepage.	Piping, erodes easily, low strength.	Not needed	Slope	Favorable	Slope, erodes easily.
Macken:						
Ma	Favorable	Compressible, low strength, shrink-swell.	Floods, percs slowly, poor outlets.	Floods, slow intake, wetness.	Not needed	Not needed.
Maddock:						
MdB, MdC	Seepage	Seepage	Not needed	Seepage, soil blowing, fast intake.	Soil blowing	Soil blowing.
Mobridge:						
Mo	Seepage	Low strength, compressible.	Floods, poor outlets.	Favorable	Not needed	Favorable.
Opal:						
OpC	Slope, depth to rock.	Shrink-swell, low strength, compressible.	Not needed	Slope, slow intake.	Percs slowly, depth to rock	Slope, percs slowly, erodes easily.
[1]OsD:						
Opal part	Slope, depth to rock.	Shrink-swell, low strength, compressible.	Not needed	Slope, slow intake.	Slope, depth to rock percs slowly.	Slope, percs slowly, erodes easily.
Sansarc part	Slope depth to rock.	Shrink-swell, low strength, compressible.	Not needed	Slope, slow intake, rooting depth	Slope, depth to rock percs slowly.	Slope, erodes easily.
Parnell:						
Pa	Favorable	Low strength, hard to pack.	Floods, percs slowly, frost action.	Floods, wetness, slow intake.	Not needed	Not needed.
Parshall:						
PrA, PrB	Seepage	Seepage, piping.	Not needed	Favorable	Erodes easily, piping.	Erodes easily.
Promise:						
PsA	Favorable	Low strength, shrink-swell, hard to pack.	Not needed	Slow intake, percs slowly.	Not needed	Percs slowly.
PsB	Slope	Low strength, shrink-swell, hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly, soil blowing.	Slope, erodes easily, percs slowly.
Raber:						
RaB	Slope	Low strength, shrink-swell.	Not needed	Slow intake, percs slowly.	Percs slowly	Slope, percs slowly, erodes easily.
RaC	Slope	Low strength, shrink-swell.	Not needed	Slope, slow intake, percs slowly.	Percs slowly	Slope, percs slowly, erodes easily.
[1]RbD:						
Raber part	Slope	Low strength, shrink-swell.	Not needed	Slope, slow intake, percs slowly.	Slope, percs slowly.	Slope, percs slowly, erodes easily.
Gettys part	Slope	Shrink-swell, low strength, erodes easily.	Not needed	Slope, slow intake.	Erodes easily, slope, percs slowly.	Percs slowly, slope, erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Regan:						
Re	Favorable	Compressible, low strength.	Poor outlets, floods, percs slowly.	Floods, wetness, percs slowly.	Not needed	Not needed.
Sansarc:						
[1]SaE:						
Sansarc part	Slope, depth to rock.	Shrink-swell, low strength, compressible.	Not needed	Slope, depth to rock rooting depth	Slope, depth to rock percs slowly.	Slope, erodes easily.
Opal part	Slope, depth to rock.	Shrink-swell, low strength, compressible.	Not needed	Slope, slow intake.	Slope, depth to rock percs slowly.	Slope, percs slowly, erodes easily.
Sully:						
SuC	Slope, seepage.	Piping, erodes easily, low strength.	Not needed	Slope, erodes easily	Favorable	Slope, erodes easily.
SuD, SuE	Slope, seepage.	Piping, erodes easily, low strength.	Not needed	Slope, erodes easily	Slope, erodes easily	Slope, erodes easily.
Swanboy:						
SwA	Slope	Shrink-swell, low strength, compressible.	Not needed	Percs slowly, excess salt.	Percs slowly	Percs slowly, excess salt.
Tally:						
TaA	Seepage	Piping	Frost action, cutbanks cave	Seepage, erodes easily	Erodes easily	Erodes easily.
TaB	Seepage	Piping	Slope, frost action, cutbanks cave	Slope, seepage, erodes easily	Erodes easily	Erodes easily.
TaC	Seepage, slope.	Piping	Slope, frost action, cutbanks cave	Slope, seepage, erodes easily	Erodes easily	Erodes easily.
Tetonka:						
Te	Favorable	Low strength, compressible, shrink-swell.	Poor outlets, percs slowly, floods.	Slow intake, floods, percs slowly.	Not needed	Wetness.
Ustifluvents:						
Us.						
Vida:						
VdD	Slope	Large stones, low strength, shrink-swell.	Not needed	Slow intake, large stones.	Percs slowly, large stones.	Not needed.
[1]VzD:						
Vida part	Slope	Low strength, piping, hard to pack.	Slope	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
Zahl part	Favorable	Compressible, shrink-swell, low strength.	Not needed	Complex slope, percs slowly.	Complex slope, erodes easily	Slope, erodes easily.
Wabek:						
WaE	Seepage	Seepage	Not needed	Droughty, seepage.	Not needed	Droughty, erodes easily.
Williams:						
[1]WbA:						
Williams part	Favorable	Low strength, shrink-swell.	Not needed	Complex slope, slow intake.	Complex slope	Favorable.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Williams:						
[1]WbA:						
Bowbells part--	Favorable------	Favorable------	Poor outlets	Slow intake---	Poor outlets	Favorable.
[1]WbB:						
Williams part--	Favorable------	Low strength, shrink-swell.	Not needed----	Complex slope, slow intake.	Complex slope	Slope.
Bowbells part--	Favorable------	Favorable------	Not needed----	Slow intake---	Poor outlets	Favorable.
[1]WdC:						
Williams part--	Slope----------	Low strength, shrink-swell.	Not needed----	Complex slope, slow intake.	Complex slope	Slope.
Vida part------	Slope----------	Low strength, piping, hard to pack.	Slope---------	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
Yecross:						
YeB, YeC---------	Seepage--------	Seepage, erodes easily.	Not needed----	Fast intake, droughty, soil blowing.	Slope, droughty, erodes easily	Not needed.
Zahl:						
[1]ZaE:						
Zahl part------	Favorable------	Compressible, shrink-swell, low strength.	Not needed----	Complex slope, percs slowly.	Complex slope, erodes easily	Slope, erodes easily.
Williams part--	Slope----------	Low strength, shrink-swell.	Not needed----	Complex slope, slow intake.	Complex slope	Slope.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 13.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Agar:				
AgA	Slight	Slight	Slight	Slight.
AgB	Slight	Slight	Moderate: slope.	Slight.
AgC	Slight	Slight	Severe: slope.	Slight.
Akaska:				
AkA	Slight	Slight	Slight	Slight.
AkB	Slight	Slight	Moderate: slope.	Slight.
Aquolls:				
Ao.				
Arveson:				
Ar	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Bon:				
Bn	Severe: floods.	Moderate: floods.	Moderate: floods, too clayey.	Slight.
Bowbells:				
BoA	Slight	Slight	Slight	Slight.
Bowdle:				
BwA	Slight	Slight	Slight	Slight.
BwB	Slight	Slight	Moderate: slope.	Slight.
[1]BxB:				
Bowdle part	Slight	Slight	Moderate: slope.	Slight.
Wabek part	Slight	Slight	Moderate: slope.	Slight.
[1]BxC:				
Bowdle part	Slight	Slight	Severe: slope.	Slight.
Wabek part	Slight	Slight	Severe: slope.	Slight.
[1]BxD:				
Bowdle part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Wabek part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Colvin:				
Co	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Demky:				
DeA	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
DeB	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
[1]DgA:				
Demky part	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Jerauld part	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
Divide:				
Dm	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Durrstein:				
Du	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Egas:				
Eg	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
Gettys:				
GeE	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.
Gravel pits:				
Gp.				
Hecla:				
HeA	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Moderate: too sandy.
Highmore:				
HhA	Slight	Slight	Slight	Slight.
HhB	Slight	Slight	Moderate: slope.	Slight.
HhC	Slight	Slight	Severe: slope.	Slight.
[1]HkA:				
Highmore part	Slight	Slight	Slight	Slight.
Eakin part	Slight	Slight	Slight	Slight.
[1]HkB:				
Highmore part	Slight	Slight	Moderate: slope.	Slight.
Eakin part	Slight	Slight	Moderate: slope.	Slight.
[1]HkC:				
Highmore part	Slight	Slight	Severe: slope.	Slight.
Eakin part	Slight	Slight	Severe: slope.	Slight.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Highmore:				
[1]HmB:				
Highmore part	Slight	Slight	Moderate: slope.	Slight.
Raber part	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
[1]HmC:				
Highmore part	Slight	Slight	Severe: slope.	Slight.
Raber part	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
Hoven:				
Ho	Severe: percs slowly, floods, wetness.	Severe: wetness.	Severe: percs slowly, floods, wetness.	Severe: wetness.
Hurley:				
HuB	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Jerauld:				
Je	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
[1]Js:				
Jerauld part	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
Slickspots part.				
Lehr:				
LaA	Slight	Slight	Slight	Slight.
LaB	Slight	Slight	Moderate: slope.	Slight.
[1]LbB:				
Lehr part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Bowdle part	Slight	Slight	Moderate: slope.	Slight.
Lowry:				
LoA	Slight	Slight	Slight	Slight.
LoB	Slight	Slight	Moderate: slope.	Slight.
LoC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Macken:				
Ma	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Maddock:				
MdB	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Maddock:				
MdC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Mobridge:				
Mo	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Opal:				
OpC	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey, percs slowly.	Severe: too clayey.
[1]OsD:				
Opal part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey, percs slowly.	Severe: too clayey.
Sansarc part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey, depth to rock.	Severe: too clayey.
Parnell:				
Pa	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
Parshall:				
PrA	Slight	Slight	Slight	Slight.
PrB	Slight	Slight	Moderate: slope.	Slight.
Promise:				
PsA, PsB	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Raber:				
RaB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
RaC	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
[1]RbD:				
Raber part	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
Gettys part	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Regan:				
Re	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Sansarc:				
[1]SaE:				
Sansarc part	Severe: slope, too clayey, percs slowly.	Severe: slope, too clayey.	Severe: slope, too clayey, depth to rock.	Severe: slope, too clayey.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Sansarc:				
[1]SaE:				
Opal part	Severe: slope, too clayey, percs slowly.	Severe: slope, too clayey.	Severe: slope, too clayey, percs slowly.	Severe: too clayey.
Sully:				
SuC	Slight	Slight	Severe: slope.	Slight.
SuD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
SuE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Swanboy:				
SwA	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Tally:				
TaA	Slight	Slight	Slight	Slight.
TaB	Slight	Slight	Moderate: slope.	Slight.
TaC	Slight	Slight	Severe: slope.	Slight.
Tetonka:				
Te	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Ustifluvents:				
Us.				
Vida:				
VdD	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
[1]VzD:				
Vida part	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
Zahl part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Wabek:				
WaE	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Williams:				
[1]WbA:				
Williams part	Slight	Slight	Slight	Slight.
Bowbells part	Slight	Slight	Slight	Slight.
[1]WbB:				
Williams part	Slight	Slight	Moderate: slope.	Slight.
Bowbells part	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Williams:				
[1]WdC:				
Williams part	Slight	Slight	Severe: slope.	Slight.
Vida part	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
Yecross:				
YeB, YeC	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Moderate: too sandy, soil blowing.
Zahl:				
[1]ZaE:				
Zahl part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Williams part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

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	
Agar:											
AgA, AgB, AgC-----	0-6	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	6-18	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	18-60	Silty clay loam, silt loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
Akaska:											
AkA, AkB----------	0-7	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	7-26	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	26-34	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	70-100	30-45	5-15
	34-60	Sand and gravel	SM, GM-GC, GM, SM-SC	A-1, A-2	0	40-80	25-75	15-70	5-30	<25	[1]NP-5
Aquolls:											
Ao.											
Arveson:											
Ar----------	0-13	Sandy loam------	SM, SM-SC	A-2-4, A-4	0	100	90-100	55-85	30-50	<30	NP-8
	13-21	Fine sandy loam, sandy loam, loam.	SM, SM-SC	A-4	0	100	95-100	60-85	35-50	<20	NP-5
	21-60	Fine sand, loamy sand, sandy loam, sand.	SP-SM, SM	A-3, A-2, A-4	0	100	95-100	50-80	5-45	<20	NP-5
Bon:											
Bn----------	0-60	Loam------------	CL-ML, CL	A-4, A-6	0	100	95-100	75-95	60-85	20-38	5-20
Bowbells:											
BoA----------	0-10	Loam------------	CL, ML, CL-ML	A-4, A-6	0-5	95-100	90-100	85-95	60-90	20-40	3-23
	10-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	20-45	10-25
	28-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	20-45	10-25
Bowdle:											
BwA, BwB----------	0-7	Loam------------	ML, CL, CL-ML	A-6, A-4	0	100	95-100	85-95	60-85	25-40	5-20
	7-25	Loam, gravelly loam.	CL, ML, CL-ML	A-4, A-6	0	85-100	85-100	70-95	60-80	25-40	5-20
	25-60	Sand and gravel	SM, SC, GM, GC	A-1, A-2	0	40-80	25-75	15-70	5-30	<30	NP-5
[2]BxB:											
Bowdle part-----	0-7	Loam------------	ML, CL, CL-ML	A-6, A-4	0	100	95-100	85-95	60-85	25-40	5-20
	7-25	Loam, gravelly loam.	CL, ML, CL-ML	A-4, A-6	0	85-100	85-100	70-95	60-80	25-40	5-20
	25-60	Sand and gravel	SM, SC, GM, GC	A-1, A-2	0	40-80	25-75	15-70	5-30	<30	NP-5

See footnotes at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Bowdle:											
2BxB:											
Wabek part------	0-5	Loam----------	ML, CL	A-4	0-1	90-100	90-100	75-90	50-70	25-40	NP-10
	5-9	Gravelly sandy loam, gravelly loam, gravelly coarse sandy loam.	SM, GM	A-2, A-4	0-1	50-100	50-95	50-65	20-40	---	NP
	9-60	Very gravelly coarse sand, gravelly loamy coarse sand, sand and gravel.	SM, SP, GM, GP	A-1, A-2	0-1	50-100	50-95	10-40	2-35	---	NP
2BxC:											
Bowdle part-----	0-7	Loam----------	ML, CL, CL-ML	A-6, A-4	0	100	95-100	85-95	60-85	25-40	5-20
	7-25	Loam, gravelly loam.	CL, ML, CL-ML	A-4, A-6	0	85-100	85-100	70-95	60-80	25-40	5-20
	25-60	Sand and gravel	SM, SC, GM, GC	A-1, A-2	0	40-80	25-75	15-70	5-30	<30	NP-5
Wabek part------	0-5	Loam----------	ML, CL	A-4	0-1	90-100	90-100	75-90	50-70	25-40	NP-10
	5-9	Gravelly sandy loam, gravelly loam, gravelly coarse sandy loam.	SM, GM	A-2, A-4	0-1	50-100	50-95	50-65	20-40	---	NP
	9-60	Very gravelly coarse sand, gravelly loamy coarse sand, sand and gravel.	SM, SP, GM, GP	A-1, A-2	0-1	50-100	50-95	10-40	2-35	---	NP
2BxD:											
Bowdle part-----	0-7	Loam----------	ML, CL, CL-ML	A-6, A-4	0	100	95-100	85-95	60-85	25-40	5-20
	7-25	Loam, gravelly loam.	CL, ML, CL-ML	A-4, A-6	0	85-100	85-100	70-95	60-80	25-40	5-20
	25-60	Sand and gravel	SM, SC, GM, GC	A-1, A-2	0	40-80	25-75	15-70	5-30	<30	NP-5
Wabek part------	0-5	Loam----------	ML, CL	A-4	0-1	90-100	90-100	75-90	50-70	25-40	NP-10
	5-9	Gravelly sandy loam, gravelly loam, gravelly coarse sandy loam.	SM, GM	A-2, A-4	0-1	50-100	50-95	50-65	20-40	---	NP
	9-60	Very gravelly coarse sand, gravelly loamy coarse sand, sand and gravel.	SM, SP, GM, GP	A-1, A-2	0-1	50-100	50-95	10-40	2-35	---	NP
Colvin:											
Co----------	0-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	100	100	90-100	80-95	20-50	11-30
Demky:											
DeA, DeB----------	0-7	Loam----------	CL, ML	A-4, A-6	0	100	100	90-100	60-80	30-40	5-15
	7-23	Clay loam, clay	CL, CH	A-6, A-7	0	100	95-100	85-100	65-95	35-60	15-35
	23-60	Clay loam, loam	CL, CH	A-6, A-7	0-5	95-100	90-100	80-100	55-90	35-55	10-30
2DgA:											
Demky part------	0-7	Loam----------	CL, ML	A-4, A-6	0	100	100	90-100	60-80	30-40	5-15
	7-23	Clay loam, clay	CL, CH	A-6, A-7	0	100	95-100	85-100	65-95	35-60	15-35
	23-60	Clay loam, loam	CL, CH	A-6, A-7	0-5	95-100	90-100	80-100	55-90	35-55	10-30

See footnotes at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Demky:											
2DgA:											
Jerauld part----	0-2	Silt loam-------	ML, CL	A-4, A-6	0	100	100	90-100	60-100	25-40	5-15
	2-11	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	90-100	75-95	45-70	20-45
	11-60	Silty clay, clay, clay loam.	CL, CH, MH	A-7	0	100	95-100	85-100	75-100	45-85	20-60
Divide:											
Dm----------	0-14	Loam----------	ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-85	15-40	5-25
	14-23	Loam, clay loam, gravelly loam.	ML, CL	A-4, A-6	0-3	95-100	80-100	60-90	55-80	15-40	5-25
	23-60	Stratified sand and gravel.	GM, SM	A-1, A-2	0-5	25-75	15-65	10-40	5-25	---	NP
Durrstein:											
Du----------	0-2	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	5-15
	2-14	Silty clay, clay	CH, MH	A-7	0	100	100	90-100	75-95	50-85	20-50
	14-60	Silty clay, clay, clay loam.	CH, CL, MH	A-7	0	100	100	90-100	75-95	40-75	15-45
Egas:											
Eg----------	0-13	Silty clay loam	CH, MH	A-7	0	100	100	95-100	90-100	50-90	22-50
	13-60	Silty clay, silty clay loam, clay.	CH, MH	A-7	0	100	100	90-100	85-100	50-90	22-50
Gettys:											
GeE----------	0-24	Clay loam-------	CL, CH	A-7	0	95-100	90-100	85-100	70-85	40-60	15-35
	24-60	Clay loam, clay	CL, CH, MH	A-7	0	95-100	90-100	85-100	70-85	45-65	20-40
Gravel pits:											
Gp.											
Hecla:											
HeA----------	0-24	Loamy sand------	SM, SM-SC	A-2	0	100	95-100	85-100	15-35	<25	NP-5
	24-60	Loamy sand, fine sand, loamy fine sand.	SM, SM-SC	A-2	0	100	95-100	85-100	15-35	<25	NP-5
Highmore:											
HhA, HhB, HhC-----	0-5	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	95-100	95-100	90-100	30-45	5-20
	5-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	27-60	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	95-100	85-100	70-100	30-45	5-20
2HkA:											
Highmore part---	0-5	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	95-100	95-100	90-100	30-45	5-20
	5-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	27-60	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	95-100	85-100	70-100	30-45	5-20

See footnotes at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Highmore:											
2HkA:											
Eakin part------	0-7	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	7-32	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	32-60	Clay loam, loam, clay.	CL, CH	A-7	0	95-100	85-100	75-100	60-95	40-70	16-42
2HkB:											
Highmore part---	0-5	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	95-100	95-100	90-100	30-45	5-20
	5-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	27-60	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	95-100	85-100	70-100	30-45	5-20
Eakin part------	0-7	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	7-32	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	32-60	Clay loam, loam, clay.	CL, CH	A-7	0	95-100	85-100	75-100	60-95	40-70	16-42
2HkC:											
Highmore part---	0-5	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	95-100	95-100	90-100	30-45	5-20
	5-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	27-60	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	95-100	85-100	70-100	30-45	5-20
Eakin part------	0-7	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	7-32	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	32-60	Clay loam, loam, clay.	CL, CH	A-7	0	95-100	85-100	75-100	60-95	40-70	16-42
2HmB:											
Highmore part---	0-5	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	95-100	95-100	90-100	30-45	5-20
	5-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	27-60	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	95-100	85-100	70-100	30-45	5-20
Raber part------	0-3	Loam------------	CL	A-4, A-6	0	100	100	85-95	60-75	30-40	10-20
	3-13	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-60	11-35
	13-60	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	90-100	70-90	30-60	11-35
2HmC:											
Highmore part---	0-5	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	95-100	95-100	90-100	30-45	5-20
	5-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	27-60	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	95-100	85-100	70-100	30-45	5-20

See footnotes at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Highmore:											
[2]HmC:											
Raber part------	0-3	Loam----------	CL	A-4, A-6	0	100	100	85-95	60-75	30-40	10-20
	3-13	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-60	11-35
	13-60	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	90-100	70-90	30-60	11-35
Hoven:											
Ho----------	0-5	Silt loam-------	ML, CL	A-4, A-6	0	100	100	90-100	75-95	27-40	5-15
	5-25	Silty clay, clay, clay loam.	CH, MH	A-7	0	100	95-100	95-100	80-100	50-80	20-45
	25-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	70-100	35-75	11-45
Hurley:											
HuB----------	0-2	Silt loam-------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-27	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	80-100	50-90	20-55
	27-60	Unweathered bedrock.	CH, MH	A-7	0	100	100	95-100	80-100	50-100	20-65
Jerauld:											
Je----------	0-2	Silt loam-------	ML, CL	A-4, A-6	0	100	100	90-100	60-100	25-40	5-15
	2-11	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	90-100	75-95	45-70	20-45
	11-60	Silty clay, clay, clay loam.	CL, CH, MH	A-7	0	100	95-100	85-100	75-100	45-85	20-60
[2]Js:											
Jerauld part----	0-2	Silt loam-------	ML, CL	A-4, A-6	0	100	100	90-100	60-100	25-40	5-15
	2-11	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	90-100	75-95	45-70	20-45
	11-60	Silty clay, clay, clay loam.	CL, CH, MH	A-7	0	100	95-100	85-100	75-100	45-85	20-60
Slickspots part.											
Lehr:											
LaA, LaB----------	0-5	Loam----------	ML, CL	A-4	0	95-100	95-100	85-95	60-80	15-40	NP-10
	5-14	Loam, clay loam	ML, CL	A-4, A-6	0-5	95-100	95-100	85-95	60-75	15-40	5-15
	14-60	Sand and gravel	SM, SP, GM, GP	A-1	0-5	40-70	25-50	10-35	2-15	---	NP
[2]LbB:											
Lehr part-------	0-5	Loam----------	ML, CL	A-4	0	95-100	95-100	85-95	60-80	15-40	NP-10
	5-14	Loam, clay loam	ML, CL	A-4, A-6	0-5	95-100	95-100	85-95	60-75	15-40	5-15
	14-60	Sand and gravel	SM, SP, GM, GP	A-1	0-5	40-70	25-50	10-35	2-15	---	NP
Bowdle part-----	0-7	Loam----------	ML, CL, CL-ML	A-6, A-4	0	100	95-100	85-95	60-85	25-40	5-20
	7-25	Loam, gravelly loam.	CL, ML, CL-ML	A-4, A-6	0	85-100	85-100	70-95	60-80	25-40	5-20
	25-60	Sand and gravel	SM, SC, GM, GC	A-1, A-2	0	40-80	25-75	15-70	5-30	<30	NP-5
Lowry:											
LoA, LoB, LoC-----	0-15	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	25-40	5-15
	15-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	70-100	25-40	NP-10
Macken:											
Ma----------	0-29	Silty clay------	CH, MH	A-7	0	100	100	95-100	85-100	50-80	20-45
	29-60	Silty clay, silty clay loam, clay.	CH, MH	A-7	0	100	100	95-100	85-100	50-80	20-45

See footnotes at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Maddock:											
MdB, MdC	0-15	Fine sandy loam	SM	A-2, A-4	0	100	100	60-85	30-50	---	NP
	15-60	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	95-100	60-95	5-35	---	NP
Mobridge:											
Mo	0-11	Silt loam	ML, CL	A-6, A-4	0	100	95-100	90-100	70-100	30-40	5-15
	11-25	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	25-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	95-100	85-100	30-45	10-25
Opal:											
OpC	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	5-20	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	20-30	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	30-60	Unweathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
[2]OsD:											
Opal part	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	5-20	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	20-30	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	30-60	Unweathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Sansarc part	0-13	Clay, very shaly clay.	CH, MH	A-7	0	100	95-100	90-100	75-100	50-100	20-65
	13-60	Unweathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-120	20-75
Parnell:											
Pa	0-10	Clay loam	CL, CH	A-7	0	100	100	95-100	85-95	40-60	15-30
	10-48	Clay loam, silty clay loam, silty clay, clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-80	20-50
	48-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-95	70-95	30-80	15-50
Parshall:											
PrA, PrB	0-12	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
	12-60	Fine sandy loam, sandy loam, loamy sand.	SM, ML	A-4, A-2	0	100	100	60-85	30-55	---	NP
Promise:											
PsA, PsB	0-6	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-70	20-40
	6-60	Clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	20-50
Raber:											
RaB, RaC	0-3	Loam	CL	A-4, A-6	0	100	100	85-95	60-75	30-40	10-20
	3-13	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-60	11-35
	13-60	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	90-100	70-90	30-60	11-35
[2]RbD:											
Raber part	0-3	Loam	CL	A-4, A-6	0	100	100	85-95	60-75	30-40	10-20
	3-13	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-60	11-35
	13-60	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	90-100	70-90	30-60	11-35
Gettys part	0-24	Clay loam	CL, CH	A-7	0	95-100	90-100	85-100	70-85	40-60	15-35
	24-60	Clay loam, clay	CL, CH, MH	A-7	0	95-100	90-100	85-100	70-85	45-65	20-40

See footnotes at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Regan:											
Re	0-26	Silt loam, silty clay loam.	CL, CL-ML	A-7, A-6	0	100	100	90-100	80-95	20-50	5-30
	26-60	Stratified sandy loam to silty clay loam.	ML, CL, SC, SM	A-7, A-6, A-4	0	100	100	65-100	35-95	15-50	NP-30
Sansarc:											
[2]SaE:											
Sansarc part	0-13	Clay, very shaly clay.	CH, MH	A-7	0	100	95-100	90-100	75-100	50-100	20-65
	13-60	Unweathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-120	20-75
Opal part	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	5-20	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	20-30	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	30-60	Unweathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Sully:											
SuC, SuD, SuE	0-60	Silt loam	ML, CL, CL-ML	A-4	0	100	100	90-100	85-100	25-40	5-15
Swanboy:											
SwA	0-19	Clay	CH, MH	A-7	0	100	100	90-100	75-95	50-100	20-60
	19-60	Clay	CH, MH	A-7	0	100	100	90-100	75-95	50-100	20-60
Tally:											
TaA, TaB, TaC	0-17	Fine sandy loam	SM	A-4	0	100	100	70-85	35-50	15-30	NP-4
	17-60	Fine sandy loam	SM	A-2	0	100	100	55-80	20-45	<25	NP-4
Tetonka:											
Te	0-13	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	80-100	27-40	5-15
	13-41	Clay, silty clay, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	65-100	35-65	15-40
	41-60	Clay loam, silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	100	90-100	80-100	55-95	30-65	15-40
Ustifluvents:											
Us.											
Vida:											
VdD	0-2	Stony loam	CL-ML, CL	A-4	3-25	90-100	85-95	80-90	60-75	20-30	5-10
	2-60	Clay loam, loam	CL, CL-ML	A-4, A-6	0-20	90-100	90-100	85-95	70-80	25-40	5-20
[2]VzD:											
Vida part	0-2	Loam	CL-ML, CL	A-4	0-15	90-100	85-95	80-90	60-75	20-30	5-10
	2-60	Clay loam, loam	CL, CL-ML	A-4, A-6	0-15	90-100	90-100	85-95	70-80	25-40	5-20
Zahl part	0-5	Loam	CL	A-6	0-1	95-100	95-100	80-95	55-75	25-40	10-20
	5-60	Clay loam, loam	CL	A-6	0-1	95-100	95-100	80-95	60-80	25-40	10-20
Wabek:											
WaE	0-5	Loam	ML, CL	A-4	0-1	90-100	90-100	75-90	50-70	25-40	NP-10
	5-9	Gravelly sandy loam, gravelly loam, gravelly coarse sandy loam.	SM, GM	A-2, A-4	0-1	50-100	50-95	50-65	20-40	---	NP
	9-60	Very gravelly coarse sand, gravelly loamy coarse sand, sand and gravel.	SM, SP, GM, GP	A-1, A-2	0-1	50-100	50-95	10-40	2-35	---	NP

See footnotes at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Williams:											
[2]WbA:											
Williams part---	0-4	Loam----------	CL, ML, CL-ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	4-22	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	22-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
Bowbells part---	0-10	Loam----------	CL, ML, CL-ML	A-4, A-6	0-5	95-100	90-100	85-95	60-90	20-40	3-23
	10-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	20-45	10-25
	28-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	20-45	10-25
[2]WbB:											
Williams part---	0-4	Loam----------	CL, ML, CL-ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	4-22	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	22-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
Bowbells part---	0-10	Loam----------	CL, ML, CL-ML	A-4, A-6	0-5	95-100	90-100	85-95	60-90	20-40	3-23
	10-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	20-45	10-25
	28-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	60-80	20-45	10-25
[2]WdC:											
Williams part---	0-4	Loam----------	CL, ML, CL-ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	4-22	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	22-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
Vida part-------	0-2	Loam----------	CL-ML, CL	A-4	0-15	90-100	85-95	80-90	60-75	20-30	5-10
	2-60	Clay loam, loam	CL, CL-ML	A-4, A-6	0-15	90-100	90-100	85-95	70-80	25-40	5-20
Yecross:											
YeB, YeC----------	0-9	Loamy fine sand	SM, SM-SC	A-2	0	100	95-100	60-80	15-35	<25	NP-5
	9-60	Sand, loamy sand, gravelly sand.	SM, SW-SM	A-1, A-2	0-5	95-100	75-100	35-70	5-30	<25	NP-5
Zahl:											
[2]ZaE:											
Zahl part-------	0-5	Loam----------	CL	A-6	0-1	95-100	95-100	80-95	55-75	25-40	10-20
	5-60	Clay loam, loam	CL	A-6	0-1	95-100	95-100	80-95	60-80	25-40	10-20
Williams part---	0-4	Loam----------	CL, ML, CL-ML	A-4, A-6, A-7	0-5	95-100	95-100	85-95	60-90	25-45	3-20
	4-22	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30
	22-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	60-80	30-50	10-30

[1]Nonplastic.
[2]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater then. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
Agar:											
AgA, AgB, AgC-----	0-6	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	6-18	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	High-----	Low------	0.43		
	18-60	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.43		
Akaska:											
AkA, AkB----------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	4	6
	7-26	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	High-----	Low------	0.32		
	26-34	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.32		
	34-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-------	High-----	Low------	0.10		
Aquolls:											
Ao----------	0-60	0.06-0.6	0.13-0.22	5.6-7.8	<2	High------	High-----	Moderate	---	---	8
Arveson:											
Ar----------	0-13	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low-------	High-----	Low------	---	---	3
	13-21	0.6-6.0	0.15-0.17	7.9-8.4	<2	Low-------	High-----	Low------	---		
	21-60	2.0-20	0.05-0.15	7.4-8.4	<2	Low-------	High-----	Low------	---		
Bon:											
Bn----------	0-60	0.6-2.0	0.18-0.20	6.6-8.4	<2	Low-------	Low------	Low------	0.24	5	6
Bowbells:											
BoA----------	0-10	0.6-2.0	0.17-0.24	6.1-7.3	<2	Low-------	High-----	Low------	0.28	5	6
	10-28	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.28		
	28-60	0.2-0.6	0.14-0.18	7.9-8.4	<2	Moderate	High-----	Low------	0.37		
Bowdle:											
BwA, BwB----------	0-7	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	4	6
	7-25	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28		
	25-60	6.0-20	0.03-0.06	7.4-7.8	<2	Low-------	Moderate	Low------	0.10		
[1]BxB:											
Bowdle part-----	0-7	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	4	6
	7-25	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28		
	25-60	6.0-20	0.03-0.06	7.4-7.8	<2	Low-------	Moderate	Low------	0.10		
Wabek part------	0-5	2.0-6.0	0.20-0.22	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	2	5
	5-9	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low-------	Moderate	Low------	0.10		
	9-60	6.0-20	0.02-0.04	7.4-7.8	<2	Low-------	Moderate	Low------	0.10		
[1]BxC:											
Bowdle part-----	0-7	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	4	6
	7-25	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28		
	25-60	6.0-20	0.03-0.06	7.4-7.8	<2	Low-------	Moderate	Low------	0.10		
Wabek part------	0-5	2.0-6.0	0.20-0.22	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	2	5
	5-9	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low-------	Moderate	Low------	0.10		
	9-60	6.0-20	0.02-0.04	7.4-7.8	<2	Low-------	Moderate	Low------	0.10		
[1]BxD:											
Bowdle part-----	0-7	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	4	6
	7-25	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28		
	25-60	6.0-20	0.03-0.06	7.4-7.8	<2	Low-------	Moderate	Low------	0.10		
Wabek part------	0-5	2.0-6.0	0.20-0.22	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	2	5
	5-9	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low-------	Moderate	Low------	0.10		
	9-60	6.0-20	0.02-0.04	7.4-7.8	<2	Low-------	Moderate	Low------	0.10		
Colvin:											
Co----------	0-60	0.2-0.6	0.16-0.22	7.4-9.0	<2	High------	High-----	Low------	---	---	4L
Demky:											
DeA, DeB----------	0-7	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	Moderate	Low------	0.32	3	6
	7-23	0.06-0.2	0.12-0.15	6.1-8.4	2-4	High------	High-----	Moderate	0.32		
	23-60	0.06-0.2	0.13-0.17	7.4-8.4	4-16	High------	High-----	Moderate	0.32		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
Demky:											
[1]DgA:											
Demky part------	0-7	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	Moderate	Low------	0.32	3	6
	7-23	0.06-0.2	0.12-0.15	6.1-8.4	2-4	High------	High-----	Moderate	0.32		
	23-60	0.06-0.2	0.13-0.17	7.4-8.4	4-16	High------	High-----	Moderate	0.32		
Jerauld part----	0-2	0.6-2.0	0.18-0.22	5.6-7.3	<4	Moderate	Moderate	Low------	0.43	2	8
	2-11	<0.2	0.10-0.15	6.6-9.0	<4	High------	High-----	Moderate	0.32		
	11-60	<0.2	0.08-0.13	7.4-9.0	<4	High------	High-----	Moderate	0.32		
Divide:											
Dm----------	0-14	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low-------	High-----	Low------	0.28	4	4L
	14-23	0.6-2.0	0.16-0.19	7.9-8.4	<2	Low-------	High-----	Low------	0.28		
	23-60	>20	0.03-0.07	7.9-8.4	<2	Low-------	High-----	Low------	0.10		
Durrstein:											
Du----------	0-2	0.6-2.0	0.17-0.20	6.6-7.3	<2	Low-------	High-----	High-----	0.37	1	8
	2-14	<0.2	0.10-0.15	7.9-9.0	<2	High------	High-----	High-----	0.28		
	14-60	<0.2	0.08-0.13	7.9-9.0	<2	High------	High-----	High-----	0.28		
Egas:											
Eg----------	0-13	0.06-0.2	0.10-0.15	7.4-9.0	>8	High------	High-----	Moderate	0.28	5	8
	13-60	0.06-0.2	0.08-0.13	7.9-9.0	>8	High------	High-----	Moderate	0.28		
Gettys:											
GeE----------	0-24	0.2-0.6	0.14-0.17	6.6-8.4	<2	High------	High-----	Low------	0.28	5	4L
	24-60	0.2-0.6	0.11-0.17	7.9-8.4	<2	High------	High-----	Moderate	0.28		
Gravel pits:											
Gp.											
Hecla:											
HeA----------	0-24	2.0-20	0.10-0.12	6.1-7.8	<2	Low-------	Low------	Low------	0.17	5	2
	24-60	2.0-20	0.06-0.13	6.1-8.4	<2	Low-------	Moderate	Low------	0.17		
Highmore:											
HhA, HhB, HhC-----	0-5	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	5-27	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.43		
	27-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.43		
[1]HkA:											
Highmore part---	0-5	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	5-27	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.43		
	27-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.43		
Eakin part------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	7-32	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.32		
	32-60	0.2-0.6	0.16-0.20	7.4-9.0	<2	Moderate	High-----	Moderate	0.32		
[1]HkB:											
Highmore part---	0-5	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	5-27	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.43		
	27-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.43		
Eakin part------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	7-32	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.32		
	32-60	0.2-0.6	0.16-0.20	7.4-9.0	<2	Moderate	High-----	Moderate	0.32		
[1]HkC:											
Highmore part---	0-5	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	5-27	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.43		
	27-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.43		
Eakin part------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	7-32	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.32		
	32-60	0.2-0.6	0.16-0.20	7.4-9.0	<2	Moderate	High-----	Moderate	0.32		
[1]HmB:											
Highmore part---	0-5	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	5-27	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.43		
	27-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.43		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Highmore:											
[1]HmB:											
Raber part------	0-3	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	High-----	Low------	0.28	5	6
	3-13	0.06-0.6	0.13-0.19	6.6-7.8	<2	High------	High-----	Low------	0.28		
	13-60	0.06-0.6	0.11-0.20	7.4-8.4	<2	High------	High-----	Moderate	0.37		
[1]HmC:											
Highmore part---	0-5	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	High-----	Low------	0.32	5	6
	5-27	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	High-----	Low------	0.43		
	27-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.43		
Raber part------	0-3	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	High-----	Low------	0.28	5	6
	3-13	0.06-0.6	0.13-0.19	6.6-7.8	<2	High------	High-----	Low------	0.28		
	13-60	0.06-0.6	0.11-0.20	7.4-8.4	<2	High------	High-----	Moderate	0.37		
Hoven:											
Ho----------	0-5	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	Moderate	Moderate	0.37	1	8
	5-25	<0.06	0.10-0.19	6.1-8.4	<2	High------	High-----	Moderate	0.28		
	25-60	<0.2	0.08-0.17	7.4-9.0	<2	High------	High-----	Moderate	0.28		
Hurley:											
HuB----------	0-2	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low-------	High-----	Low------	0.43	1	8
	2-27	<0.06	0.05-0.13	6.6-9.0	4-16	High------	High-----	Moderate	0.28		
	27-60	<0.06	---	6.1-8.4	<2	High------	High-----	Moderate	---		
Jerauld:											
Je----------	0-2	0.6-2.0	0.18-0.22	5.6-7.3	<4	Moderate	Moderate	Low------	0.43	2	8
	2-11	<0.2	0.10-0.15	6.6-9.0	<4	High------	High-----	Moderate	0.32		
	11-60	<0.2	0.08-0.13	7.4-9.0	<4	High------	High-----	Moderate	0.32		
[1]Js:											
Jerauld part----	0-2	0.6-2.0	0.18-0.22	5.6-7.3	<4	Moderate	Moderate	Low------	0.43	2	8
	2-11	<0.2	0.10-0.15	6.6-9.0	<4	High------	High-----	Moderate	0.32		
	11-60	<0.2	0.08-0.13	7.4-9.0	<4	High------	High-----	Moderate	0.32		
Slickspots part.											
Lehr:											
LaA, LaB----------	0-5	2.0-6.0	0.17-0.22	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	3	6
	5-14	2.0-6.0	0.17-0.20	6.6-7.8	<2	Low-------	Moderate	Low------	0.28		
	14-60	>6.0	0.02-0.04	7.4-8.4	<2	Low-------	Moderate	Low------	0.10		
[1]LbB:											
Lehr part-------	0-5	2.0-6.0	0.17-0.22	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	3	6
	5-14	2.0-6.0	0.17-0.20	6.6-7.8	<2	Low-------	Moderate	Low------	0.28		
	14-60	>6.0	0.02-0.04	7.4-8.4	<2	Low-------	Moderate	Low------	0.10		
Bowdle part-----	0-7	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28	4	6
	7-25	0.6-2.0	0.18-0.20	6.6-7.3	<2	Low-------	Moderate	Low------	0.28		
	25-60	6.0-20	0.03-0.06	7.4-7.8	<2	Low-------	Moderate	Low------	0.10		
Lowry:											
LoA, LoB, LoC-----	0-15	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low-------	Moderate	Low------	0.32	5	5
	15-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	Moderate	Low------	0.43		
Macken:											
Ma----------	0-29	0.06-0.2	0.10-0.18	6.1-8.4	<2	High------	High-----	Moderate	0.28	5	8
	29-60	0.06-0.2	0.08-0.17	7.4-8.4	<2	High------	High-----	Moderate	0.28		
Maddock:											
MdB, MdC----------	0-15	6.0-20	0.13-0.18	6.6-7.8	<2	Low-------	Moderate	Low------	0.17	5	3
	15-60	6.0-20	0.05-0.13	6.6-8.4	<2	Low-------	Moderate	Low------	0.17		
Mobridge:											
Mo----------	0-11	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low-------	Moderate	Low------	0.32	5	6
	11-25	0.6-2.0	0.19-0.22	6.6-7.8	<2	Moderate	High-----	Low------	0.32		
	25-60	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	High-----	Low------	0.43		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
Opal:											
OpC	0-5	<0.06	0.10-0.14	6.6-7.8	<2	High	High	Low	0.28	4	4
	5-20	<0.06	0.08-0.14	7.4-8.4	<2	High	High	Low	0.28		
	20-30	<0.06	0.08-0.12	7.4-8.4	2-4	High	High	Moderate	0.28		
	30-60	<0.06	---	6.6-8.4	<2	High	High	Moderate	---		
[1]OsD:											
Opal part	0-5	<0.06	0.10-0.14	6.6-7.8	<2	High	High	Low	0.28	4	4
	5-20	<0.06	0.08-0.14	7.4-8.4	<2	High	High	Low	0.28		
	20-30	<0.06	0.08-0.12	7.4-8.4	2-4	High	High	Moderate	0.28		
	30-60	<0.06	---	6.6-8.4	<2	High	High	Moderate	---		
Sansarc part	0-13	0.06-0.2	0.08-0.12	6.6-8.4	<2	High	High	Moderate	0.28	2	8
	13-60	---	---	5.6-8.4	<2	High	High	Moderate	---		
Parnell:											
Pa	0-10	0.2-0.6	0.18-0.22	6.1-7.8	<2	Moderate	High	Low	---	---	7
	10-48	0.06-0.2	0.13-0.19	6.6-7.8	<2	High	High	Low	---		
	48-60	0.06-0.2	0.11-0.19	6.6-8.4	<2	High	High	Low	---		
Parshall:											
PrA, PrB	0-12	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low	Moderate	Low	0.20	5	3
	12-60	2.0-6.0	0.12-0.17	6.6-8.4	<2	Low	Moderate	Low	0.20		
Promise:											
PsA, PsB	0-6	<0.2	0.10-0.14	6.1-7.8	<2	High	High	Low	0.28	5	4
	6-60	<0.06	0.08-0.14	7.4-9.0	<2	High	High	Low	0.28		
Raber:											
RaB, RaC	0-3	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	High	Low	0.28	5	6
	3-13	0.06-0.6	0.13-0.19	6.6-7.8	<2	High	High	Low	0.28		
	13-60	0.06-0.6	0.11-0.20	7.4-8.4	<2	High	High	Moderate	0.37		
[1]RbD:											
Raber part	0-3	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	High	Low	0.28	5	6
	3-13	0.06-0.6	0.13-0.19	6.6-7.8	<2	High	High	Low	0.28		
	13-60	0.06-0.6	0.11-0.20	7.4-8.4	<2	High	High	Moderate	0.37		
Gettys part	0-24	0.2-0.6	0.14-0.17	6.6-8.4	<2	High	High	Low	0.28	5	4L
	24-60	0.2-0.6	0.11-0.17	7.9-8.4	<2	High	High	Moderate	0.28		
Regan:											
Re	0-26	0.2-2.0	0.16-0.22	7.4-8.4	<4	Moderate	High	Low	---	---	4L
	26-60	0.2-2.0	0.14-0.17	7.9-9.0	<8	High	High	Low	---		
Sansarc:											
[1]SaE:											
Sansarc part	0-13	0.06-0.2	0.08-0.12	6.6-8.4	<2	High	High	Moderate	0.28	2	8
	13-60	---	---	5.6-8.4	<2	High	High	Moderate	---		
Opal part	0-5	<0.06	0.10-0.14	6.6-7.8	<2	High	High	Low	0.28	4	4
	5-20	<0.06	0.08-0.14	7.4-8.4	<2	High	High	Low	0.28		
	20-30	<0.06	0.08-0.12	7.4-8.4	2-4	High	High	Moderate	0.28		
	30-60	<0.06	---	6.6-8.4	<2	High	High	Moderate	---		
Sully:											
SuC, SuD, SuE	0-60	0.6-2.0	0.15-0.20	6.6-8.4	<2	Low	Low	Low	0.43	5	4L
Swanboy:											
SwA	0-19	<0.06	0.08-0.12	6.6-9.0	<2	High	High	Moderate	0.28	5	8
	19-60	<0.06	0.05-0.12	6.6-9.0	2-10	High	High	High	0.28		
Tally:											
TaA, TaB, TaC	0-17	2.0-6.0	0.14-0.18	6.6-7.8	<2	Low	High	Low	0.20	5	3
	17-60	2.0-6.0	0.06-0.12	7.4-8.4	<2	Low	High	Low	0.17		
Tetonka:											
Te	0-13	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	Moderate	Moderate	0.24	3	6
	13-41	<0.06	0.13-0.19	6.1-7.3	<2	High	High	Moderate	0.32		
	41-60	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High	High	Moderate	0.32		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
Ustifluvents:											
Us.											
Vida:											
VdD	0-2	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	High	Low	0.28	5	8
	2-60	0.2-2.0	0.15-0.20	7.4-9.0	<2	Moderate	High	Low	0.37		
[1]VzD:											
Vida part	0-2	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	High	Low	0.28	5	6
	2-60	0.2-2.0	0.15-0.20	7.4-9.0	<2	Moderate	High	Low	0.37		
Zahl part	0-5	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	High	Low	0.28	5	8
	5-60	0.2-2.0	0.15-0.19	7.4-8.4	<2	Moderate	High	Low	0.37		
Wabek:											
WaE	0-5	2.0-6.0	0.20-0.22	6.6-7.3	<2	Low	Moderate	Low	0.28	2	5
	5-9	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	Moderate	Low	0.10		
	9-60	6.0-20	0.02-0.04	7.4-7.8	<2	Low	Moderate	Low	0.10		
Williams:											
[1]WbA:											
Williams part	0-4	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low	High	Low	0.28	5	6
	4-22	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	High	Low	0.28		
	22-60	0.2-0.6	0.15-0.18	7.4-8.4	<2	Moderate	High	Low	0.37		
Bowbells part	0-10	0.6-2.0	0.17-0.24	6.1-7.3	<2	Low	High	Low	0.28	5	6
	10-28	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	High	Low	0.28		
	28-60	0.2-0.6	0.14-0.18	7.9-8.4	<2	Moderate	High	Low	0.37		
[1]WbB:											
Williams part	0-4	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low	High	Low	0.28	5	6
	4-22	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	High	Low	0.28		
	22-60	0.2-0.6	0.15-0.18	7.4-8.4	<2	Moderate	High	Low	0.37		
Bowbells part	0-10	0.6-2.0	0.17-0.24	6.1-7.3	<2	Low	High	Low	0.28	5	6
	10-28	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	High	Low	0.28		
	28-60	0.2-0.6	0.14-0.18	7.9-8.4	<2	Moderate	High	Low	0.37		
[1]WdC:											
Williams part	0-4	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low	High	Low	0.28	5	6
	4-22	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	High	Low	0.28		
	22-60	0.2-0.6	0.15-0.18	7.4-8.4	<2	Moderate	High	Low	0.37		
Vida part	0-2	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	High	Low	0.28	5	6
	2-60	0.2-2.0	0.15-0.20	7.4-9.0	<2	Moderate	High	Low	0.37		
Yecross:											
YeB, YeC	0-9	6.0-20	0.10-0.12	6.6-7.8	<2	Low	Low	Low	0.17	5	2
	9-60	6.0-20	0.06-0.10	7.4-8.4	<2	Low	Moderate	Low	0.10		
Zahl:											
[1]ZaE:											
Zahl part	0-5	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	High	Low	0.28	5	8
	5-60	0.2-2.0	0.15-0.19	7.4-8.4	<2	Moderate	High	Low	0.37		
Williams part	0-4	0.6-2.0	0.17-0.24	6.6-7.3	<2	Low	High	Low	0.28	5	6
	4-22	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	High	Low	0.28		
	22-60	0.2-0.6	0.15-0.18	7.4-8.4	<2	Moderate	High	Low	0.37		

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols. The symbol < means less than; > means more than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Agar: AgA, AgB, AgC	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Akaska: AkA, AkB	B	None	---	---	>6.0	---	---	>60	---	Low.
Aquolls: Ao.										
Arveson: Ar	A/D	Rare to common.	Brief	Apr-Jun	0-3.0	Apparent	Apr-Jul	>60	---	High.
Bon: Bn	B	Common	Brief	Apr-Oct	>6.0	---	---	>60	---	Moderate.
Bowbells: BoA	B	None to common.	Very brief	Oct-Jun	>6.0	---	---	>60	---	Moderate.
Bowdle: BwA, BwB	B	None	---	---	>6.0	---	---	>60	---	Low.
[1]BxB:										
Bowdle part	B	None	---	---	>6.0	---	---	>60	---	Low.
Wabek part	A	None	---	---	>6.0	---	---	>60	---	Low.
[1]BxC:										
Bowdle part	B	None	---	---	>6.0	---	---	>60	---	Low.
Wabek part	A	None	---	---	>6.0	---	---	>60	---	Low.
[1]BxD:										
Bowdle part	B	None	---	---	>6.0	---	---	>60	---	Low.
Wabek part	A	None	---	---	>6.0	---	---	>60	---	Low.
Colvin: Co	C/D	Frequent	Long	Apr-Jun	1.0-3.0	Apparent	Sep-Jun	>60	---	High.
Demky: DeA, DeB	D	None	---	---	>6.0	---	---	>60	---	Low.
[1]DgA:										
Demky part	D	None	---	---	>6.0	---	---	>60	---	Low.
Jerauld part	D	None	---	---	>6.0	---	---	>60	---	Low.
Divide: Dm	B	None	---	---	3.0-5.0	Apparent	Sep-Jun	>60	---	Moderate.
Durrstein: Du	D	Common	Brief	Apr-Oct	1.0-6.0	Apparent	Oct-Jun	>60	---	Moderate.
Egas: Eg	D	Common	Brief	Apr-Oct	1.0-5.0	Apparent	Oct-Jun	>60	---	High.
Gettys: GeE	C	None	---	---	>6.0	---	---	>60	---	Low.
Gravel pits: Gp.										
Hecla: HeA	A	None	---	---	3.0-6.0	Apparent	Apr-Oct	>60	---	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Highmore: HhA, HhB, HhC	B	None	---	---	>6.0	---	---	>60	---	Moderate.
[1]HkA: Highmore part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Eakin part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
[1]HkB: Highmore part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Eakin part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
[1]HkC: Highmore part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Eakin part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
[1]HmB: Highmore part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Raber part	C	None	---	---	>6.0	---	---	>60	---	Low.
[1]HmC: Highmore part	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Raber part	C	None	---	---	>6.0	---	---	>60	---	Low.
Hoven: Ho	D	Common	Very long	Sep-Jul	>6.0	---	---	>60	---	Moderate.
Hurley: HuB	D	None	---	---	>6.0	---	---	20-60	Rippable	Low.
Jerauld: Je	D	None	---	---	>6.0	---	---	>60	---	Low.
[1]Js: Jerauld part	D	None	---	---	>6.0	---	---	>60	---	Low.
Slickspots part.										
Lehr: LaA, LaB	B	None	---	---	>6.0	---	---	>60	---	Low.
[1]LbB: Lehr part	B	None	---	---	>6.0	---	---	>60	---	Low.
Bowdle part	E	None	---	---	>6.0	---	---	>60	---	Low.
Lowry: LoA, LoB, LoC	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Macken: Ma	D	Common	Very long	Sep-Jun	>6.0	---	---	>60	---	Moderate.
Maddock: MdB, MdC	A	None	---	---	>6.0	---	---	>60	---	Low.
Mobridge: Mo	B	None to common.	Very brief	Oct-Jun	>6.0	---	---	>60	---	Moderate.
Opal: OpC	D	None	---	---	>6.0	---	---	20-40	Rippable	Low.
[1]OsD: Opal part	D	None	---	---	>6.0	---	---	20-40	Rippable	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Opal: [1]OsD: Sansarc part---	D	None--------	---	---	>6.0	---	---	4-20	Rippable	Low.
Parnell: Pa----------	D	Frequent----	Long------	Apr-Nov	0-2.0	Apparent	Jan-Dec	>60	---	High.
Parshall: PrA, PrB---------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Promise: PsA, PsB---------	D	None to common.	Very brief	Apr-Oct	>6.0	---	---	>60	---	Low.
Raber: RaB, RaC---------	C	None--------	---	---	>6.0	---	---	>60	---	Low.
[1]RbD: Raber part-----	C	None--------	---	---	>6.0	---	---	>60	---	Low.
Gettys part----	C	None--------	---	---	>6.0	---	---	>60	---	Low.
Regan: Re----------	B/D	Common------	Brief to long.	Mar-Jun	1.0-5.0	Apparent	Oct-Jun	>60	---	High.
Sansarc: [1]SaE: Sansarc part---	D	None--------	---	---	>6.0	---	---	4-20	Rippable	Low.
Opal part------	D	None--------	---	---	>6.0	---	---	20-40	Rippable	Low.
Sully: SuC, SuD, SuE----	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Swanboy: SwA----------	D	None--------	---	---	>6.0	---	---	>60	---	Low.
Tally: TaA, TaB, TaC----	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Tetonka: Te----------	C/D	Common------	Very long	Jan-Dec	0-5.0	Perched	Jan-Dec	>60	---	High.
Ustifluvents: Us.										
Vida: VdD----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]VzD: Vida part------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Zahl part------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Wabek: WaE----------	A	None--------	---	---	>6.0	---	---	>60	---	Low.
Williams: [1]WbA: Williams part--	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Bowbells part--	B	None to common.	Very brief	Oct-Jun	>6.0	---	---	>60	---	Moderate.
[1]WbB: Williams part--	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Bowbells part--	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
[1]WdC: Williams part--	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
Williams:										
[1]WdC:										
Vida part------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Yecross:										
YeB, YeC---------	A	None--------	---	---	>6.0	---	---	>60	---	Low.
Zahl:										
[1]ZaE:										
Zahl part------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.
Williams part--	B	None--------	---	---	>6.0	---	---	>60	---	Moderate.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 17.--ENGINEERING TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution								Liquid limit	Plasticity index	Moisture density	
			Percentage passing sieve					Percentage smaller than--					Maximum dry density	Optimum moisture
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				
											Pct		Lb/ft^3	Pct
Akaska silt loam (S72SD-129-001)														
B21t---- 07 to 15	A-6(11)	CL	100	100	99	95	85	--	29	--	37	13	105	19
Cca----- 26 to 34	A-4(06)	CL	100	100	100	98	86	--	30	--	30	8	108	18
IIC----- 34 to 60	A-2-4(00)	SM	100	92	85	56	21	--	10	--	21	NP	115	15
Bowdle loam (S72SD-129-005)														
B22----- 15 to 21	A-4(05)	ML	100	98	97	84	66	--	27	--	35	10	106	19
IIC----- 25 to 60	A-1-b(00)	SW-SM	100	88	79	36	11	--	6	--	20	NP	117	14
Lehr loam (S72SD-129-002)														
B21----- 05 to 14	A-6(04)	ML	100	98	94	76	53	--	20	--	37	12	107	18
IIC1ca-- 14 to 24	A-1-a(01)	SW-SM	100	57	43	23	7	--	3	--	22	NP	123	12
Mobridge silt loam (S72SD-129-024)														
Ap------ 00 to 11	A-4(11)	ML	100	100	100	100	98	--	30	--	36	10	93	25
B22t---- 17 to 25	A-6(15)	ML	100	100	100	100	97	--	36	--	39	13	97	23
C1ca---- 30 to 60	A-6(17)	CL	100	100	100	100	97	--	40	--	40	16	104	20
Raber loam (S72SD-129-004)														
B22t---- 08 to 13	A-7-5(29)	MH	100	100	100	97	90	--	53	--	61	26	89	28
C1ca---- 24 to 36	A-7-5(32)	MH	100	98	98	94	83	--	50	--	67	34	92	26
Tetonka silt loam (S72SD-129-003)														
A2------ 06 to 11	A-4(07)	CL	100	100	100	98	96	--	30	--	29	8	101	21
B21t---- 13 to 33	A-7-6(25)	ML	100	100	100	99	98	--	46	--	49	21	101	21
Cca----- 42 to 65	A-6(13)	CL	100	100	100	100	97	--	32	--	36	12	105	19

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Agar	Fine-silty, mixed, mesic Typic Argiustolls
Akaska	Fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Argiustolls
Aquolls	Loamy and clayey, mixed, mesic Fluventic Haplaquolls
Arveson	Coarse-loamy, frigid Typic Calciaquolls
Bon	Fine-loamy, mixed, mesic Cumulic Haplustolls
*Bowbells	Fine-loamy, mixed Pachic Argiborolls
Bowdle	Fine-loamy over sandy or sandy-skeletal, mixed Pachic Haploborolls
Colvin	Fine-silty, frigid Typic Calciaquolls
Demky	Fine, montmorillonitic, mesic Glossic Natrustolls
Divide	Fine-loamy over sandy or sandy-skeletal, frigid Aeric Calciaquolls
Durrstein	Fine, montmorillonitic, mesic Typic Natraquolls
Eakin	Fine-silty, mixed, mesic Typic Argiustolls
*Egas	Fine, montmorillonitic (calcareous), mesic Typic Haplaquolls
Gettys	Fine, montmorillonitic (calcareous), mesic Typic Ustorthents
Hecla	Sandy, mixed Aquic Haploborolls
Highmore	Fine-silty, mixed, mesic Typic Argiustolls
Hoven	Fine, montmorillonitic, mesic Typic Natraquolls
Hurley	Very-fine, montmorillonitic, mesic Leptic Natrustolls
Jerauld	Fine, montmorillonitic, mesic Leptic Natrustolls
Lehr	Fine-loamy over sandy or sandy-skeletal, mixed Typic Haploborolls
Lowry	Coarse-silty, mixed, mesic Typic Haplustolls
Macken	Fine, montmorillonitic, mesic Vertic Haplaquolls
Maddock	Sandy, mixed Udorthentic Haploborolls
Mobridge	Fine-silty, mixed, mesic Pachic Argiustolls
Opal	Very-fine, montmorillonitic, mesic Vertic Haplustolls
Parnell	Fine, montmorillonitic, frigid Typic Argiaquolls
Parshall	Coarse-loamy, mixed Pachic Haploborolls
Promise	Very-fine, montmorillonitic, mesic Vertic Haplustolls
Raber	Fine, montmorillonitic, mesic Typic Argiustolls
Regan	Fine-silty, frigid Typic Calciaquolls
Sansarc	Clayey, montmorillonitic (calcareous), mesic, shallow Typic Ustorthents
Sully	Coarse-silty, mixed (calcareous), mesic Typic Ustorthents
Swanboy	Very-fine, montmorillonitic, mesic Ustertic Camborthids
Tally	Coarse-loamy, mixed Typic Haploborolls
Tetonka	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Ustifluvents	Loamy and clayey, mixed, mesic Ustifluvents
Vida	Fine-loamy, mixed Typic Argiborolls
Wabek	Sandy-skeletal, mixed Entic Haploborolls
Williams	Fine-loamy, mixed Typic Argiborolls
Yecross	Mixed, frigid Typic Ustipsamments
*Zahl	Fine-loamy, mixed Entic Haploborolls

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