United States Department of Agriculture

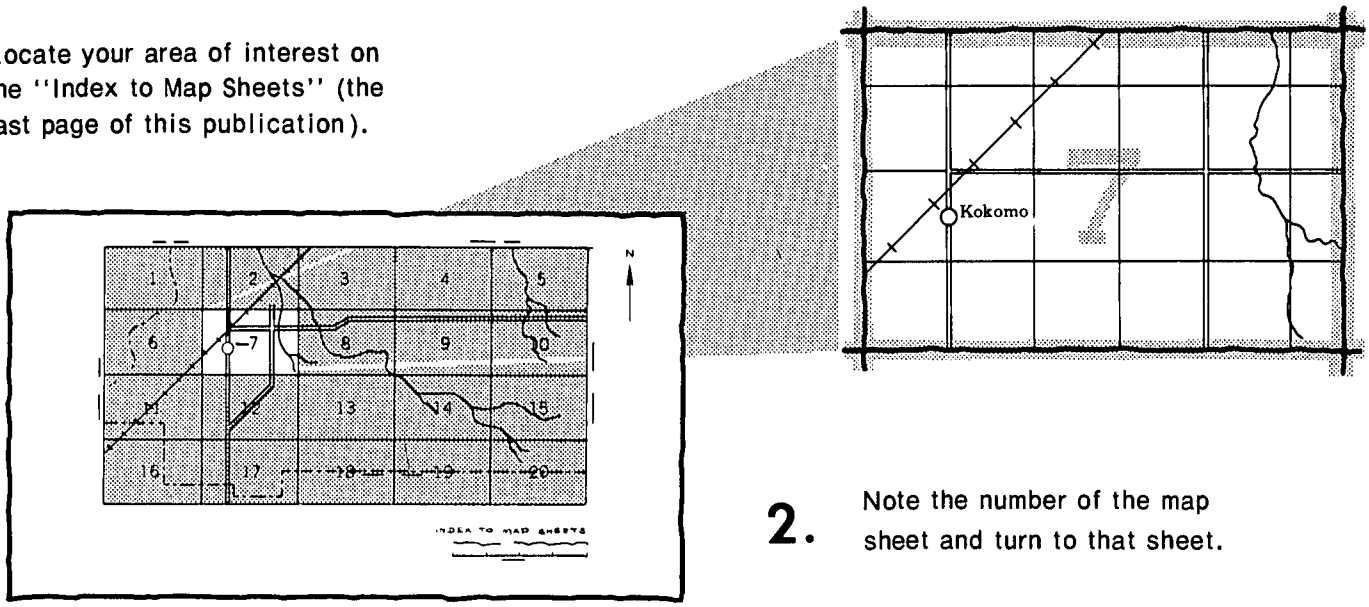
Soil Conservation Service

In Cooperation with the South Dakota Agricultural Experiment Station

Soil Survey of Bon Homme County South Dakota

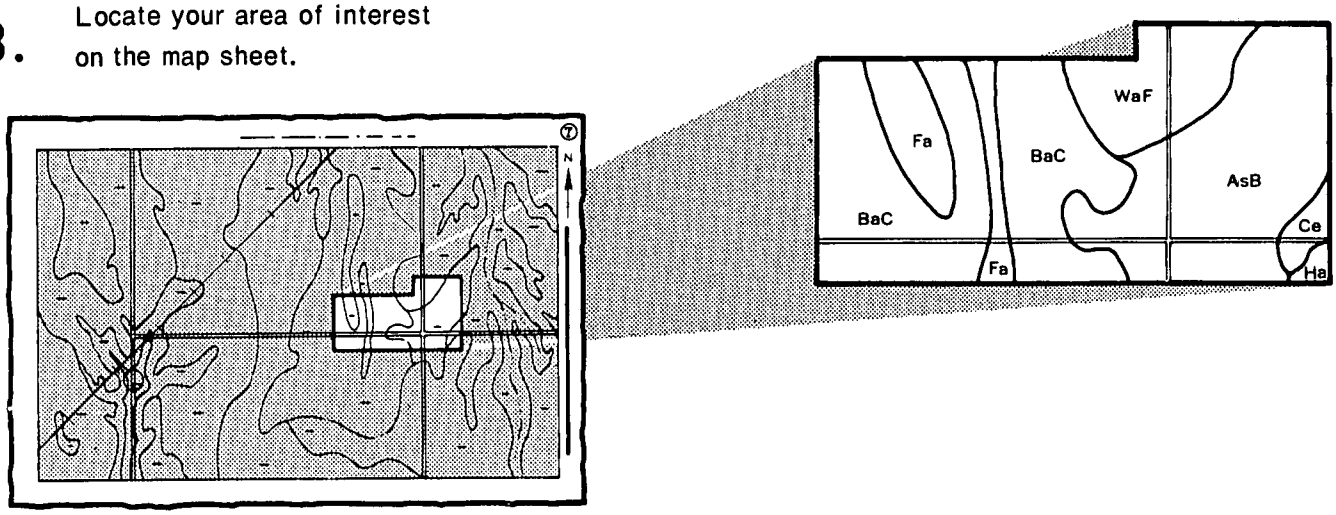
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

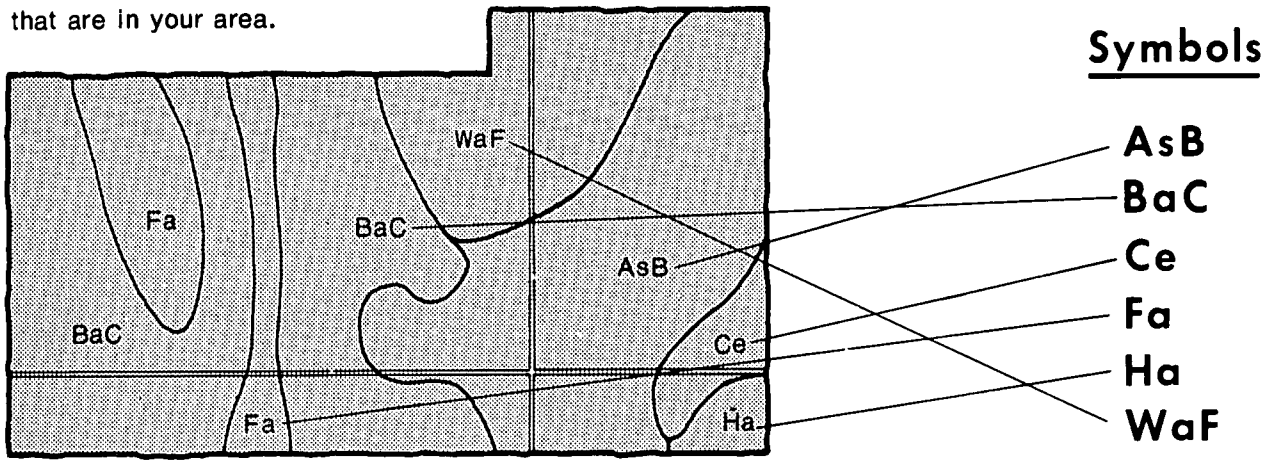


2. Note the number of the map sheet and turn to that sheet.

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

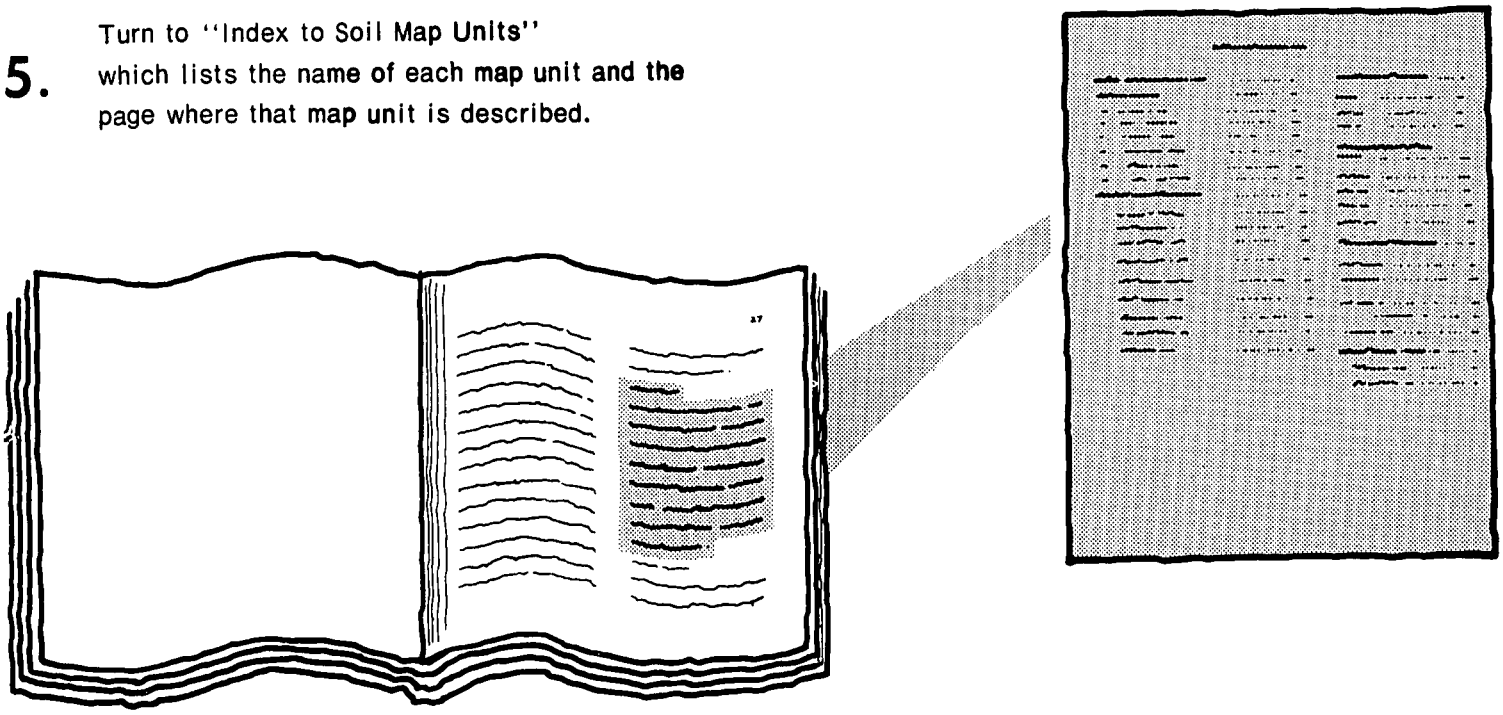


4. List the map unit symbols that are in your area.

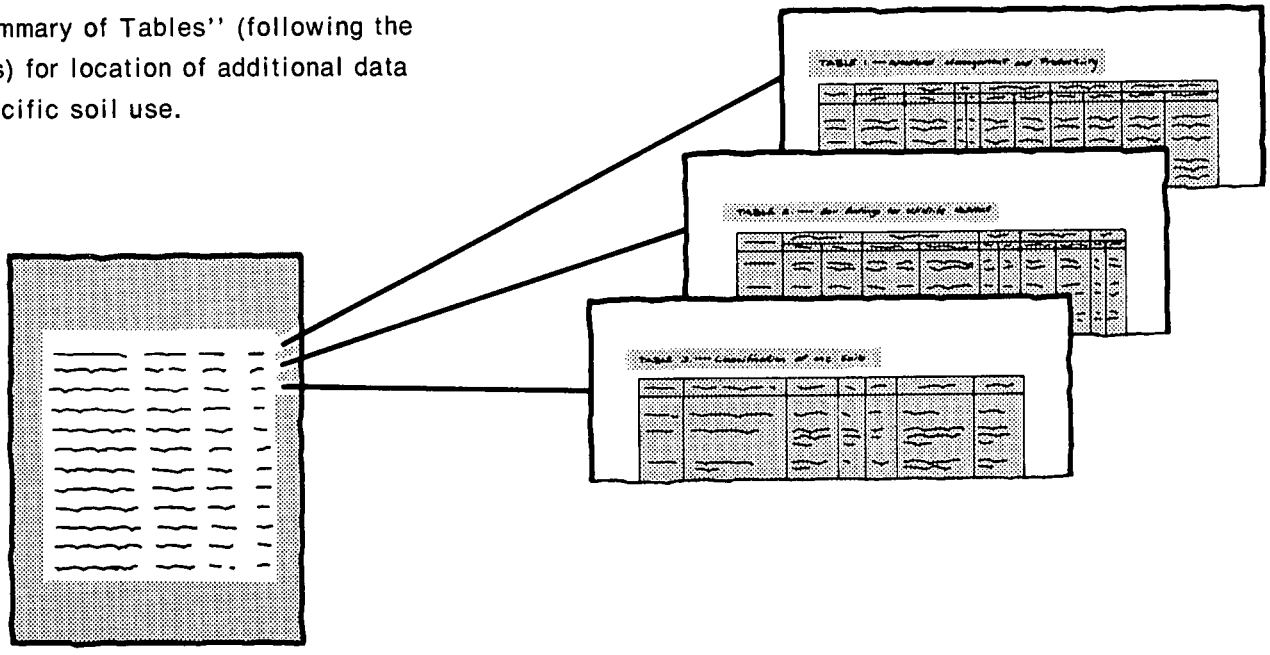


THIS SOIL SURVEY

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



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



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

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

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 Bon Homme County Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue and the Bon Homme County Commissioners. Major fieldwork was performed in the period 1977-81. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981.

Cover: Farmstead on Clarno-Bonilla loams, 2 to 6 percent slopes.

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soil series

Issued January 1983

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foreword

This soil survey contains information that can be used in land-planning programs in Bon Homme County, South Dakota. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements need to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

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

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

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

R. D. Swenson
State Conservationist
Soil Conservation Service

soil survey of
Bon Homme County, South Dakota

By Elmer M. Ward, Soil Conservation Service

Soils surveyed by Scott W. Anderson, Edgar H. Ensz, Leonard S. Kempf, Thomas J. Martin, Nilo G. Reber, and Elmer M. Ward, Soil Conservation Service

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

BON HOMME COUNTY is in the southeastern part of South Dakota (fig. 1). It has a total area of 378,880 acres, or about 592 square miles, which includes about 20,416 acres of water. According to the 1980 census, the county has a population of 8,059. Tyndall, the county seat, has a population of 1,253; Avon, in the west-central part of the county, has one of 576; Scotland, in the northeastern part, one of 1,022; Springfield, in the south-central part, one of 1,377; and Tabor, in the southeastern part, one of 460. Other villages in the county are Kingsburg, Perkins, and Running Water. Only a few buildings and foundations mark the former villages of Andrus, Blaha, Bon Homme, Loretta, Plum, and Wanari.

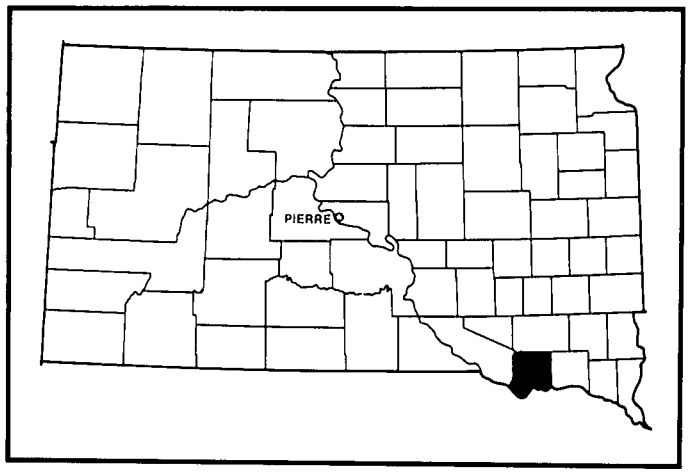

Figure 1.—Location of Bon Homme County in South Dakota.

general nature of the county

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

climate

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

Bon Homme County is usually warm in summer, but hot spells are frequent and cool days occasional. The county is cold in winter, when arctic air frequently surges over the area. Most of the precipitation falls during the warm period, and rainfall normally is heaviest late in spring and early in summer. In winter snowfall is blown into drifts, so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Tyndall in the period 1951 to 1978. 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 about 21 degrees F, and the average daily minimum temperature is 11 degrees. The lowest temperature on record, which occurred at Tyndall on January 19, 1970, is -30 degrees. In summer the average temperature is about 73 degrees, and the average daily maximum temperature is 86

degrees. The highest recorded temperature, which occurred at Tyndall on July 13, 1954, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 23.86 inches. Of this, 19 inches, or about 80 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 3.95 inches at Tyndall on August 28, 1960. Thunderstorms occur on about 40 days each year, and most occur in summer.

Average seasonal snowfall is about 34 inches. The greatest snow depth at any one time during the period of record was 30 inches. On an average of 35 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

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

physiography, relief, and drainage

Most of Bon Homme County is within the James Basin division of the Central Lowland (*5*). A narrow area along the west side of the county, however, is within the Coteau du Missouri division of the Missouri Plateau, and an area in the eastern part is in the James River Highlands. The landscape of the James Basin is a nearly level and gently undulating glacial till plain where many small drainageways terminate in depressions. The Coteau du Missouri consists of gently rolling to hilly end moraines of the Mankato Substage of the Wisconsin Glaciation and nearly level and undulating ground moraines. Much of the material deposited on the ground moraines is silty drift. The James River Highlands is an undulating and gently rolling glacial drift plain that is several hundred feet higher than the adjacent James Basin.

The steep trench of the Missouri River is along the southern border of the county. The breaks along the river are areas of loamy glacial till, clayey soils underlain by Pierre shale, sandy soils, and silty soils underlain by Niobrara chalk rock. Much of the flood plain along the Missouri River is inundated by Lewis and Clark Lake.

Beaver, Choteau, Dawson, Emanuel, and Snatch Creeks are the major drainageways. Except for Beaver Creek, which drains into the James River, they drain into Lewis and Clark Lake or the Missouri River. The water in these intermittent drainageways flows in the spring and after heavy rains.

Elevation ranges from about 1,208 feet above sea level in the southeastern part of the county to about 1,900 feet in the northwestern part. The lowest elevation is on the flood plains along the Missouri River.

settlement

Lewis and Clark, traveling up the Missouri River in 1804, passed by what is now Bon Homme County on their way to examine the land acquired through the Louisiana Purchase. The first settlement in the county was established in 1858 (*6*). It was called Bon Homme, which was in Bon Homme Township.

Bon Homme County, named for an island in the Missouri River, was established in 1862 by the first legislature held in the Dakota Territory. The name Bon Homme is a French term meaning "good man." The former town of Bon Homme was selected as the first county seat. The county seat was transferred to Tyndall in 1885, after railroad transportation was extended into the county.

By 1890, the county had a population of 9,062. The population reached 10,241 in 1940. It declined to 8,577 by 1970 and 8,059 by 1980.

South Dakota State Highways 25, 37, 46, 50, and 52 are the main thoroughfares in the county. Most rural areas are served by all-weather roads to centers of trade. A small airport is at Springfield. Railroad transportation was extended into the county in 1879.

farming

Farming is the principal enterprise in the county. About 70 percent of the farm income is derived from the sale of livestock and livestock products (*11*). Many of the crops are used as feed for livestock. In 1978, farmland totaled 324,255 acres, which is about 90 percent of the total acreage of the county. In 1975, the 879 farms averaged 369 acres in size (*10*). The average size has been increasing since the mid 1930's.

About 74 percent of the land area is used for cultivated crops and tame pasture and hay, about 17 percent is range, and 1 percent is native woods (*3*). Dryland farming is dominant, but some areas are irrigated. The main cropping system is row crops and small grain grown in rotation with legumes. Corn, grain sorghum, oats, and soybeans are the main cultivated crops. Wheat and barley are also grown. Alfalfa, smooth bromegrass, and intermediate wheatgrass are the main crops grown for tame pasture and hay. According to the South Dakota Crop and Livestock Reporting Service, corn was grown on about 96,495 acres in 1978, oats on 50,227 acres, soybeans on 15,886 acres, and sorghum on 8,612 acres. The corn from 87,314 acres was harvested for grain. The rest was used for silage.

natural resources

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

Lewis and Clark Lake, Lake Henry, and the Missouri River are excellent sources of water for domestic and industrial use and for irrigation. Many small dams, dugouts, and flows of Beaver, Choteau, Dawson, Emanuel, and Snatch Creeks provide water for livestock in most years. Ground water from wells is available in most parts of the county.

Significant deposits of sand and gravel are in the Ethan-Boyd-Thurman association, which is described under the heading "General soil map units." Most of the sand and gravel has an excessive amount of fine rock fragments, such as shale, chalk, and clay ironstone, which make it unsuitable as concrete aggregate or as construction material. All of the sand and gravel can be used as subgrade material for roads and as bituminous aggregate. Deposits of fine sand in areas of the Ethan-Boyd-Thurman association are suitable for the production of cement.

Coyote, cottontail, white-tailed deer, and upland game birds, such as bobwhite, gray partridge, ring-necked pheasant, and wild turkeys, are the chief wildlife resources. The wetlands provide wildlife production areas. Bass, bluegill, northern pike, perch, and other fish inhabit most of the permanent water areas. Lewis and Clark Lake and the Missouri River provide excellent opportunities for catching walleyed pike and paddlefish.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. 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; and the kinds of rock. They dug many holes to study 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 plant roots.

The soil scientists recorded the characteristics of the profiles they studied to a depth of 5 feet and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management 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 can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The associations on the general soil map of this county are described on the pages that follow. The names of some associations do not agree with those on the general soil maps in the published soil surveys of adjacent Charles Mix, Hutchinson, and Yankton Counties. They do not fully agree because of differences in the design of the map units.

soil descriptions

1. Fluvaquents-Sarpy association

Very poorly drained and excessively drained, level and nearly level, loamy and sandy soils on flood plains along the Missouri River

This association is on the flood plains along the Missouri River. The soils dominantly are level but are steeper on a few narrow, low ridges and in oxbows. The areas adjacent to Lewis and Clark Lake are subject to seasonal flooding when the water level in the lake is high. The areas that are not flooded when the water level in the lake is high are protected because Fort Randall Dam holds back the potential floodwater in the river.

This association makes up about 1 percent of the county. It is about 73 percent Fluvaquents, 14 percent Sarpy soils, and 13 percent minor soils.

The very poorly drained Fluvaquents are on broad flats and in old channels adjacent to Lewis and Clark Lake. Slopes are less than 1 percent. Typically, these soils have a light colored, loamy surface layer that is underlain by light colored, stratified loamy material.

The excessively drained Sarpy soils are slightly higher on the flood plains than the Fluvaquents. Slopes range from 0 to 3 percent. Typically, the surface layer is grayish brown loamy fine sand. The underlying material is light brownish gray fine sand.

Minor in this association are the moderately well drained, loamy Bon soils. These soils are farther from the river than the major soils.

Only about 10 percent of this association is cropland. Alfalfa, corn, and oats are the main crops. Some areas support native grasses and an overstory of deciduous trees. They are used for grazing and wildlife habitat. The rest of the association is suitable only as wildlife habitat because it is marshy most of the year.

The Fluvaquents generally are unsuited to cultivated crops, tame pasture and hay, and range. They are well suited to wetland wildlife habitat. The Sarpy soils are suited to range, tame pasture and hay, and cultivated crops. Wind erosion is a severe hazard, however, if cultivated crops are grown.

2. Clarno-Bonilla association

Well drained and moderately well drained, nearly level and undulating, loamy soils on uplands and in upland swales

This association is on uplands characterized by gentle rises and swales. In most areas the drainageways terminate in small depressions. The drainage pattern is poorly defined in these areas, but it is well defined along the larger drainageways.

This association makes up 6 percent of the county. It is about 53 percent Clarno soils, 22 percent Bonilla soils, and 25 percent minor soils.

The well drained Clarno soils are on convex and smooth slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is brown and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

The moderately well drained Bonilla soils are on flats and in swales. In this association they have a slope of 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and light gray clay loam. It is mottled in the lower part. The

underlying material is light gray, mottled, calcareous clay loam.

Minor in this association are the somewhat poorly drained Crossplain soils in deep swales, the calcareous Davison soils on the edges of the swales, the calcareous Ethan soils on knolls and ridges, and the poorly drained Tetonka soils in depressions.

About 87 percent of this association is cropland. Corn, oats, alfalfa, soybeans, and grain sorghum are the main crops. Controlling erosion is the main concern in managing cultivated areas. The major soils are suited to cultivated crops, tame pasture and hay, range, and openland and rangeland wildlife habitat.

3. Clarno-Crossplain-Davison association

Moderately well drained and somewhat poorly drained, nearly level, loamy soils on uplands and in upland swales

This association is on uplands characterized by many shallow swales. The drainage pattern is poorly defined in most areas, but it is well defined along drainageways.

This association makes up about 19 percent of the county. It is about 45 percent Clarno soils, 25 percent Crossplain soils, 15 percent Davison soils, and 15 percent minor soils (fig. 2).

The moderately well drained Clarno soils are on slight rises. In this association they have a slope of 0 to 3 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is brown and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

The somewhat poorly drained Crossplain soils are in swales. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray clay loam. The subsoil is dark gray, olive gray, and light olive gray clay and clay loam. It is calcareous in the lower part. The underlying material is pale olive, mottled, calcareous clay loam.

The moderately well drained Davison soils border narrow swales and small depressions. Slopes range from 0 to 3 percent. Typically, the surface layer is grayish brown, calcareous loam. The underlying material is light brownish gray and pale olive, calcareous loam and light yellowish brown, mottled, calcareous clay loam.

Minor in this association are the moderately well drained Bonilla soils in swales, the calcareous Ethan soils on the higher ridges and knolls, and the poorly drained Tetonka soils in depressions.

About 85 percent of this association is cropland. Corn, oats, alfalfa, soybeans, and grain sorghum are the main crops. Some areas are irrigated. Controlling the wetness of the Crossplain soils and maintaining the fertility of the Davison soils are the main concerns in managing the cultivated areas. The major soils are suited to cultivated crops, tame pasture and hay, range, and openland and rangeland wildlife habitat.

4. Clarno-Ethan-Bonilla association

Well drained and moderately well drained, nearly level to rolling, loamy soils on uplands and in upland swales

This association is on uplands characterized by many shallow swales. Slopes generally are undulating but are steeper along drainageways. The drainage pattern is poorly defined in areas where the drainageways terminate in small depressions. It is well defined, however, along the larger drainageways.

This association makes up about 18 percent of the county. It is about 45 percent Clarno soils, 25 percent Ethan soils, 20 percent Bonilla soils, and 10 percent minor soils (fig. 3).

The well drained Clarno soils are on mid slopes and broad flats. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is brown and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

The well drained Ethan soils are on convex slopes. In this association they have a slope of 2 to 15 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is light yellowish brown, calcareous clay loam. The underlying material is pale yellow, mottled, calcareous clay loam.

The moderately well drained Bonilla soils are on flats and in swales. In this association they have a slope of 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and light gray clay loam. It is mottled in the lower part. The underlying material is light gray, mottled, calcareous clay loam.

Minor in this association are Betts, Crossplain, Delmont, Enet, Tetonka, and Worthing soils. The calcareous Betts soils are on the higher ridges and along drainageways. The somewhat poorly drained Crossplain soils are in swales. The somewhat excessively drained Delmont and well drained Enet soils are underlain by sand and gravel. They occur as areas intermingled with some areas of the Clarno soils. The poorly drained Tetonka and very poorly drained Worthing soils are in depressions.

About 83 percent of this association is cropland. Corn, oats, alfalfa, soybeans, and grain sorghum are the main crops. The steeper areas along the larger drainageways support native grasses and are used for grazing. Controlling erosion and maintaining fertility are the main concerns in managing the Clarno and Ethan soils for crops. The major soils are suited to cultivated crops, tame pasture and hay, range, and openland and rangeland wildlife habitat.

5. Homme-Ethan-Onita association

Well drained and moderately well drained, nearly level to rolling, silty and loamy soils on uplands and in upland swales

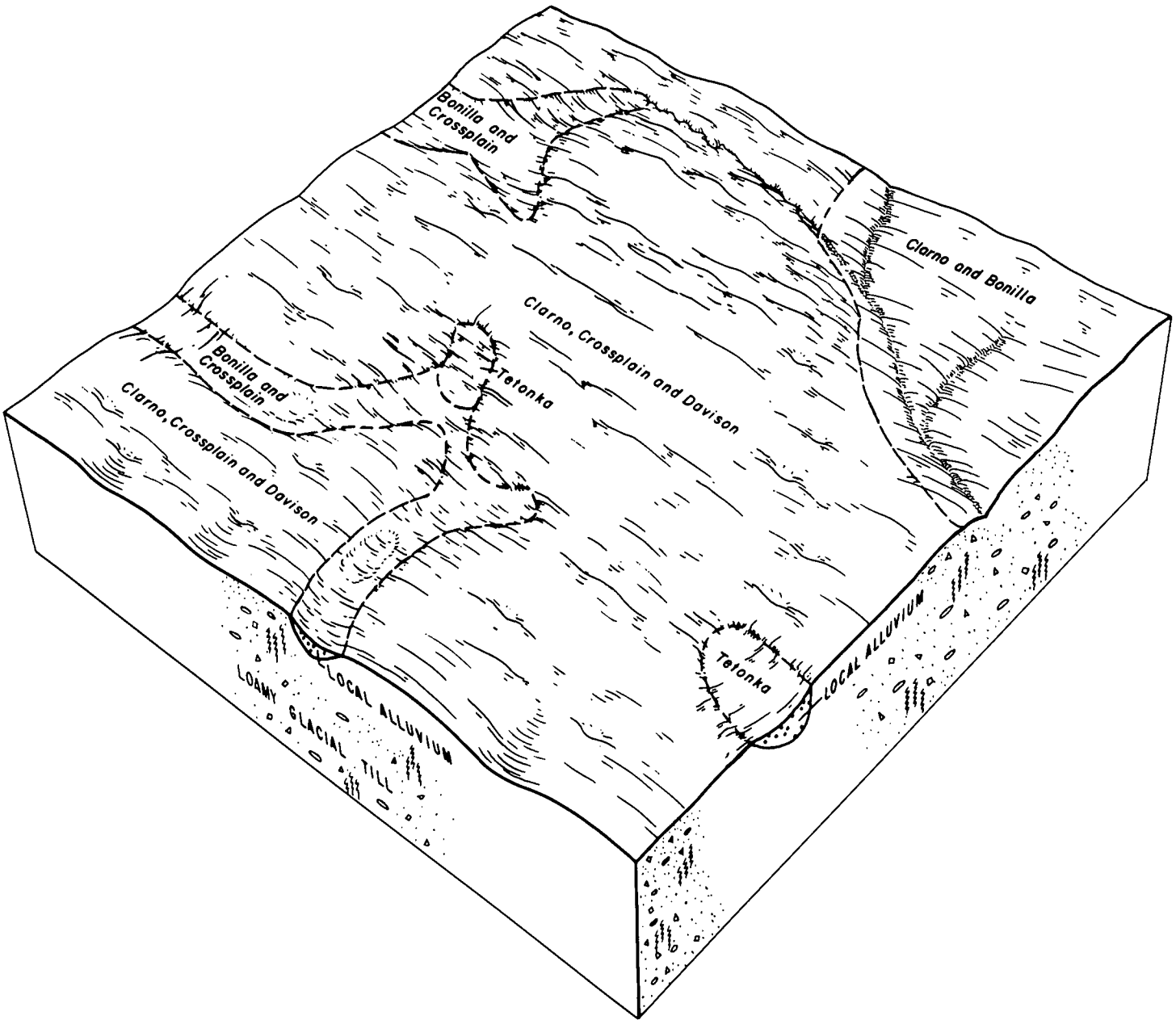

Figure 2.—Pattern of soils and underlying material in the Clarno-Crossplain-Davison association.

This association is on uplands characterized by many shallow swales. Slopes generally are undulating but are steeper along drainageways and are less steep on flats and in swales. The drainage pattern is poorly defined in areas where drainageways terminate in small depressions. It is well defined, however, along the larger drainageways.

This association makes up about 33 percent of the county. It is about 45 percent Homme soils, 25 percent Ethan soils, 10 percent Onita soils, and 20 percent minor soils (fig. 4).

The well drained and moderately well drained Homme soils are on mid slopes and broad flats. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is brown, light olive brown, and light yellowish brown silty clay loam. It

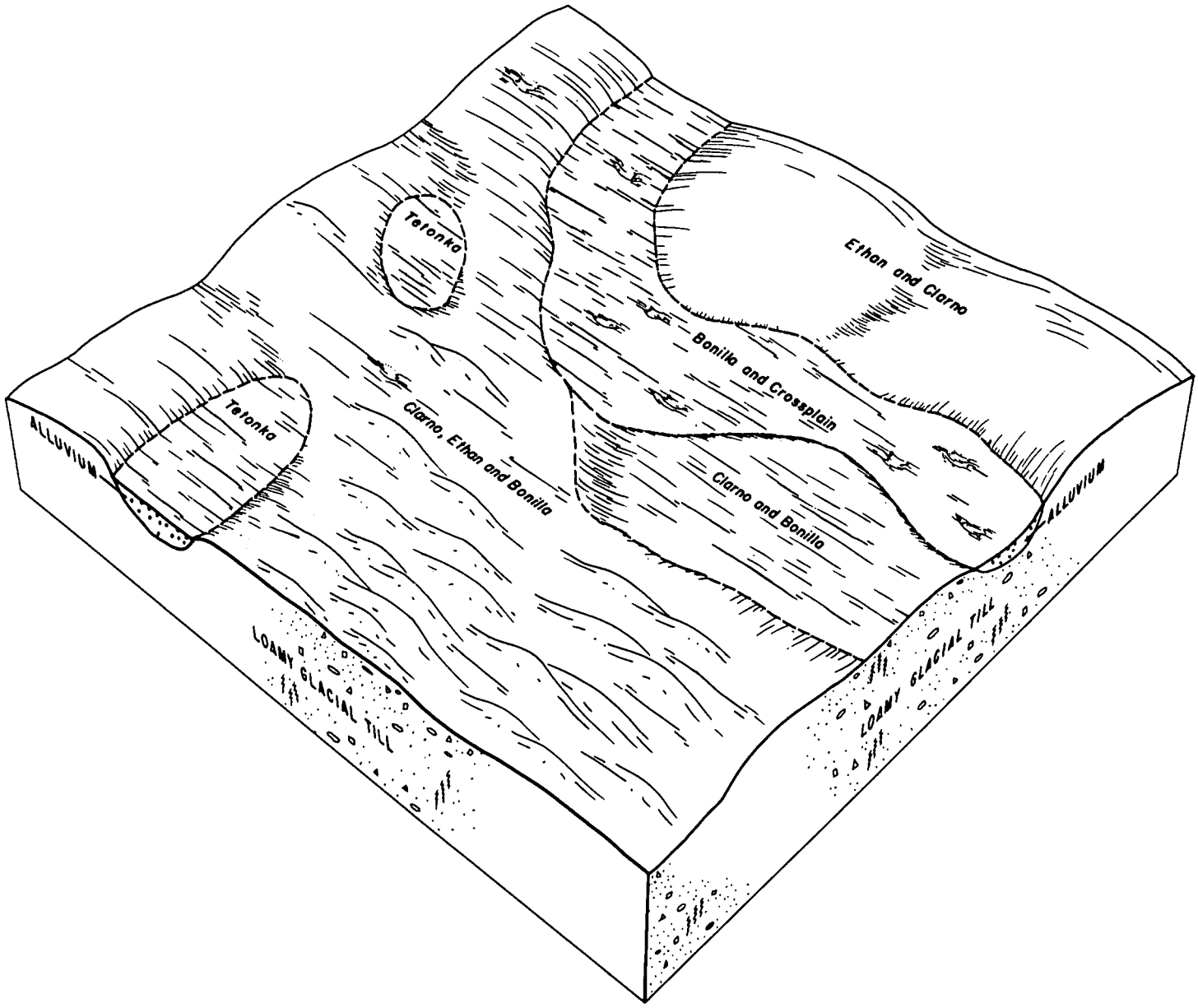

Figure 3.—Pattern of soils and underlying material in the Clarno-Ethan-Bonilla association.

is calcareous in the lower part. The underlying material is light brownish gray, mottled, calcareous clay loam.

The well drained Ethan soils are on convex slopes. In this association they have a slope of 2 to 15 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is light yellowish brown, calcareous clay loam. The underlying material is pale yellow, mottled, calcareous clay loam.

The moderately well drained Onita soils are on flats and in swales. In this association they have a slope of 0 to 2 percent. Typically, the surface layer is very dark grayish brown silty clay loam. The subsoil is dark grayish brown, very dark grayish brown, and light olive brown silty clay loam. The underlying material is light yellowish brown, calcareous silty clay loam and clay loam. It is mottled in the lower part.

Minor in this association are the calcareous Betts soils on the higher ridges and along entrenched

drainageways, the somewhat poorly drained Chancellor soils in the deeper swales, the moderately well drained Davison soils in areas that border narrow swales and small depressions, and the poorly drained Tetonka and very poorly drained Worthing soils in depressions.

About 85 percent of this association is cropland. Corn, oats, soybeans, grain sorghum, and alfalfa are the main crops. The steeper areas along the larger drainageways support native grasses and are used for grazing. Maintaining fertility and controlling erosion are the main concerns in managing the major soils for crops. These soils are suited to cultivated crops, tame pasture and hay, range, and openland and rangeland wildlife habitat.

6. Eltree-Yankton-Alcester association

Well drained and moderately well drained, nearly level to strongly sloping, silty soils on uplands and in upland swales

This association is on uplands characterized by smooth gently sloping areas, deeply dissected more sloping areas, and upland swales. In most areas the drainage pattern is well defined, but it is poorly defined in areas where small drainageways terminate in swales and small depressions.

This association makes up 8 percent of the county. It is about 25 percent Eltree soils, 20 percent Yankton soils, 20 percent Alcester soils, and 35 percent minor soils (fig. 5).

The well drained Eltree soils are in convex and smooth areas. Slopes range from 0 to 15 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray, calcareous silt loam. The underlying material is pale brown, calcareous silt loam.

The well drained Yankton soils are in smooth and convex areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silt loam. The subsurface layer is grayish brown, calcareous silt loam. The subsoil is grayish brown and light brownish

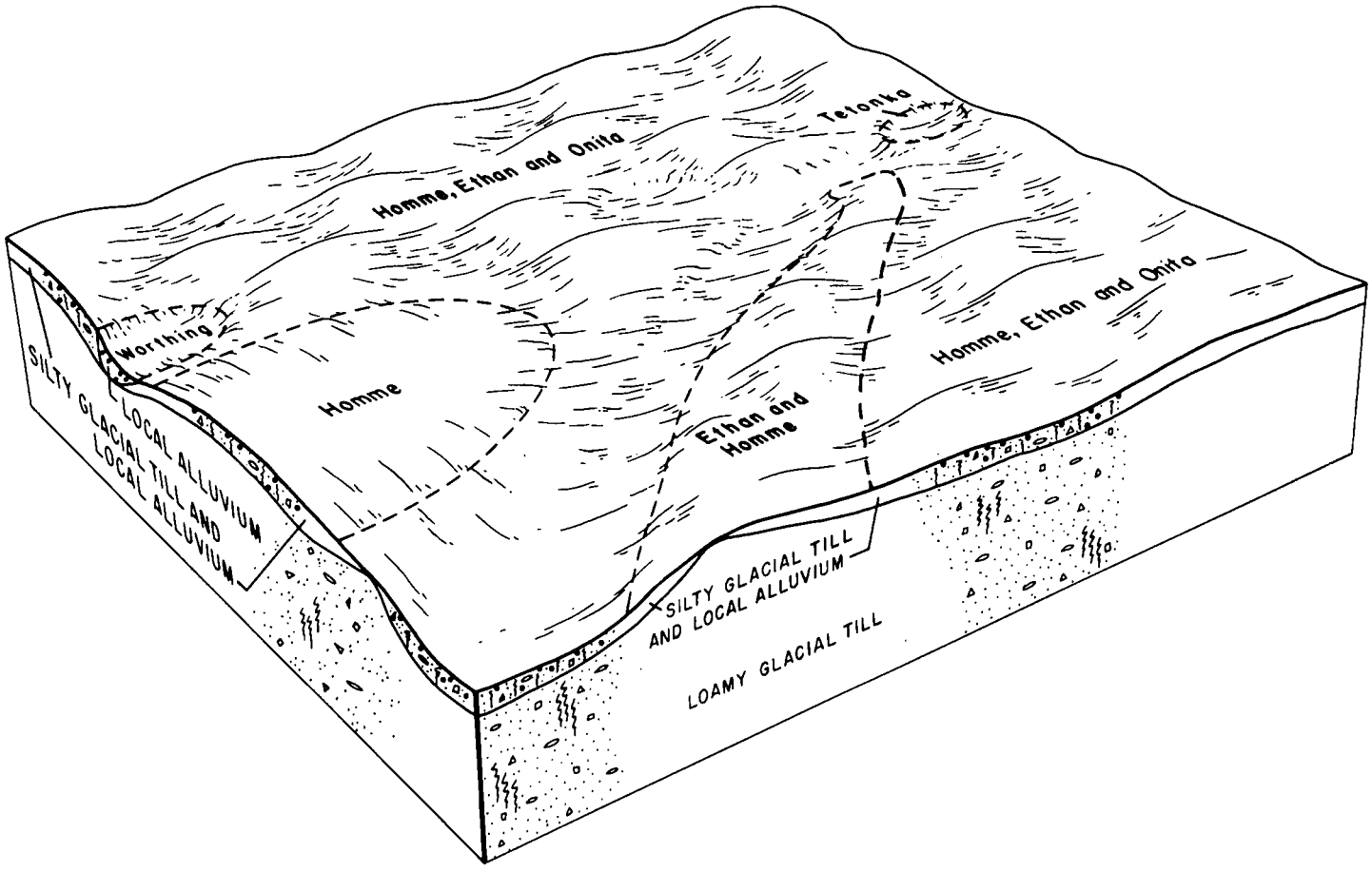

Figure 4.—Pattern of soils and underlying material in the Homme-Ethan-Onita association.

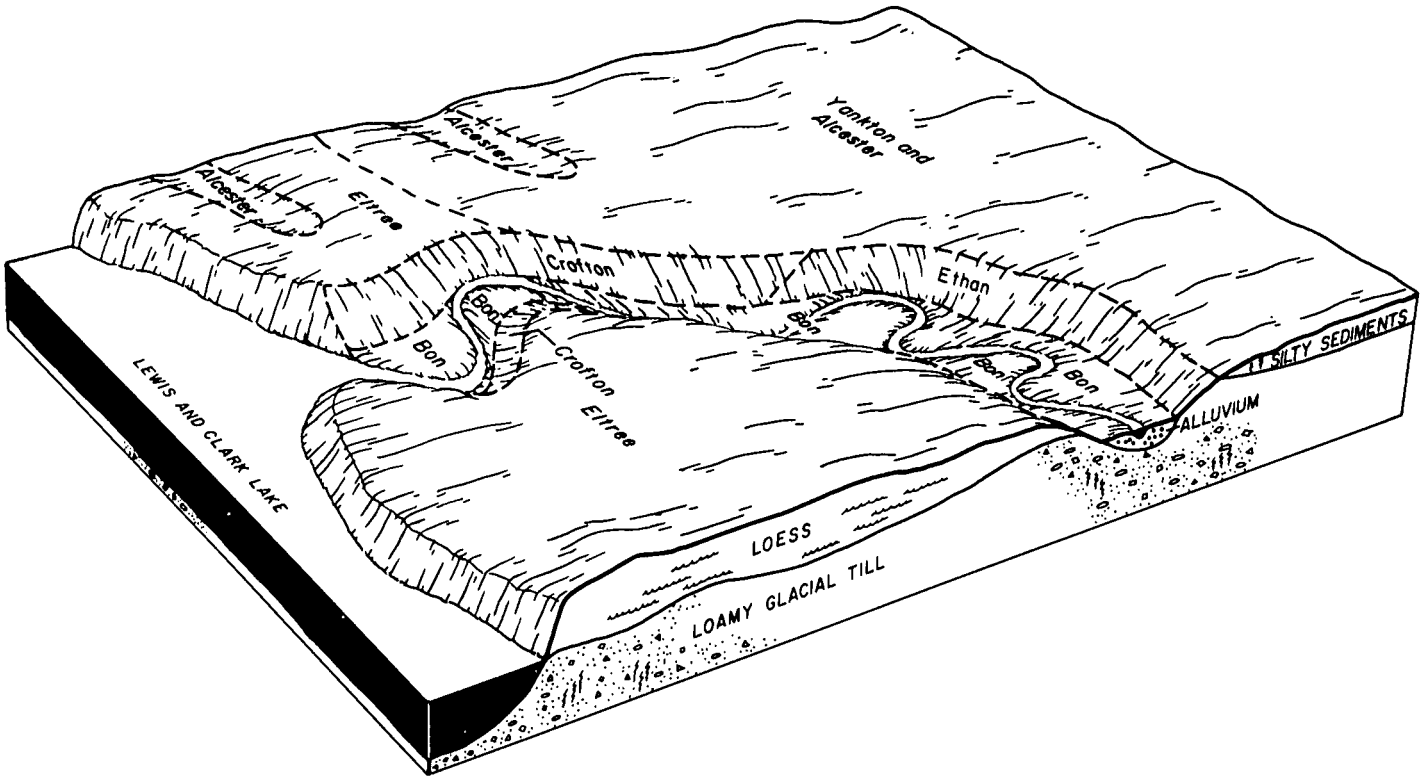

Figure 5.—Pattern of soils and underlying material in the Eltree-Yankton-Alcester association.

gray, calcareous silt loam. The underlying material is light gray, calcareous clay loam.

The moderately well drained Alcester soils are in swales. In this association they have a slope of 0 to 2 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark gray and dark grayish brown silt loam and grayish brown, calcareous silty clay loam. The underlying material is gray, calcareous silty clay loam.

Minor in this association are Betts, Bon, Chancellor, Crofton, Davis, Delmont, Ethan, Tetonka, and Worthing soils. The calcareous Betts, Crofton, and Ethan soils are on ridges and the steeper side slopes. The moderately well drained Bon soils are on the flood plains along small drainageways. The somewhat poorly drained Chancellor soils are in swales. The loamy Davis soils are on foot slopes. Delmont soils are underlain by gravelly material at a depth of 10 to 20 inches. They are in positions on the landscape similar to those of the Eltree and Yankton soils. The poorly drained Tetonka and very poorly drained Worthing soils are in depressions.

About 75 percent of this association is cropland. Corn, oats, alfalfa, soybeans, and grain sorghum are the main crops. The steeper areas support native grasses and are used for grazing. Controlling erosion is the main concern in managing the major soils for crops. These soils are suited to cultivated crops, range, and openland and rangeland wildlife habitat, but the slope of the Eltree soils is a limitation in some areas.

7. Ethan-Bon association

Well drained and moderately well drained, nearly level to steep, loamy soils on uplands, flood plains, and terraces

This association is on side slopes along the smaller drainageways and on flood plains and low terraces along the larger drainageways. Slopes generally are moderately sloping to steep on the side slopes. They are nearly level on the flood plains and terraces. The drainage pattern is well defined.

This association makes up about 9 percent of the county. It is about 40 percent Ethan and similar soils, 25 percent Bon and similar soils, and 35 percent minor soils.

The well drained Ethan soils are on the convex side slopes. In this association they have a slope of 6 to 40 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is light yellowish brown,

calcareous clay loam. The underlying material is pale yellow, mottled, calcareous clay loam.

The well drained and moderately well drained Bon soils are on the flood plains and terraces. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsurface layer is dark gray and gray, calcareous loam. The underlying material is light brownish gray, calcareous loam.

Minor in this association are Boyd, Delmont, Enet, Gavins, Sansarc, and Talmo soils. The moderately deep, clayey Boyd soils, the shallow, loamy Gavins soils, and the shallow, clayey Sansarc soils are on the lower side slopes in the uplands. Delmont, Enet, and Talmo soils are underlain by gravelly material. They are in positions on the landscape similar to those of the Ethan soils.

About 75 percent of this association supports native grasses and is used for grazing. Some areas of the Bon soils are cultivated. Corn, oats, alfalfa, soybeans, and grain sorghum are the main crops. Controlling erosion and runoff is the main concern of management. The major soils are well suited to range and rangeland wildlife habitat. The Bon soils are suited to cultivated crops, but the Ethan soils generally are unsuited because of the slope.

8. Ethan-Boyd-Thurman association

Well drained, moderately sloping to steep, loamy, clayey, and sandy soils on uplands

This association is on breaks along the Missouri River and Choteau Creek. It is characterized by steep slopes and deeply entrenched drainageways. The soils generally are steep or moderately steep but are moderately sloping or strongly sloping in some areas. The drainage pattern is well defined.

This association makes up about 6 percent of the county. It is about 50 percent Ethan and similar soils, 20 percent Boyd soils, 15 percent Thurman soils, and 15 percent minor soils.

The deep, loamy Ethan soils are on side slopes and ridges. In this association they have a slope of 9 to 40 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is light yellowish brown, calcareous clay loam. The underlying material is pale yellow, mottled, calcareous clay loam.

The moderately deep, clayey Boyd soils are on the lower side slopes. Slopes range from 15 to 30 percent. Typically, the surface layer, subsoil, and underlying material are grayish brown, calcareous clay. Below this is light gray and light brownish gray, calcareous shale.

The deep, sandy Thurman soils are on the upper convex side slopes and ridges. Slopes range from 6 to 40 percent. Typically, the surface layer is dark grayish brown loamy sand. The next layer also is dark grayish brown loamy sand. The underlying material is light brownish gray sand and very pale brown and light gray fine sand.

Minor in this association are Delmont, Gavins, and Talmo soils. Delmont and Talmo soils are underlain by gravelly material. They are on ridges. The shallow Gavins soils are in areas below the Boyd soils.

About 95 percent of this association is range. Controlling erosion and runoff is the main concern of management. The major soils are well suited to range and rangeland wildlife habitat. They generally are unsuited to cultivated crops because of the slope.

detailed soil map units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Eltree silt loam, 0 to 2 percent slopes, is one of several phases in the Eltree series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Homme-Ethan-Onita complex, 1 to 6 percent slopes, is an example.

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

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

The names of some of the map units identified on the detailed soil maps do not fully agree with those identified on the maps in the soil surveys of adjacent Charles Mix, Hutchinson, and Yankton Counties. Differences are the result of variations in the design and composition of the map units.

soil descriptions

AaA—Alcester silt loam. This deep, nearly level, moderately well drained soil is in swales and on foot slopes in the uplands. It is occasionally flooded. Areas are 5 to 80 acres in size and are irregularly shaped. Slopes are slightly concave.

Typically, the surface layer is dark grayish brown silt loam about 13 inches thick. The subsoil is about 29 inches thick. It is dark gray and dark grayish brown, friable silt loam over grayish brown, firm silty clay loam. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Chancellor soils in swales. Also included is a soil that has free carbonates throughout and is higher on the landscape than the Alcester soil. Included soils make up less than 15 percent of any one mapped area.

Organic matter content and fertility are high in the Alcester soil. Tilth is good. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 3 to 6 feet in the spring of most years. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage is cropland. This soil is well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture are the main management needs in cultivated areas. Leaving crop residue on the surface is an example. The soil is suited to irrigation. Farming is delayed in some years

when the soil receives runoff from adjacent uplands, but in most years the additional moisture is beneficial.

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

This soil is well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is big bluestem and green needlegrass. Overused areas are dominated by Kentucky bluegrass.

The capability unit is I-3; Overflow range site.

AcA—Alcester-Chancellor complex. These deep, nearly level soils are in swales on uplands. They are frequently flooded. The moderately well drained Alcester soil is in the higher parts of the swales, and the somewhat poorly drained Chancellor soil is in the lower parts. Areas are 5 to 80 acres in size and are long and narrow. They are 45 to 55 percent Alcester soil and 30 to 40 percent Chancellor soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Alcester soil is dark grayish brown silt loam about 13 inches thick. The subsoil is about 29 inches thick. It is dark gray and dark grayish brown, friable silt loam over grayish brown, firm silty clay loam. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam.

Typically, the surface layer of the Chancellor soil is dark gray silty clay loam about 13 inches thick. The subsoil is about 26 inches of gray, olive gray, and light olive gray, mottled, firm silty clay and silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam.

Included with these soils in mapping are small areas of Homme and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The well drained Homme soils are on the higher parts of the landscape. The poorly drained Tetonka soils are in depressions.

Organic matter content and fertility are high in the Alcester and Chancellor soils. Tilth is good in the Alcester soil and fair in the Chancellor soil. Permeability is moderate in the Alcester soil and slow in the Chancellor soil. Available water capacity is high in both soils. The Alcester soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. The Chancellor soil has a seasonal high water table within a depth of 3 feet part of the year. Runoff is slow on both soils. The shrink-swell potential is moderate in the Alcester soil and high in the Chancellor soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth bromegrass. Measures that conserve moisture are the main management needs in cultivated areas of the Alcester soil. Leaving crop residue on the surface is an example. The main management needs in areas of the Chancellor soil are measures that control flooding and improve tilth. Returning crop residue to the soil and delaying tillage when the soil is wet help to prevent deterioration of tilth. Diverting the runoff from adjacent soils and installing surface drains help to control the excess water.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that require an abundant moisture supply grow especially well.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is big bluestem and green needlegrass. Overused areas are dominated by Kentucky bluegrass.

The Alcester soil is in capability unit I-1, the Chancellor soil in capability unit IIw-1; both soils are in Overflow range site.

Bn—Bon loam. This deep, well drained, nearly level soil is on flood plains and low stream terraces. It is occasionally flooded. Areas are 10 to 80 acres in size and are irregular in shape. Slopes are long and smooth.

Typically, the surface layer is dark gray loam about 10 inches thick. The subsurface layer is dark gray and gray, calcareous, stratified loam about 26 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In places the upper 20 inches is noncalcareous.

Included with this soil in mapping are small areas of Enet and Lamo soils. These soils make up less than 15 percent of any one mapped area. Enet soils are underlain by gravelly material. They are slightly higher on the terraces than the Bon soil. The somewhat poorly drained Lamo soils are lower on the flood plains than the Bon soil.

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

Most of the acreage is cropland. This soil is well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, intermediate wheatgrass, and smooth bromegrass. The main management needs in cultivated areas are measures that conserve moisture during dry periods. Leaving crop residue on the surface is an example. Floodwater delays planting in some years, but in most years the additional moisture is beneficial and the flood damage is minor.

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

This soil is well suited to native grasses, but very few areas are used for range. The native vegetation

dominantly is big bluestem. Overused areas are dominanted by western wheatgrass and Kentucky bluegrass. After continued overuse, Kentucky bluegrass and weeds dominate the site.

The capability unit is I-1; Overflow range site.

Bo—Bon loam, channeled. This deep, moderately well drained, nearly level soil is on flood plains that are dissected into many small tracts by narrow channels and partly filled old stream meanders (fig. 6). It is frequently flooded. Areas are 10 to more than 200 acres in size and are long and narrow.

Typically, the surface layer is dark gray loam about 10 inches thick. The subsurface layer is dark gray and gray, calcareous, stratified loam about 26 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In places the upper 20 inches is noncalcareous.

Included with this soil in mapping are small areas of the poorly drained Salmo soils. These soils make up less than 15 percent of any one mapped area. They are on the low parts of the flood plains.

Organic matter content and fertility are high in the Bon soil. Tilth is good. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 2 to 6 feet in the spring of most years. Runoff is slow.

Most of the acreage supports native grasses. This soil is suited to range. The native vegetation dominantly is big bluestem, indiangrass, switchgrass, and deciduous trees. The trees provide protection for wildlife and livestock. Overused areas are dominated by western wheatgrass and Kentucky bluegrass.

This soil generally is unsuited to cultivated crops and to tame pasture and hay because it is dissected into small tracts and is subject to flooding in the spring. It is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. They can be planted by hand. Because of the meandering stream

Figure 6.—A meandering channel in an area of Bon loam, channeled.

channels, however, they generally cannot be planted by machine.

The capability unit is VIw-1; Subirrigated range site.

Br—Bonilla-Crossplain complex. These deep, nearly level soils are in swales on uplands. They are frequently flooded. The moderately well drained Bonilla soil is on the sides of the swales. The somewhat poorly drained Crossplain soil is in the lower parts of the swales. Areas are 15 to 60 acres in size and long and narrow. They are 50 to 60 percent Bonilla soil and 30 to 40 percent Crossplain soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Bonilla soil is dark gray loam about 11 inches thick. The subsoil is dark grayish brown, brown, and light gray, friable clay loam about 25 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam that has accumulations of carbonate. In places salts are at or near the surface. In some areas the depth to free carbonates is more than 40 inches.

Typically, the surface layer of the Crossplain soil is very dark gray clay loam about 9 inches thick. The subsoil is about 28 inches of dark gray, olive gray, and light olive gray, mottled, firm clay and clay loam. The underlying material to a depth of 60 inches is pale olive, mottled, calcareous clay loam that has accumulations of carbonate.

Included with these soils in mapping are small areas of Clarno, Davison, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The well drained Clarno soils are higher on the landscape than the Bonilla and Crossplain soils. Davison soils have free carbonates in the surface layer. They generally are on low rises adjacent to the Crossplain soil. The poorly drained Tetonka soils are in depressions.

Organic matter content and fertility are high in the Bonilla and Crossplain soils. Tilth is good in the Bonilla soil and fair in the Crossplain soil. Permeability is moderate in the upper part of the Bonilla soil and moderately slow in the underlying material. It is slow in the Crossplain soil. Available water capacity is high in both soils. The Bonilla soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. The Crossplain soil has a high seasonal water table within a depth of 3 feet part of the year. Runoff is slow on both soils. The shrink-swell potential is moderate in the Bonilla soil and high in the subsoil of the Crossplain soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth bromegrass. The main management needs in cultivated areas are measures that control the flooding caused by runoff from adjacent soils and that improve tilth. Returning crop residue to the soil and delaying tillage when the soils are wet help to prevent deterioration of tilth. Diverting the runoff from adjacent soils and installing surface drains help to control excess water.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that require an abundant moisture supply grow especially well.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is big bluestem and green needlegrass. Overused areas are dominated by Kentucky bluegrass.

The Bonilla soil is in capability unit I-3, the Crossplain soil in capability unit IIw-1; both soils are in Overflow range site.

BsE—Boyd-Sansarc clays, 15 to 40 percent slopes. These well drained, hilly and steep soils are on uplands. The moderately deep Boyd soil is on the less sloping side slopes and foot slopes. The shallow Sansarc soil is on the steeper side slopes and ridges. Areas are 80 to 800 acres in size and are irregular in shape. They are 45 to 55 percent Boyd soil and 30 to 40 percent Sansarc soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Boyd soil is grayish brown clay about 4 inches thick. The subsoil is grayish brown, firm and very firm, calcareous clay about 13 inches thick. The underlying material is grayish brown, calcareous clay about 7 inches thick. Below this to a depth of 60 inches is light gray and light brownish gray shale that has accumulations of carbonate in the cracks and seams. In places the depth to shale is more than 40 inches.

Typically, the surface layer of the Sansarc soil is grayish brown, calcareous clay about 4 inches thick. The underlying material is light brownish gray, calcareous shaly clay about 12 inches thick. Below this to a depth of 60 inches is light gray shale.

Included with these soils in mapping are small areas of Betts, Crofton, Ethan, Gavins, and Thurman soils. Also included are steep escarpments where shale and siltstone crop out. The included soils and rock outcrops make up less than 20 percent of any one mapped area. The loamy Betts and Ethan soils and the silty Crofton soils are higher on the landscape than the Boyd and Sansarc soils. The loamy Gavins soils are 10 to 20 inches deep over siltstone. They are lower on the landscape than the Boyd and Sansarc soils. The sandy Thurman soils are higher on the landscape than the Boyd and Sansarc soils.

Organic matter content is moderate in the Boyd soil and low in the Sansarc soil. Fertility is medium in the Boyd soil and low in the Sansarc soil. Tilth is poor in both soils. Permeability is slow. Available water capacity

is low in the Boyd soil and very low in the Sansarc soil. Runoff is rapid on both soils. The shrink-swell potential is very high.

Most areas support native grasses. These soils are suited to range. The native vegetation on the Boyd soil dominantly is western wheatgrass, green needlegrass, and big bluestem. That on the Sansarc soil dominantly is little bluestem, green needlegrass, western wheatgrass, and big bluestem. Overused areas are dominated by western wheatgrass, sideoats grama, and blue grama.

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

The Boyd soil is in capability unit VIe-4, Clayey range site; the Sansarc soil is in capability unit VIIe-8, Shallow Clay range site.

CmA—Clarno-Bonilla loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Clarno soil is on slight rises. The moderately well drained Bonilla soil is on flats and in swales (fig. 7). It is occasionally flooded for very brief periods in the spring. Areas are 5 to more than 200 acres in size and are irregular in shape. They are 50 to 60 percent Clarno soil and 20 to 30 percent Bonilla soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is dark grayish brown loam about 8 inches thick. The subsoil is brown and light yellowish brown, friable clay loam about 18 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is light yellowish brown, mottled, calcareous clay loam. In places stratified silt loam, loam, very fine sandy loam, or fine sandy loam is below a depth of 40 inches.

Typically, the surface layer of the Bonilla soil is dark gray loam about 11 inches thick. The subsoil is dark grayish brown, brown, and light gray, friable clay loam about 25 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam that has accumulations of carbonate. In places salts are at or near the surface. In some areas the depth to free carbonates is more than 40 inches.

Included with these soils in mapping are small areas of Crossplain, Davison, and Tetonka soils. Also included, on small flats, are areas of soils that have a sodium affected subsoil. Included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Crossplain soils are in the deeper swales. The

Figure 7.—An area of Clarno-Bonilla loams, 0 to 2 percent slopes. The Clarno soil is on the slight rises, and the Bonilla soil is in the swales.

moderately well drained Davison soils are calcareous throughout. They are in an intermediate position on the landscape between the Bonilla and Clarno soils. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Clarno soil and high in the Bonilla soil. Fertility is medium in the Clarno soil and high in the Bonilla soil. Tilth is good in both soils. Permeability is moderate in the upper part of the profile and moderately slow in the underlying material. Available water capacity is high. The Bonilla soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture are the main management needs in cultivated areas. Leaving crop residue on the surface is an example. Farming is delayed in some years when the Bonilla soil receives runoff from the adjacent uplands, but in most years the additional moisture is beneficial.

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

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The capability unit is I-2; the Clarno soil is in Silty range site, the Bonilla soil in Overflow range site.

CmB—Clarno-Bonilla loams, 2 to 6 percent slopes. These deep, nearly level and undulating soils are on uplands. The well drained Clarno soil is on the upper slopes. The moderately well drained Bonilla soil is in swales. It is occasionally flooded for very brief periods in the spring. Areas are 15 to more than 200 acres in size and are irregular in shape. They are 55 to 65 percent Clarno soil and 15 to 25 percent Bonilla soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is dark grayish brown loam about 8 inches thick. The subsoil is brown and light yellowish brown, friable clay loam about 18 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is light yellowish brown, mottled, calcareous clay loam. In places stratified silt loam, loam, very fine sandy loam, or fine sandy loam is below a depth of 40 inches.

Typically, the surface layer of the Bonilla soil is dark gray loam about 11 inches thick. The subsoil is dark grayish brown, brown, and light gray, friable clay loam about 25 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam that has accumulations of carbonate. In places salts are at or near the surface. In some areas the depth to free carbonates is more than 40 inches.

Included with these soils in mapping are small areas of Crossplain, Ethan, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Crossplain soils are in the deeper swales. Ethan soils have lime near the surface. They are on ridges and knolls. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Clarno soil and high in the Bonilla soil. Fertility is medium in the Clarno soil and high in the Bonilla soil. Tilth is good in both soils. Permeability is moderate in the upper part of the profile and moderately slow in the underlying material. Available water capacity is high. The Bonilla soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. Runoff is medium on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. Contour farming, grassed waterways, and terraces also can help to control erosion, but slopes in some areas are too short or too irregular for contouring and terracing. Farming is delayed in some years because the Bonilla soil receives runoff from the adjacent uplands.

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

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The capability unit is IIe-2; the Clarno soil is in Silty range site, the Bonilla soil in Overflow range site.

CnA—Clarno-Crossplain-Davison complex, 0 to 3 percent slopes. These deep, nearly level soils are in areas on uplands where slopes generally are short and complex (fig. 8). The moderately well drained Clarno soil is on the higher parts of the landscape. The somewhat poorly drained Crossplain soil is in swales. It is frequently flooded for brief periods in the spring. The moderately well drained Davison soil is in areas between the Clarno and Crossplain soils. Areas are 20 to several thousand

Figure 8.—An area of Clarno-Crossplain-Davison complex, 0 to 3 percent slopes.

acres in size and are irregular in shape. They are 40 to 50 percent Clarno soil, 20 to 30 percent Crossplain soil, and 10 to 20 percent Davison soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is dark grayish brown loam about 8 inches thick. The subsoil is brown and light yellowish brown, friable clay loam about 18 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is light yellowish brown, mottled, calcareous clay loam. In places stratified silt loam, loam, very fine sandy loam, or fine sandy loam is below a depth of 40 inches.

Typically, the surface layer of the Crossplain soil is very dark gray clay loam about 9 inches thick. The subsoil is about 28 inches of dark gray, olive gray, and light olive gray, mottled, firm clay and clay loam. The underlying material to a depth of 60 inches is pale olive, mottled, calcareous clay loam that has accumulations of carbonate.

Typically, the surface layer of the Davison soil is grayish brown, calcareous loam about 8 inches thick. The upper part of the underlying material is light brownish gray and pale olive, mottled, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Bonilla, Ethan, and Tetonka soils. Also included, on small flats, are soils that have a sodium affected subsoil. Included soils make up less than 15 percent of any one mapped area. The moderately well drained Bonilla soils are in the broader, less entrenched swales and on foot slopes. The well drained Ethan soils are on knolls. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Clarno and Davison soils and high in the Crossplain soil. Fertility is medium in the Clarno soil, high in the Crossplain soil, and low in the Davison soil. Tilth is good in the Clarno and Davison soils and fair in the Crossplain soil. Permeability is moderate in the upper part of the Clarno and Davison soils and moderately slow in the underlying material. It is slow in the Crossplain soil. Available water capacity is high in all three soils. During wet periods a seasonal high water table is at a depth of 3.0 to 6.0 feet in the Clarno soil, within a depth of 3.0 feet in the Crossplain soil, and at a depth of 1.5 to 6.0 feet in the Davison soil. Runoff is slow or medium on the Clarno and Davison soils and very slow on the Crossplain soil. The shrink-swell potential is moderate in the Clarno and Davison soils and high in the Crossplain soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. If cultivated crops are grown, measures that conserve moisture in the Clarno soil and improve fertility and control wind erosion in areas of the Davison soil are the main management needs. Leaving crop residue on the surface and including grasses and legumes in the cropping system are examples. Diverting the runoff from adjacent soils and installing surface drains help to control excess water on the Crossplain soil.

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

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is big bluestem, little bluestem, and green needlegrass. Overused areas are dominated by Kentucky bluegrass, saltgrass, and weeds.

The Clarno soil is in capability unit I-2, Silty range site; the Crossplain soil is in capability unit IIw-1, Overflow range site; the Davison soil is in capability unit IIe-4, Limy Subirrigated range site.

CsB—Clarno-Ethan-Bonilla loams, 2 to 6 percent slopes. These deep, undulating soils are in areas on uplands where slopes generally are short and complex. The well drained Clarno soil is on smooth side slopes. The well drained Ethan soil is on the upper convex side slopes and narrow ridges. The moderately well drained Bonilla soil is on foot slopes and in swales. It is occasionally flooded for very brief periods in the spring. Areas are 10 to several hundred acres in size and are irregular in shape. They are 40 to 50 percent Clarno soil, 20 to 30 percent Ethan soil, and 15 to 25 percent Bonilla

soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is dark grayish brown loam about 8 inches thick. The subsoil is brown and light yellowish brown, friable clay loam about 18 inches thick. In the lower part it is calcareous and has accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is light yellowish brown, mottled, calcareous clay loam. In places stratified silt loam, loam, very fine sandy loam, or fine sandy loam is below a depth of 40 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Bonilla soil is dark gray loam about 11 inches thick. The subsoil is dark grayish brown, brown, and light gray, friable clay loam about 25 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam that has accumulations of carbonate. In places salts are at or near the surface. In some areas the depth to free carbonates is more than 40 inches.

Included with these soils in mapping are small areas of Crossplain, Davison, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Crossplain soils are in swales. The moderately well drained Davison soils are calcareous throughout. They are in areas between the Clarno and Crossplain soils. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Clarno soil, low in the Ethan soil, and high in the Bonilla soil. Fertility is medium in the Clarno soil, low in the Ethan soil, and high in the Bonilla soil. Tilth is good in all three soils. Permeability is moderate in the upper part of the profile and moderately slow in the underlying material. Available water capacity is high. The Bonilla soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. Runoff is medium on all three soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, smooth bromegrass, and intermediate wheatgrass. The main management needs in cultivated areas are measures that control erosion and conserve moisture. Other management needs are measures that increase the organic matter content and improve the fertility of the Ethan soil. The high content of lime in this soil adversely affects the availability of plant nutrients. In some years planting is delayed because of the wetness of the Bonilla soil. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, increase the organic matter content, and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but slopes in some areas are too short or too irregular for contouring and terracing.

These soils are suited to windbreaks and environmental plantings. Optimum survival, growth, and vigor are unlikely on the Ethan soil, but all climatically suited trees and shrubs grow well on the Clarno and Bonilla soils.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The Clarno soil is in capability unit IIe-2, Silty range site; the Ethan soil is in capability unit IIIe-6, Silty range site; the Bonilla soil is in capability unit IIe-3, Overflow range site.

DaB—Davis loam, 0 to 6 percent slopes. This deep, well drained, nearly level and gently sloping soil is on fans and foot slopes in the uplands. Areas are 5 to 80 acres in size and generally are long and narrow. Most slopes are smooth.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is dark gray, friable loam about 40 inches thick. In the lower part it is calcareous and has soft accumulations of carbonate. The underlying material to a depth of 60 inches is dark gray loam. It is calcareous and has soft accumulations of carbonate. In places the soil is stratified.

Included with this soil in mapping are small areas of Clarno, Lamo, and Salmo soils. These soils make up less than 15 percent of any one mapped area. The dark colors of the Clarno soils do not extend below a depth of 20 inches. The somewhat poorly drained Lamo and poorly drained Salmo soils are on flood plains. Salmo soils have visible salts throughout.

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

Most of the acreage is cropland. This soil is well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage. Contour farming, grassed waterways, and terraces also help to control erosion. The soil is well suited to irrigation.

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

This soil is well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The capability unit is IIe-2; Silty range site.

DaC—Davis loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping and strongly sloping soil is on foot slopes in the uplands. Areas are 10 to 100 acres in size and generally are long and narrow. Most slopes are smooth.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is dark gray, friable loam about 40 inches thick. In the lower part it is calcareous and has soft accumulations of carbonate. The underlying material to a depth of 60 inches is dark gray loam. It is calcareous and has soft accumulations of carbonate. In places the soil is stratified.

Included with this soil in mapping are small areas of Clarno, Ethan, and Lamo soils. These soils make up less than 15 percent of any one mapped area. Clarno and Ethan soils are higher on the landscape than the Davis soil. Also, Ethan soils have a thinner surface layer. They have lime near the surface. The dark colors of the Clarno soils do not extend below a depth of 20 inches. The somewhat poorly drained Lamo soils are on the low parts of flood plains.

Most of the acreage supports native grasses. This soil is suited to range. The native vegetation dominantly is big bluestem, little bluestem, and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

This soil is suited to cultivated crops and to tame pasture and hay, but the slope is a limitation. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that control erosion are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, farming on the contour, terracing, and establishing grassed waterways.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIIe-2; Silty range site.

DlC—Delmont-Talmo loams, 6 to 9 percent slopes. These gently rolling soils are in areas on uplands where slopes generally are short and complex. The somewhat excessively drained Delmont soil is on the sides and tops of the broader ridges. The excessively drained Talmo soil is on the steeper and more convex upper slopes. The Delmont soil is shallow over gravelly sand, and the Talmo soil is very shallow over gravelly sand. Areas are 5 to 50 acres in size and are irregular in shape. They are 45 to 55 percent Delmont soil and 25 to 35 percent Talmo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Delmont soil is very dark grayish brown loam about 8 inches thick. The subsoil is dark grayish brown, very friable loam about 7 inches thick. The underlying material to a depth of 60 inches is brown, calcareous gravelly sand. In places the gravelly sand is below a depth of 20 inches.

Typically, the surface layer of the Talmo soil is very dark grayish brown loam about 5 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand.

Included with these soils in mapping are small areas of Betts and Clarno soils. These included soils make up less than 20 percent of any one mapped area. They formed in glacial till. Betts soils are along the edge of the mapped areas. Clarno soils are on the lower sides of some ridges and knolls.

Fertility is medium in the Delmont soil and low in the Talmo soil. Organic matter content is moderate in both soils. Tilth is good. Permeability is moderate in the subsoil of the Delmont soil and rapid in the underlying material. It is rapid in the Talmo soil. Available water capacity is low in both soils. Runoff is medium.

Most of the acreage supports native grasses. These soils are best suited to range. The native vegetation dominantly is needleandthread and grama grasses. Overused areas are dominated by blue grama, threadleaf sedge, and weeds. If the range is severely overgrazed, the surface is bare in spots.

Because they are droughty, these soils generally are unsuited to cultivated crops, windbreaks and environmental plantings, and tame pasture and hay. Some trees and shrubs can be established for special purposes if they are planted by hand and given special care.

The Delmont soil is in capability unit IVe-4, Shallow to Gravel range site; the Talmo soil is in capability unit VIs-3, Very Shallow range site.

EaA—Eltree silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are 10 to 250 acres in size and are irregular in shape. Slopes generally are smooth.

Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, friable, calcareous silt loam about 27 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam. In places clay loam glacial till is below a depth of 40 inches. In some areas the dark colors do not extend below a depth of 20 inches.

Included with this soil in mapping are small areas of Homme and Crofton soils. These soils make up less than 10 percent of any one mapped area. They are along the edge of the mapped areas. Homme soils contain more clay in the subsoil than the Eltree soil and are underlain by glacial till at a depth of 30 to 50 inches. The surface layer of Crofton soils is thinner than that of the Eltree soil.

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

Most of the acreage is cropland. This soil is well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that control wind erosion are the main management needs in cultivated areas. Leaving crop residue on the surface is an example. The soil is well suited to irrigation.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well.

This soil is well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The capability unit is I-2; Silty range site.

EaB—Eltree silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are 10 to 100 acres in size and are irregular in shape. Slopes generally are smooth.

Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, friable, calcareous silt loam about 27 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam. In places clay loam glacial till is below a depth of 40 inches. In some areas the dark colors do not extend below a depth of 20 inches.

Included with this soil in mapping are small areas of Homme and Crofton soils. These soils make up less than 15 percent of any one mapped area. They are along the edge of the mapped areas. Homme soils contain more clay in the subsoil than the Eltree soil and are underlain by glacial till at a depth of 30 to 50 inches. The surface layer of the Crofton soils is thinner than that of the Eltree soil.

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

Most of the acreage is cropland. This soil is well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alflafa, intermediate wheatgrass, and smooth bromegrass. Measures that control erosion and conserve moisture are the main management needs in cultivated areas. Examples are minimizing tillage and leaving crop residue on the surface. Contour farming, grassed waterways, and terraces also help to control erosion. The soil is well suited to irrigation.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well.

This soil is well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The capability unit is IIe-3; Silty range site.

EbC—Eltree-Ethan complex, 6 to 9 percent slopes. These deep, well drained, gently rolling soils are on uplands. The Eltree soil is on smooth side slopes. The Ethan soil is on the tops and shoulders of ridges. Areas are 10 to 100 acres in size and are irregular in shape. They are 45 to 55 percent Eltree soil and 25 to 35 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eltree soil is dark grayish brown silt loam about 12 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, friable, calcareous silt loam about 27 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam. In places clay loam glacial till is within a depth of 40 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Crofton soils. Also included, on the lower parts of the landscape, are soils that contain more clay in the subsoil than the Eltree soil. Included soils make up less than 20 percent of any one mapped area. The silty Crofton soils are on the higher parts of the landscape. Their surface layer is thinner than that of the Eltree soil.

Organic matter content and fertility are high in the Eltree soil and low in the Ethan soil. Tilth is good in both soils. Permeability is moderate in the Eltree soil. It is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. Available water capacity is high in both soils. Runoff is medium. The shrink-swell potential is moderate in the Ethan soil.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa,

intermediate wheatgrass, and smooth bromegrass. The main concern in managing cultivated areas is controlling erosion. Improving the fertility of the Ethan soil also is a concern. The high content of lime in this soil adversely affects the availability of plant nutrients. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but in some areas the slopes are too short or too irregular for contouring and terracing.

These soils are suited to windbreaks and environmental plantings, but the high content of lime in the Ethan soil is a limitation. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well on the Eltree soil. Trees and shrubs can be established on the Ethan soil, but optimum survival, growth, and vigor are unlikely. Planting on the contour helps to control erosion.

These soils are suited to range. The native vegetation dominantly is big bluestem and little bluestem. Overused areas are dominated by Kentucky bluegrass and weeds.

The Eltree soil is in capability unit IIIe-2, the Ethan soil in capability unit IVe-2; both soils are in Silty range site.

EbE—Eltree-Ethan complex, 9 to 40 percent slopes. These deep, well drained, strongly sloping to steep soils are on uplands. The Eltree soil is on the smooth, less sloping parts of the landscape. The Ethan soil is on ridges and knolls. Areas are 10 to 100 acres in size and are irregular in shape. They are 40 to 50 percent Eltree soil and 25 to 35 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eltree soil is dark grayish brown silt loam about 12 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, friable, calcareous silt loam about 27 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam. In places clay loam glacial till is within a depth of 40 inches. In some areas carbonates are leached to a depth of more than 36 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Bon and Crofton soils. These included soils make up less than 15 percent of any one mapped area. The moderately well drained Bon soils are on flood plains. Crofton soils are on the higher parts of the landscape. Their surface layer is thinner than that of the Eltree soil.

Organic matter content and fertility are high in the Eltree soil and low in the Ethan soil. Permeability is moderate in the Eltree soil. It is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. Available water capacity is high in both soils. Runoff is rapid. The shrink-swell potential is moderate in the Ethan soil.

Most of the acreage supports native grasses. These soils are best suited to range. The native vegetation dominantly is big bluestem and little bluestem. Overused areas are dominated by Kentucky bluegrass and weedy forbs.

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

The capability unit is VIIe-1; Silty range site.

EcD—Eltree-Crofton silt loams, 9 to 15 percent slopes. These deep, well drained, strongly sloping soils are on uplands. The Eltree soil is on the smooth, less sloping parts of the landscape. The Crofton soil is on ridges and knolls. Areas are 15 to 80 acres in size and are irregular in shape. They are 45 to 55 percent Eltree soil and 20 to 30 percent Crofton soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eltree soil is dark grayish brown silt loam about 12 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, friable, calcareous silt loam about 27 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam. In places clay loam glacial till is within a depth of 40 inches. In some areas carbonates are leached to a depth of more than 36 inches.

Typically, the surface layer of the Crofton soil is dark grayish brown silt loam about 4 inches thick. The underlying material to a depth of 60 inches is light gray, light brownish gray, and light yellowish brown, calcareous silt loam.

Included with these soils in mapping are small areas of Bon and Ethan soils. These included soils make up less than 15 percent of any one mapped area. The moderately well drained Bon soils are on flood plains. Ethan soils formed in glacial till. They are on the higher, steeper parts of the landscape.

Organic matter content and fertility are high in the Eltree soil and low in the Crofton soil. Tilth is good in both soils. Permeability is moderate. Available water capacity is high. Runoff is rapid.

Most of the acreage supports native grasses. These soils are suited to range. The native vegetation dominantly is big bluestem, little bluestem, and needlegrasses. Overused areas are dominated by Kentucky bluegrass, blue grama, and weeds.

These soils generally are unsuited to cultivated crops because of the slope. They are suited, however, to tame

pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. If the soil is cultivated, the main concern of management is controlling erosion. Including grasses and legumes in the cropping system, minimizing tillage, and leaving crop residue on the surface help to control erosion and improve fertility. Contour farming, terraces, and grassed waterways also help to control erosion.

The Eltree soil is well suited and the Crofton soil generally unsuited to windbreaks and environmental plantings. Planting on the contour helps to control erosion.

The Eltree soil is in capability unit IVe-1, Silty range site; the Crofton soil is in capability unit VIe-3, Thin Upland range site.

EdA—Enet-Delmont loams, 0 to 2 percent slopes. These nearly level soils are in areas on uplands where slopes generally are long and smooth. The well drained Enet soil is on the side slopes. It is moderately deep over gravelly material. The somewhat excessively drained Delmont soil is on the higher parts of the landscape. It is shallow over gravelly sand. Areas are 5 to 200 acres in size and are irregular in shape. They are 40 to 50 percent Enet soil and 30 to 40 percent Delmont soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Enet soil is dark gray loam about 10 inches thick. The subsoil is dark grayish brown and grayish brown, friable loam about 15 inches thick. It is calcareous in the lower part. The upper part of the underlying material is brown, calcareous gravelly loamy sand. The lower part to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the soil contains more sand between depths of 10 and 40 inches.

Typically, the surface layer of the Delmont soil is very dark grayish brown loam about 8 inches thick. The subsoil is dark grayish brown, very friable loam about 7 inches thick. The underlying material to a depth of 60 inches is brown, calcareous gravelly sand. In places the gravelly sand is within a depth of 10 inches.

Included with these soils in mapping are small areas of Clarno and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. Clarno soils are not underlain by gravelly sand. They are in positions on the landscape similar to those of the Enet and Delmont soils. The poorly drained Tetonka soils are in depressions. They are not underlain by gravel.

Organic matter content is moderate and fertility medium in the Enet and Delmont soils. Tilth is good. Permeability is moderate in the upper part of the soils and rapid in the underlying sand and gravel. Available water capacity is low. Runoff is slow.

Most of the acreage is cropland. These soils are suited to cultivated crops, but they are droughty. They are better suited to small grain and grasses than to late maturing crops, such as corn. Measures that conserve moisture are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system. The soils are well suited to irrigation.

These soils are suited to tame pasture and hay. Only drought resistant grasses, however, are suitable. Crested wheatgrass and pubescent wheatgrass are examples.

These soils are suited to native grasses, but they are droughty. Very few areas are used for range. The native vegetation dominantly is bluestems and needlegrasses. Overused areas are dominated by western wheatgrass, blue grama, and threadleaf sedge. After continued overuse, Kentucky bluegrass, blue grama, and weeds dominate the site.

These soils are suited to windbreaks and environmental plantings, but the droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The Enet soil is in capability unit IIs-3, Silty range site; the Delmont soil is in capability unit IIIs-3, Shallow to Gravel range site.

EdB—Enet-Delmont loams, 2 to 6 percent slopes. These undulating soils are in areas on uplands where slopes generally are short and complex. The well drained Enet soil is on side slopes. It is moderately deep over gravelly material. The somewhat excessively drained Delmont soil is on the steeper slopes and on knolls. It is shallow over gravelly sand. Areas are 5 to 200 acres in size and are irregular in shape. They are 40 to 50 percent Enet soil and about 30 to 40 percent Delmont soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Enet soil is dark gray loam about 10 inches thick. The subsoil is dark grayish brown and grayish brown, friable loam about 15 inches thick. It is calcareous in the lower part. The upper part of the underlying material is brown, calcareous gravelly loamy sand. The lower part to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the soil contains more sand between depths of 10 and 40 inches.

Typically, the surface layer of the Delmont soil is very dark grayish brown loam about 8 inches thick. The subsoil is dark grayish brown, very friable loam about 7 inches thick. The underlying material to a depth of about 60 inches is brown, calcareous gravelly sand. In places the gravelly sand is within a depth of 10 inches.

Included with these soils in mapping are small areas of Clarno and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. Clarno soils are not underlain by gravelly sand. They are in positions on the landscape similar to those of the Enet

soil. The poorly drained Tetonka soils are in depressions. They are not underlain by gravel.

Organic matter content is moderate and fertility medium in the Enet and Delmont soils. Tilth is good. Permeability is moderate in the upper part of the soils and rapid in the underlying sand and gravel. Available water capacity is low. Runoff is medium.

Most of the acreage is cropland. These soils are suited to cultivated crops, but they are droughty. They are better suited to small grain and grasses than to late maturing crops, such as corn. Measures that conserve moisture and control erosion are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system.

A cover of tame pasture plants or hay is effective in controlling erosion, but these soils are only fairly well suited to tame pasture and hay. Only drought resistant grasses are suitable. Crested wheatgrass and pubescent wheatgrass are examples.

These soils are suited to native grasses, but they are droughty. Very few areas are used for range. The native vegetation dominantly is bluestems and needlegrasses. Overused areas are dominated by western wheatgrass, blue grama, and threadleaf sedge. After continued overuse, Kentucky bluegrass, blue grama, and weeds dominate the site.

These soils are suited to windbreaks and environmental plantings, but the droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The Enet soil is in capability unit IIIs-2, Silty range site; the Delmont soil is in capability unit IVs-2, Shallow to Gravel range site.

EhB—Ethan-Alcester complex, 1 to 6 percent slopes. These deep, nearly level and undulating soils are on uplands. The well drained Ethan soil is on knolls. The moderately well drained Alcester soil is in swales. It is occasionally flooded for brief periods in the spring. Areas are 10 to 100 acres in size and are irregular in shape. They are 40 to 50 percent Ethan soil and 30 to 40 percent Alcester soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Alcester soil is dark grayish brown silt loam about 13 inches thick. The subsoil is about 29 inches thick. It is dark gray and dark grayish brown, friable silt loam over grayish brown, firm silty clay loam. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam.

Included with these soils in mapping are small areas of Chancellor and Clarno soils. These included soils make up less than 20 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales. The well drained Clarno soils are on side slopes. They are deeper to free carbonates than the Ethan soil.

Organic matter content and fertility are low in the Ethan soil and high in the Alcester soil. Tilth is good in both soils. Permeability is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. It is moderate in the Alcester soil. Available water capacity is high in both soils. The Alcester soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. Runoff is medium on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are suited to cultivated crops. The main concerns of management are controlling erosion and conserving moisture. Improving fertility also is a concern in areas of the Ethan soil. The high content of lime in the surface layer of this soil adversely affects the availability of plant nutrients. Farming is delayed in some years when the Alcester soil receives runoff from the adjacent uplands. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but in some areas slopes are too short or too irregular for contouring and terracing.

These soils are suited to tame pasture and hay. All climatically suited pasture plants grow well on the Alcester soil, but they do not grow so well on the Ethan soil because of the high content of lime in the surface layer. The best suited pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is big bluestem, little bluestem, and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

These soils are suited to windbreaks and environmental plantings, but the high content of lime in the surface layer of the Ethan soil is a limitation. Trees and shrubs can be established on the Ethan soil, but optimum survival, growth, and vigor are unlikely. The species that require an abundant supply of moisture grow especially well on the Alcester soil.

The Ethan soil is in capability unit IIIe-6, the Alcester soil in capability unit IIe-1; both soils are in Silty range site.

EhC—Ethan-Alcester complex, 1 to 9 percent slopes. These deep, nearly level to gently rolling soils are on uplands. The well drained Ethan soil is on knolls.

The moderately well drained Alcester soil is in swales. It is occasionally flooded for brief periods in the spring. Areas are 10 to 100 acres in size and are irregular in shape. They are 40 to 50 percent Ethan soil and 30 to 40 percent Alcester soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, mottled, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Alcester soil is dark grayish brown silt loam about 13 inches thick. The subsoil is about 29 inches thick. It is dark gray and dark grayish brown, friable silt loam over grayish brown, firm silty clay loam. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam.

Included with these soils in mapping are small areas of Chancellor and Clarno soils. These included soils make up less than 20 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales. The well drained Clarno soils are on side slopes. They are deeper to free carbonates than the Ethan soil.

Organic matter content and fertility are low in the Ethan soil and high in the Alcester soil. Tilth is good in both soils. Permeability is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. It is moderate in the Alcester soil. Available water capacity is high in both soils. The Alcester soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. Runoff is medium on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are suited to cultivated crops. The main concern of management is controlling erosion. Improving fertility also is a concern because the high content of lime in the surface layer of the Ethan soil adversely affects the availability of plant nutrients. Farming is delayed in some years when the Alcester soil receives runoff from the adjacent uplands. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and improve fertility. Contour farming, terraces, and grassed waterways also can help to control erosion, but in some areas slopes are too short or too irregular for contouring and terracing.

These soils are suited to tame pasture and hay. All climatically suited pasture plants grow well on the Alcester soil, but they do not grow so well on the Ethan soil because of the high content of lime in the surface layer. The best suited pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

These soils are suited to windbreaks and environmental plantings, but the high content of lime in the surface layer of the Ethan soil is a limitation. Trees and shrubs can be established on the Ethan soil, but optimum survival, growth, and vigor are unlikely. The species that require an abundant supply of moisture grow especially well on the Alcester soil.

The Ethan soil is in capability unit IVe-2, the Alcester soil in capability unit IIe-1; both soils are in Silty range site.

EmE—Ethan-Betts loams, 15 to 40 percent slopes. These deep, well drained, moderately steep and steep soils are on the sides of drainageways and the upper parts of the breaks along the Missouri River. In places stones and boulders are on the surface. The Ethan soil is on the less steep side slopes. The Betts soil is on the steeper knolls and ridges. Areas are 15 to 250 acres in size and are irregular in shape. They are 45 to 55 percent Ethan soil and 25 to 35 percent Betts soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam.

Typically, the surface layer of the Betts soil is dark grayish brown, calcareous loam about 4 inches thick. The next 5 inches is pale brown, mottled, friable, calcareous loam. The underlying material to a depth of 60 inches is light brownish gray and light gray, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Bon, Davis, Gavins, and Talmo soils. These included soils make up less than 20 percent of any one mapped area. The moderately well drained Bon soils are on narrow flood plains. Davis soils are on toe slopes. They are dark to a depth of more than 20 inches. Gavins soils are underlain by siltstone within a depth of 20 inches. They are on the lower parts of the landscape. Talmo soils have gravelly sand within a depth of 14 inches. They are on knolls and ridges.

Organic matter content and fertility are low in the Ethan and Betts soils. Permeability is moderate in the upper part of the soils and moderately slow in the underlying material. Available water capacity is high. Runoff is rapid. The shrink-swell potential is moderate.

Most of the acreage supports native grasses. These soils are best suited to range. The native vegetation dominantly is big bluestem, little bluestem, and needlegrasses. Overused areas are dominated by blue grama, Kentucky bluegrass, and weeds. Many areas in

the deeper drainageways are suitable sites for stock water impoundments.

These soils generally are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Some of the wooded draws provide habitat for wildlife, such as deer, rabbits, ring-necked pheasant, grouse, and quail (fig. 9).

The Ethan soil is in capability unit VIe-3, Silty range site; the Betts soil is in capability unit VIIe-1, Thin Upland range site.

EnC—Ethan-Bonilla loams, 1 to 9 percent slopes. These deep, nearly level to gently rolling soils are on uplands (fig. 10). The well drained Ethan soil is on knolls. The moderately well drained Bonilla soil is in swales. It is occasionally flooded for very brief periods in the spring. Areas are 5 to 80 acres in size and are irregular in shape. They are 50 to 60 percent Ethan soil and 25 to 35 percent Bonilla soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Bonilla soil is dark gray loam about 11 inches thick. The subsoil is dark grayish brown, brown, and light gray, friable clay loam about 25 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam that has accumulations of carbonate.

Included with these soils in mapping are small areas of Clarno, Crossplain, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The well drained Clarno soils are on side slopes. They are deeper to free carbonates than the Ethan soil. The somewhat poorly drained Crossplain soils are in swales. The poorly drained Tetonka soils are in depressions.

Organic matter content and fertility are low in the Ethan soil and high in the Bonilla soil. Tilth is good in both soils. Permeability is moderate in the upper part of the soils and moderately slow in the underlying material. Available water capacity is high. The Bonilla soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. Runoff is medium on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are suited to cultivated crops. The main concerns of management are controlling erosion and improving fertility. The high content of lime in the surface layer of

Figure 9.—An area of Ethan-Betts loams, 15 to 40 percent slopes. This area provides habitat for wildlife. Bon loam is on the right.

Figure 10.—An area of Ethan-Bonilla loams, 1 to 9 percent slopes. The Ethan soil is on the upper slopes, and the Bonilla soil is in the swales.

the Ethan soil adversely affects the availability of plant nutrients. Farming is delayed in some years when the Bonilla soil receives runoff from the adjacent uplands. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and improve fertility. Contour farming, terraces, and grassed waterways also can help to control erosion, but in most areas slopes are too short or too irregular for contouring and terracing.

These soils are suited to windbreaks and environmental plantings, but the high content of lime in the surface layer of the Ethan soil is a limitation. Trees and shrubs can be established on the Ethan soil, but optimum survival, growth, and vigor are unlikely. The species that require an abundant supply of moisture grow especially well on the Bonilla soil.

These soils are well suited to range. The native vegetation dominantly is big bluestem, little bluestem, and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The Ethan soil is in capability unit IVe-2. Silty range site the Bonilla soil is in capability unit IIe-1, Overflow range site.

EoD—Ethan-Davis loams, 9 to 15 percent slopes. These deep, well drained, rolling soils are in areas on uplands where slopes generally are short and complex. The Ethan soil is steeper than the Davis soil and is higher on the landscape. The Davis soil is on the lower side slopes and on toe slopes. Scattered glacial stones commonly are on the surface. Areas are 15 to 100 acres in size and are irregular in shape. They are 45 to 55 percent Ethan soil and 35 to 45 percent Davis soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous

clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Davis soil is very dark grayish brown loam about 10 inches thick. The subsoil is dark gray, friable loam about 40 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is dark gray loam. It is calcareous and has soft accumulations of carbonate. In places it is stratified.

Included with these soils in mapping are small areas of Talmo and Thurman soils. These included soils make up less than 10 percent of any one mapped area. They are on the upper parts of the landscape. Talmo soils have gravelly sand within a depth of 14 inches. Thurman soils are sandy throughout.

Organic matter content and fertility are low in the Ethan soil and high in the Davis soil. Tilth is good in both soils. Permeability is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. It is moderate in the Davis soil. Available water capacity is high in both soils. Runoff is moderate. The shrink-swell potential also is moderate.

Most areas support native grasses. These soils are suited to range. The native vegetation dominantly is big bluestem, little bluestem, and needlegrasses. Overused areas are dominated by Kentucky bluegrass and weeds.

These soils are suited to tame pasture and hay, but the high content of lime in the surface layer of the Ethan soil is a limitation. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable pasture plants.

These soils generally are unsuited to cultivated crops and windbreaks and environmental plantings because of the slope. Climatically suited trees and shrubs can be established for special purposes on the Davis soil if they are planted by hand and given special care.

The Ethan soil is in capability unit VIe-3, the Davis soil in capability unit IVe-1; both soils are in Silty range site.

EpC—Ethan-Homme complex, 6 to 9 percent slopes. These deep, well drained, gently rolling soils are in areas on uplands where slopes generally are short and complex. The Ethan soil is on knolls and ridges. The Homme soil is on side slopes. Areas are 5 to 80 acres in size and are long and narrow or irregular in shape. They are about 45 to 55 percent Ethan soil and 25 to 35 percent Homme soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 8 inches thick. The subsoil is brown, light olive brown, and light yellowish brown, firm silty clay loam about 28 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Chancellor, Davison, Onita, and Tetonka soils. These included soils make up less than 10 percent of any one mapped area. The somewhat poorly drained Chancellor and moderately well drained Onita soils are in swales. The moderately well drained Davison soils are at the base of some slopes. The poorly drained Tetonka soils are in depressions.

Organic matter content and fertility are low in the Ethan soil. Organic matter content is moderate and fertility medium in the Homme soil. Tilth is good in both soils. Permeability is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. It is moderately slow in the Homme soil. Available water capacity is high in both soils. Runoff is medium. The shrink-swell potential is moderate in the Ethan soil. It is high in the subsoil of the Homme soil and moderate in the underlying material.

Most of the acreage is cropland. These soils are suited to cultivated crops. The main concerns of management are controlling erosion and improving fertility. The high content of lime in the surface layer of the Ethan soil adversely affects the availability of plant nutrients. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but in some areas slopes are too short or too irregular for contouring and terracing.

These soils are suited to tame pasture and hay. All climatically suited pasture plants grow well on the Homme soil, but they do not grow so well on the Ethan soil because of the high content of lime in the surface layer. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass.

These soils are suited to range. The native vegetation dominantly is bluestems and needlegrasses. Overused areas are dominated by Kentucky bluegrass and weeds.

These soils are suited to windbreaks and environmental plantings, but the high content of lime in the surface layer of the Ethan soil is a limitation. All climatically suited trees and shrubs grow well on the Homme soil, but optimum growth and survival are unlikely on the Ethan soil. Planting on the contour helps to control erosion.

The Ethan soil is in capability unit IVe-2, the Homme soil in capability unit IIIe-2; both soils are in Silty range site.

Fv—Fluvaquents, ponded. These level, very poorly drained alluvial soils are on flood plains along the

Missouri River. They are ponded when the water level of Lewis and Clark Lake is high. Areas are 10 to several hundred acres in size and are oblong.

Typically, the surface layer is light colored loamy material about 6 inches thick. The underlying material to a depth of 60 inches is light colored, stratified, and loamy. In some areas the surface layer and underlying material are fine sand.

A water table is within a depth of 2 feet when the water level in Lewis and Clark Lake is low. As much as 2 feet of water ponds on the surface when the water level in the lake is high.

Included with these soils in mapping are small areas of the sandy Sarpy and loamy Waubonsie soils. These soils do not have a water table within a depth of 3 feet and are not ponded. They are higher on the landscape than the Fluvaquents.

Nearly all areas support aquatic vegetation and are used as wetland wildlife habitat. The native vegetation dominantly is cattail, reedgrass, rushes, and willow.

These soils are well suited to wetland wildlife habitat. Because of the ponding, however, they are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIIIw-1; no range site is assigned.

GeE—Gavins-Ethan loams, 15 to 40 percent slopes. These well drained, moderately steep and steep soils are on the breaks along the Missouri River. The shallow Gavins soil is on the short lower side slopes. The deep Ethan soil is on the upper slopes. In some areas scattered stones and boulders are on the surface. Areas are 10 to 80 acres in size and are irregular in shape. They are 40 to 50 percent Gavins soil and 25 to 35 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Gavins soil is grayish brown, calcareous loam about 5 inches thick. The next 5 inches is very pale brown, calcareous silt loam. The underlying material, to a depth of about 16 inches, is very pale brown, calcareous silt loam. Very pale brown siltstone is at a depth of about 16 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Crofton, Davis, Redstoe Variant, Talmo, and Thurman soils. These included soils make up less than 20 percent of any one mapped area. The deep, silty Crofton soils formed in loess. They are on the upper part of some ridges. The deep Davis soils have dark colors that extend below a depth of 20 inches. They are on toe slopes. Redstoe Variant soils are more than 60 inches deep over siltstone. They are on the lower, less sloping parts of the landscape. Talmo soils have gravelly sand within a depth of 14 inches. Thurman soils are sandy. Talmo and Thurman soils occur in a random pattern throughout some mapped areas.

Organic matter content and fertility are low in the Gavins and Ethan soils. Permeability is moderate above the siltstone in the Gavins soil. It is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. Available water capacity is low in the Gavins soil and high in the Ethan soil. Runoff is rapid on both soils. The shrink-swell potential is low in the Gavins soil and moderate in the Ethan soil.

Most areas support native grasses. These soils are best suited to range. The native vegetation dominantly is little bluestem, big bluestem, and needlegrasses. Overused areas are dominated by Kentucky bluegrass, blue grama, and weeds.

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

The capability unit is VIIe-1; the Gavins soil is in Thin Upland range site, the Ethan soil in Silty range site.

GrA—Graceville silty clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces. Areas are 5 to 60 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown silty clay loam about 18 inches thick. The subsoil is dark brown, brown, and light yellowish brown, friable and firm silty clay loam about 32 inches thick. The underlying material to a depth of 60 inches is dark yellowish brown and yellowish brown gravelly sand. In places the gravelly sand is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Delmont, Enet, and Onita soils. These soils make up less than 15 percent of any one mapped area. The somewhat excessively drained Delmont soils are on ridges. They have gravelly sand at a depth of 10 to 20 inches. Enet soils contain less silt and more sand in the subsoil than the Graceville soil. They are in positions on the landscape similar to those of the Graceville soil. The moderately well drained Onita soils are in swales.

Organic matter content and fertility are high in the Graceville soil. Tilth is good. Permeability is moderate in the subsoil and rapid in the underlying gravelly sand. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage is cropland. This soil is well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture are the main management needs in cultivated areas. Leaving crop

residue on the surface is an example. The soil is well suited to irrigation.

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

This soil is well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and needlegrasses. Overused areas are dominated by Kentucky bluegrass and weeds.

The capability unit is I-3; Silty range site.

HmA—Homme-Davison-Tetonka complex, 0 to 3 percent slopes. These deep, nearly level soils are in areas on uplands where slopes generally are short and complex. The moderately well drained Homme soil is on slight rises. The moderately well drained Davison soil is in areas that border narrow swales and small depressions. The poorly drained Tetonka soil is in small depressions. It is ponded during periods of snowmelt and heavy rainfall. Areas are 40 to several hundred acres in size and are irregular in shape. They are 40 to 50 percent Homme soil, 15 to 25 percent Davison soil, and 10 to 20 percent Tetonka soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 8 inches thick. The subsoil is brown, light olive brown, and light yellowish brown, firm silty clay loam about 28 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam.

Typically, the surface layer of the Davison soil is dark grayish brown, calcareous loam about 8 inches thick. The upper part of the underlying material is light brownish gray and pale olive, calcareous loam. The lower part to a depth of 60 inches is light yellowish brown, mottled, calcareous clay loam.

Typically, the surface layer of the Tetonka soil is dark grayish brown silt loam about 9 inches thick. The subsurface layer is light gray, mottled silt loam about 7 inches thick. The subsoil is about 35 inches of gray and dark gray, firm and very firm, mottled silty clay loam and silty clay. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of the moderately well drained Onita soils in swales. These included soils make up less than 10 percent of any one mapped area. They have dark colors that extend below a depth of 20 inches.

Organic matter content is moderate in the Homme, Davison, and Tetonka soils. Fertility is medium in the Homme and Tetonka soils and low in the Davison soil. Tilth is good in all three soils. Permeability is moderately slow in the Homme soil, is moderate in the upper part of the Davison soil and moderately slow in the lower part, and is very slow in the Tetonka soil. Available water capacity is high in all three soils. The Homme soil has a seasonal high water table at a depth of 3.0 to 6.0 feet during wet periods. The Davison soil has a seasonal high water table at a depth of 1.5 to 6.0 feet during wet periods. The Tetonka soil has a seasonal high water table within a depth of 1.0 foot part of the year. As much as 1.0 foot of water ponds on the surface of this soil during wet periods. Runoff is slow on the Homme and Davison soils and ponded on the Tetonka soil. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is moderate in the Davison soil and high in the Tetonka soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Farming is delayed some years because of the wetness on the Tetonka soil. The high content of lime in the Davison soil adversely affects the availability of plant nutrients. Measures that conserve moisture in the Homme soil, improve fertility and control wind erosion in areas of the Davison soil, and control the wetness of the Tetonka soil are the main management needs. Leaving crop residue on the surface and including grasses and legumes in the cropping system conserve moisture, improve fertility, and help to control wind erosion. Diverting the runoff from adjacent soils and installing surface drains help to control the excess water on the Tetonka soil.

The Homme and Davison soils are well suited and the Tetonka soil generally unsuited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well on the Homme and Davison soils, but optimum growth and survival are unlikely on the Tetonka soil unless it is drained.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems, needlegrasses, and western wheatgrass. Overused areas are dominated by blue grama, foxtail barley, saltgrass, and weeds.

The Homme soil is in capability unit I-2, Silty range site; the Davison soil is in capability unit IIe-4, Limy Subirrigated range site; the Tetonka soil is in capability unit IIw-4 if drained and in Wet Meadow range site.

HnB—Homme-Ethan-Onita complex, 1 to 6 percent slopes. These deep, nearly level and undulating soils are in areas on uplands where slopes generally are short and complex. The well drained Homme soil is on smooth side slopes. The well drained Ethan soil is on the upper convex side slopes and on narrow ridges. The moderately well drained Onita soil is on foot slopes and in swales. It is occasionally flooded for brief periods in the spring. Areas are 30 to 300 acres in size and are irregular in shape. They are 40 to 50 percent Homme

soil, 20 to 30 percent Ethan soil, and 10 to 20 percent Onita soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 8 inches thick. The subsoil is brown, light olive brown, and light yellowish brown, firm silty clay loam about 28 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Onita soil is very dark grayish brown silty clay loam about 15 inches thick. The subsoil is dark grayish brown, very dark grayish brown, and light olive brown, firm silty clay loam about 31 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam and clay loam. It is mottled in the lower part.

Included with these soils in mapping are small areas of Chancellor, Davison, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in the deeper swales. The moderately well drained Davison soils are on foot slopes. They are calcareous throughout. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Homme soil, low in the Ethan soil, and high in the Onita soil. Fertility is medium in the Homme soil, low in the Ethan soil, and high in the Onita soil. Tilth is good in the Homme and Ethan soils and fair in the Onita soil. Permeability is moderately slow in the Homme and Onita soils. It is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. Available water capacity is high in all three soils. The Onita soil has a seasonal high water table at a depth of 2.5 to 6.0 feet during wet periods. Runoff is medium on all three soils. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is moderate in the Ethan soil and high in the Onita soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. The main concerns of management in cultivated areas are controlling erosion and conserving moisture. Increasing the organic matter content and improving fertility also are concerns in areas of the Ethan soil. The high content of lime in this soil adversely affects the availability of plant nutrients. In some years planting is delayed because of the wetness of the Onita soil. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but in some areas slopes are too short or too irregular for contouring and terracing.

These soils are suited to windbreaks and environmental plantings, but the high content of lime in the surface layer of the Ethan soil is a limitation. All climatically suited trees and shrubs grow well on the Homme and Onita soils. No trees and shrubs grow well on the Ethan soil. Optimum survival, growth, and vigor are unlikely.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The Homme soil is in capability unit IIe-3, Silty range site; the Ethan soil is in capability unit IIIe-6, Silty range site; and the Onita soil is in capability unit I-3, Overflow range site.

HpB—Homme-Ethan-Tetonka complex, 0 to 6 percent slopes. These deep, level and undulating soils are in areas on uplands where slopes generally are short and complex. The well drained Homme soil is on smooth side slopes. The well drained Ethan soil is on the upper convex side slopes and on narrow ridges. The poorly drained Tetonka soil is in depressions. It is ponded during periods of snowmelt and heavy rainfall. Areas are 25 to 500 acres in size and are irregular in shape. They are 45 to 55 percent Homme soil, 20 to 30 percent Ethan soil, and 10 to 20 percent Tetonka soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 8 inches thick. The subsoil is brown, light olive brown, and light yellowish brown, firm silty clay loam about 28 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Tetonka soil is dark gray silt loam about 6 inches thick. The subsurface layer is gray, mottled silt loam about 5 inches thick. The subsoil is about 35 inches of gray and dark gray, firm and very firm, mottled silty clay loam and silty clay. The

underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Chancellor, Davison, and Onita soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales. The moderately well drained Davison soils border narrow swales and small depressions. They are calcareous throughout. The moderately well drained Onita soils are in swales.

Organic matter content is moderate in the Homme and Tetonka soils and low in the Ethan soil. Fertility is medium in the Homme and Tetonka soils and low in the Ethan soil. Tilth is good in all three soils. Permeability is moderately slow in the Homme soil. It is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. It is very slow in the Tetonka soil. Available water capacity is high in all three soils. The Tetonka soil has a seasonal high water table within a depth of 1 foot most of the year. As much as 1 foot of water ponds on the surface of this soil during some wet periods. Runoff is medium on the Homme and Ethan soils and ponded on the Tetonka soil. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is moderate in the Ethan soil and high in the Tetonka soil.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. The main concern of management in cultivated areas is controlling erosion. Improving fertility in the Ethan soil and controlling the ponding on the Tetonka soil also are management concerns. The high content of lime in the surface layer of the Ethan soil adversely affects the availability of plant nutrients. Leaving crop residue on the surface and including grasses and legumes in the cropping system help to control erosion and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but slopes generally are too short or too irregular for contouring and terracing. Surface drains and measures that divert the runoff from adjacent soils help to control the excess water on the Tetonka soil.

The Homme and Ethan soils are suited and the Tetonka soil generally unsuited to windbreaks and environmental plantings. The high content of lime in the surface layer of the Ethan soil and the ponding on the Tetonka soil are limitations. All climatically suited trees and shubs grow well on the Homme soil, but optimum growth and survival are unlikely on the Ethan and Tetonka soils.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems, green needlegrass, and western wheatgrass. Overused areas are dominated by Kentucky bluegrass, foxtail barley, and weeds.

The Homme soil is in capability unit IIe-3, Silty range site; the Ethan soil is in capability unit IIIe-6, Silty range site; the Tetonka soil is in capability unit IIw-1 if drained and in Wet Meadow range site.

HpC—Homme-Ethan-Tetonka complex, 0 to 9 percent slopes. These deep, level to gently rolling soils are in areas on uplands where slopes generally are short and complex. The well drained Homme soil is on smooth side slopes. The well drained Ethan soil is on the upper convex side slopes and on narrow ridges. The poorly drained Tetonka soil is in depressions. It is ponded during periods of snowmelt and heavy rainfall. Areas are 40 to 400 acres in size and are irregular in shape. They are 40 to 50 percent Homme soil, 25 to 35 percent Ethan soil, and 10 to 20 percent Tetonka soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 8 inches thick. The subsoil is brown, light olive brown, and light yellowish brown, firm silty clay loam about 28 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Tetonka soil is dark grayish brown silt loam about 9 inches thick. The subsurface layer is light gray, mottled silt loam about 7 inches thick. The subsoil is about 35 inches of gray and dark gray, mottled, firm and very firm silty clay loam and silty clay. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Chancellor, Davison, and Onita soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales. The moderately well drained Davison soils border narrow swales and small depressions. They are calcareous throughout. The moderately well drained Onita soils are in swales.

Organic matter content is moderate in the Homme and Tetonka soils and low in the Ethan soil. Fertility is medium in the Homme and Tetonka soils and low in the Ethan soil. Tilth is good in all three soils. Permeability is moderately slow in the Homme soil. It is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. It is very slow in the Tetonka soil. Available water capacity is high in all three soils. The Tetonka soil has a seasonal high water table within a depth of 1 foot most of the year. As much as 1 foot of

water ponds on the surface of this soil during some wet periods. Runoff is medium on the Homme and Ethan soils and ponded on the Tetonka soil. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is moderate in the Ethan soil and high in the Tetonka soil.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. The main concern of management in cultivated areas is controlling erosion. Improving fertility in the Ethan soil and controlling the ponding on the Tetonka soil also are management concerns. The high content of lime in the surface layer of the Ethan soil adversely affects the availability of plant nutrients. Leaving crop residue on the surface and including grasses and legumes in the cropping system help to control erosion and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but slopes generally are too short or too irregular for contouring and terracing. Surface drains and measures that divert the runoff from adjacent soils help to control the excess water on the Tetonka soil.

The Homme and Ethan soils are suited and the Tetonka soil generally unsuited to windbreaks and environmental plantings. The high content of lime in the surface layer of the Ethan soil and the ponding on the Tetonka soil are limitations. All climatically suited trees and shrubs grow well on the Homme soil, but optimum growth and survival are unlikely on the Ethan and Tetonka soils. Planting on the contour helps to control erosion.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems, green needlegrass, and western wheatgrass. Overused areas are dominated by Kentucky bluegrass, foxtail barley, and weeds.

The Homme soil is in capability unit IIIe-2, Silty range site; the Ethan soil is in capability unit IVe-2, Silty range site; the Tetonka soil is in capability unit IIw-1 if drained and in Wet Meadow range site.

HrA—Homme-Onita silty clay loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Homme soil is on slight rises. The moderately well drained Onita soil is on flats and in swales. It is occasionally flooded for brief periods in the spring. Areas are 10 to more than 200 acres in size and are irregular in shape. They are 55 to 65 percent Homme soil and 20 to 30 percent Onita soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 8 inches thick. The subsoil is brown, light olive brown, and light yellowish brown, firm silty clay loam about 28 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam.

Typically, the surface layer of the Onita soil is very dark grayish brown silty clay loam about 15 inches thick. The subsoil is dark grayish brown, very dark grayish brown, and light olive brown, firm silty clay loam about 31 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam and clay loam. It is mottled in the lower part.

Included with these soils in mapping are small areas of Chancellor, Davison, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales. The moderately well drained Davison soils are in an intermediate position on the landscape between the Tetonka and Homme soils. They are calcareous throughout. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Homme soil and high in the Onita soil. Fertility is medium in the Homme soil and high in the Onita soil. Tilth is good in the Homme soil and fair in the Onita soil. Permeability is moderately slow in both soils. Available water capacity is high. The Onita soil has a seasonal high water table at a depth of 2.5 to 6.0 feet during wet periods. Runoff is slow on both soils. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is high in the Onita soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture are the main management needs. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. Planting is delayed in some years when the Onita soil receives runoff from the adjacent uplands.

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

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weedy forbs.

The capability unit is I-1; the Homme soil is in Silty range site, the Onita soil in Overflow range site.

HrB—Homme-Onita silty clay loams, 1 to 6 percent slopes. These deep, nearly level, undulating, and gently sloping soils are on uplands. The well drained Homme soil is on the upper slopes. The moderately well drained Onita soil is in swales. It is occasionally flooded for brief periods in the spring. Areas are 15 to 150 acres in size and are irregular in shape. They are 50 to 60 percent

Homme soil and 20 to 30 percent Onita soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 8 inches thick. The subsoil is dark brown, light olive brown, and light yellowish brown, firm silty clay loam about 28 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam.

Typically, the surface layer of the Onita soil is very dark grayish brown silty clay loam about 15 inches thick. The subsoil is dark grayish brown, very dark grayish brown, and light olive brown, firm silty clay loam about 31 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam and clay loam. It is motted in the lower part.

Included with these soils in mapping are small areas of Chancellor, Davison, Ethan, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales. The moderately well drained Davison soils are on slight rises in the swales. They are calcareous throughout. Ethan soils have lime near the surface and formed in glacial till. They are on ridges and knolls. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Homme soil and high in the Onita soil. Fertility is medium in the Homme soil and high in the Onita soil. Tilth is good in the Homme soil and fair in the Onita soil. Permeability is moderately slow in both soils. Available water capacity is high. The Onita soil has a seasonal high water table at a depth of 2.5 to 6.0 feet during wet periods. Runoff is medium on both soils. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is high in the Onita soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that control erosion and conserve moisture are the main management needs. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. Farming is delayed in some years when the Onita soil receives runoff from the adjacent uplands.

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

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems and green needlegrass. Overused areas are dominated by Kentucky bluegrass and weedy forbs.

The capability unit is IIe-3; the Homme soil is in Silty range site, the Onita soil in Overflow range site.

HtA—Homme-Onita-Tetonka complex, 0 to 3 percent slopes. These deep, nearly level soils are on uplands. The well drained Homme soil is on slight rises. The moderately well drained Onita soil is on flats and in swales. It is occasionally flooded for brief periods in the spring. The poorly drained Tetonka soil is in depressions. It is ponded during periods of snowmelt and heavy rainfall. Areas are 40 to more than 200 acres in size and are irregular in shape. They are 40 to 50 percent Homme soil, 20 to 30 percent Onita soil, and 10 to 20 percent Tetonka soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 8 inches thick. The subsoil is brown, light olive brown, and light yellowish brown, firm silty clay loam about 28 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam.

Typically, the surface layer the Onita soil is very dark grayish brown silty clay loam about 15 inches thick. The subsoil is dark grayish brown, very dark grayish brown, and light olive brown, firm silty clay loam about 31 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam and clay loam. It is mottled in the lower part.

Typically, the surface layer of the Tetonka soil is dark grayish brown silt loam about 9 inches thick. The subsurface layer is gray, mottled silt loam about 7 inches thick. The subsoil is about 35 inches of gray and dark gray, mottled, firm and very firm silty clay loam and silty clay. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Chancellor and Davison soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales. The moderately well drained Davison soils border narrow swales and small depressions. They are calcareous throughout.

Organic matter content is moderate in the Homme and Tetonka soils and high in the Onita soil. Fertility is medium in the Homme and Tetonka soils and high in the Onita soil. Tilth is good in the Homme and Tetonka soils and fair in the Onita soil. Permeability is moderately slow in the Homme and Onita soils and very slow in the Tetonka soil. Available water capacity is high in all three soils. The Onita soil has a seasonal high water table at a depth of 2.5 to 6.0 feet during wet periods. The Tetonka soil has a seasonal high water table within a depth of 1.0 foot most of the year. As much as 1.0 foot of water ponds on the surface of this soil during some wet periods. Runoff is slow on the Homme and Onita soils

and ponded on the Tetonka soil. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is high in the Onita and Tetonka soils.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture during dry periods are the main management needs in cultivated areas. Measures that control the ponding on the Tetonka soil also are needed. Minimizing tillage, including grasses and legumes in the cropping system, and leaving crop residue on the surface conserve moisture. In most years planting is delayed because the Onita and Tetonka soils receive runoff from the adjacent uplands. Surface drains help to control the excess water.

The Homme and Onita soils are well suited and the Tetonka soil generally unsuited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well on the Homme and Onita soils, but optimum growth and survival are unlikely on the Tetonka soil unless it is drained. The trees and shrubs that require an abundant supply of moisture grow especially well on the Onita soil.

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems, needlegrasses, and prairie cordgrass. Overused areas are dominated by Kentucky bluegrass, foxtail barley, and weeds.

The Homme soil is in capability unit I-2, Silty range site; the Onita soil is in capability unit I-3, Overflow range site; the Tetonka soil is in capability unit IIw-1 if drained and in Wet Meadow range site.

La—Lamo silt loam. This deep, somewhat poorly drained, nearly level soil is on flood plains. It is occasionally flooded. Areas are 20 to 200 acres in size and generally are long and narrow.

Typically, the surface layer is dark grayish brown silt loam about 24 inches thick. The next 14 inches also is dark grayish brown silt loam. The underlying material to a depth of 60 inches is grayish brown silt loam. The soil is mottled and calcareous throughout.

Included with this soil in mapping are small areas of the poorly drained Salmo soils on the lower parts of the flood plains. These soils have visible salts throughout. Also included is a soil that contains more clay and is slightly lower on the flood plains than the Lamo soil. Included soils make up less than 15 percent of any one mapped area.

Organic matter content and fertility are high in the Lamo soil. Tilth is good. Permeability is moderately slow. Available water capacity is high. A seasonal high water table is at a depth of 1.5 to 3.0 feet most of the year. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses. This soil is suited to range. The native vegetation dominantly is big bluestem, indiangrass, switchgrass, sedges, and prairie cordgrass. Overused areas are dominated by Kentucky bluegrass, sedges, and weeds.

This soil is well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth bromegrass. The main concern of management in cultivated areas is the seasonal wetness. In some years planting and harvesting are delayed because the soil receives runoff from adjacent soils. Diverting the runoff from those soils and installing surface drains help to control the wetness.

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

The capability unit is IIw-3; Subirrigated range site.

OcA—Onita-Chancellor silty clay loams. These deep, nearly level soils are in swales on uplands. They are frequently flooded for brief periods. The moderately well drained Onita soil is near the edges of the swales. The somewhat poorly drained Chancellor soil is in the slightly lower, more entrenched parts of the swales. Areas are 5 to 100 acres in size and are long and narrow. They are 50 to 60 percent Onita soil and 25 to 35 percent Chancellor soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Onita soil is very dark grayish brown silty clay loam about 15 inches thick. The subsoil is dark grayish brown, very dark grayish brown, and light olive brown, firm silty clay loam about 31 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam and clay loam. It is calcareous in the lower part.

Typically, the surface layer of the Chancellor soil is dark gray silty clay loam about 13 inches thick. The subsoil is about 26 inches of gray, olive gray, and light olive gray, mottled, firm silty clay and silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam.

Included with these soils in mapping are small areas of Davison, Homme, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The moderately well drained Davison and well drained Homme soils are near the edges of the swales. The poorly drained Tetonka soils are in depressions.

Organic matter content and fertility are high in the Onita and Chancellor soils. Tilth is fair. Permeability is moderately slow in the Onita soil and slow in the Chancellor soil. Available water capacity is high in both soils. The Onita soil has a seasonal high water table at a depth of 2.5 to 6.0 feet during wet periods. The

Chancellor soil has a seasonal high water table within a depth of 3.0 feet during wet periods. Runoff is slow on both soils. The shrink-swell potential is high in the subsoil of the Onita soil and moderate in the underlying material. It is high in the Chancellor soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture are the main management needs in areas of the Onita soil. Leaving crop residue on the surface is an example. The main management needs in areas of the Chancellor soil are measures that control flooding and improve tilth. Returning crop residue to the soil and delaying tillage when the soil is wet help to prevent deterioration of tilth. Diverting the runoff from adjacent soils and installing surface drains help to control the excess water.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well.

These soils are well suited to range. The native vegetation dominantly is big bluestem. Overused areas are dominated by Kentucky bluegrass.

The Onita soil is in capability unit I-3, the Chancellor soil in capability unit IIw-1; both soils are in Overflow range site.

ReD—Redstoe Variant-Gavins complex, 6 to 25 percent slopes. These well drained, gently rolling to hilly soils are on uplands that are dissected by deep drainageways. The deep Redstoe Variant soil is on the mid and lower side slopes and on the broader ridgetops. The shallow Gavins soil is on the upper side slopes and on convex ridgetops. Areas are 10 to 50 acres in size and are irregular in shape. They are 45 to 55 percent Redstoe Variant soil and 30 to 40 percent Gavins soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Redstoe Variant soil is dark grayish brown, calcareous silt loam about 12 inches thick. The subsoil is grayish brown and light brownish gray, friable, calcareous silt loam about 24 inches thick. The underlying material to a depth of 60 inches is light yellowish brown and pale yellow, calcareous silt loam. It has a few fragments of siltstone in the lower part. In places siltstone is 20 to 40 inches from the surface.

Typically, the surface layer of the Gavins soil is grayish brown, calcareous loam about 5 inches thick. The next 5 inches is very pale brown, calcareous silt loam. The underlying material, to a depth of about 16 inches, is very pale brown, calcareous silt loam. Very pale brown siltstone is at a depth of about 16 inches.

Included with these soils in mapping are small areas of Bon, Ethan, and Sansarc soils. These included soils make up less than 20 percent of any one mapped area. The moderately well drained Bon soils are on flood plains. The deep, loamy Ethan soils and the shallow, clayey Sansarc soils are higher on the landscape than the Gavins soil.

Organic matter content is moderate and fertility medium in the Redstoe Variant soil. Organic matter content and fertility are low in the Gavins soil. Permeability is moderate in both soils. Available water capacity is high in the Redstoe Variant soil and low in the Gavins soil. Runoff is rapid on both soils.

Most areas support native grasses. These soils are best suited to range. The native vegetation dominantly is little bluestem, big bluestem, and needlegrasses. Overused areas are dominated by blue grama and Kentucky bluegrass.

These soils generally are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Cultivated crops, windbreaks and environmental plantings, and tame pasture plants and hay can be planted in the less sloping areas of the Redstoe Variant soil, but these areas generally are small and isolated.

The capability unit is VIe-3; Thin Upland range site.

Sa—Salmo silty clay loam. This deep, poorly drained, level soil is on flood plains along large drainageways. It is frequently flooded for brief periods in the spring. Areas are 5 to 200 acres in size and are long and narrow. Slopes generally are smooth.

Typically, the surface layer is very dark gray silty clay loam about 6 inches thick. The subsurface layer is about 22 inches thick. It is very dark gray, friable silty clay loam that has fine nests of salts. The next 13 inches is gray, friable, mottled silty clay loam that has soft accumulations of carbonate. The underlying material to a depth of 60 inches is olive gray, mottled, calcareous clay loam. It has accumulations of carbonate. In places the subsoil contains more clay. In some areas the soil contains more lime and is 20 to 36 inches deep over gravelly sand.

Included with this soil in mapping are small areas of Alcester, Bon, Enet, and Lamo soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Alcester soils are slightly higher on the flood plains than the Salmo soil. Also, they are leached of carbonates to a greater depth. The moderately well drained Bon soils are on alluvial fans adjacent to the uplands. The well drained Enet soils are on slight rises. They are underlain by sand and gravel. The somewhat poorly drained Lamo soils are slightly higher on the flood plains than the Salmo soil. Also, they contain less clay throughout and do not have visible salts.

Organic matter content is high and fertility medium in the Salmo soil. Tilth is poor. Permeability is moderately slow. Available water capacity is high. A seasonal high

water table is within a depth of 2.5 feet. Runoff is slow. The shrink-swell potential is moderate.

Most areas support native grasses. This soil is best suited to range. The native vegetation dominantly is prairie cordgrass and western wheatgrass. Overused areas are dominated by western wheatgrass, Kentucky bluegrass, and saltgrass. After continued overuse, saltgrass and weeds dominate the site. Restricting use during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is poorly suited to cultivated crops and to tame pasture and hay because of the wetness and the salinity. Tall wheatgrass and western wheatgrass are the best suited pasture plants.

This soil generally is unsuited to windbreaks and environmental plantings because of the salinity.

The capability unit is IVw-2; Saline Lowland range site.

Sb—Sarpy-Waubonsie complex. These deep, nearly level soils are on the flood plains along the Missouri River. They are frequently flooded. The excessively drained Sarpy soil is on slight rises. The moderately well drained Waubonsie soil is in low areas. Areas are 40 to 400 acres in size and are irregular in shape. They are 55 to 65 percent Sarpy soil and 20 to 30 percent Waubonsie soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Sarpy soil is grayish brown loamy fine sand about 3 inches thick. The underlying material to a depth of 60 inches is light brownish gray fine sand.

Typically, the surface layer of the Waubonsie soil is grayish brown very fine sandy loam about 6 inches thick. The upper part of the underlying material is light brownish gray, mottled, stratified, calcareous very fine sandy loam and loamy fine sand. The lower part to a depth of 60 inches is grayish brown, mottled, calcareous clay.

Included with these soils in mapping are small areas of a well drained soil that has more silt throughout and a somewhat poorly drained soil that has more clay throughout. These included soils make up less than 20 percent of any one mapped area. They occur in a random pattern throughout the mapped areas.

Organic matter content and fertility are low in the Sarpy and Waubonsie soils. Tilth is good. Permeability is rapid or very rapid in the Sarpy soil. It is moderately rapid in the upper part of the Waubonsie soil and slow or very slow in the lower part. Available water capacity is low in the Sarpy soil and moderate in the Waubonsie soil. A seasonal high water table is at a depth of 2 to 4 feet in the Waubonsie soil. Runoff is slow. The shrink-swell potential is high in the underlying material of the Waubonsie soil.

Most areas support native grasses and trees. These soils are suited to range. The native vegetation dominantly is big bluestem, little bluestem, switchgrass, and Canada wildrye. Overused areas are dominated by prairie sandreed and Kentucky bluegrass interspersed with bare spots. Scattered cottonwood, elm, and willow are throughout the mapped areas.

These soils are suited to cultivated crops and to tame pasture and hay, but the hazard of wind erosion is severe. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. The main management needs in cultivated areas are measures that control wind erosion. Examples are leaving crop residue on the surface, stripcropping, and establishing field windbreaks.

These soils are suited to windbreaks and environmental plantings. The trees and shrubs that require an abundant supply of moisture grow especially well on the Waubonsie soil. Only evergreens can be successfully established on the Sarpy soil.

The Sarpy soil is in capability unit IVe-9, the Waubonsie soil in capability unit IIs-2; both soils are in Subirrigated range site.

TaE—Talmo-Delmont loams, 15 to 40 percent slopes. These hilly and steep soils are on uplands. The excessively drained Talmo soil is on ridges and the steeper, more convex upper slopes. The somewhat excessively drained Delmont soil is on side slopes. The Talmo soil is very shallow over gravelly sand, and the Delmont soil is shallow over gravelly sand. Areas are 10 to 80 acres in size and are irregular in shape. They are 50 to 60 percent Talmo soil and 25 to 35 percent Delmont soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Talmo soil is very dark grayish brown loam about 5 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand.

Typically, the surface layer of the Delmont soil is very dark grayish brown loam about 8 inches thick. The subsoil is dark grayish brown, very friable loam about 7 inches thick. The underlying material to a depth of 60 inches is brown, calcareous gravelly sand. In places the gravelly sand is below a depth of 20 inches.

Included with these soils in mapping are small areas of Betts soils. These included soils make up less than 10 percent of any one mapped area. They formed in glacial till. They are along the edge of the mapped areas.

Organic matter content and fertility are low in the Talmo soil. Organic matter content is moderate and fertility medium in the Delmont soil. Permeability is rapid in the Talmo soil. It is moderate in the upper part of the Delmont soil and rapid in the underlying material. Available water capacity is very low in the Talmo soil and low in the Delmont soil. Runoff is rapid on both soils.

Most of the acreage supports native grasses. These soils are best suited to range. The native vegetation

dominantly is needleandthread and grama grasses. Overused areas are dominated by sedges and grama grasses. If the range is severely overgrazed, the surface is bare in spots.

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

The Talmo soil is in capability unit VIIs-2, Very Shallow range site; the Delmont soil is in capability unit VIe-6, Shallow to Gravel range site.

TbE—Talmo-Ethan complex, stony, 6 to 40 percent slopes. These gently rolling to steep soils are on uplands. The excessively drained Talmo soil is on ridges. It is very shallow over gravelly sand. The deep, well drained Ethan soil is on side slopes. Areas are 10 to 60 acres in size and are irregular in shape. They are 35 to 45 percent Talmo soil and 30 to 40 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Talmo soil is dark grayish brown very stony sandy loam about 5 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the gravelly sand is below a depth of 20 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous very stony loam about 7 inches thick. The subsoil is light yellowish brown, firm, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Clarno, Davis, and Thurman soils. These included soils make up less than 20 percent of any one mapped area. Clarno soils are not underlain by sand and gravel and are deeper to lime than the Ethan soil. They are on the lower slopes. Davis soils are on toe slopes. Their dark surface layer is thicker than that of either the Talmo or Ethan soil. Thurman soils are not gravelly in the underlying material and contain more sand throughout than the Ethan soil. They occur in a random pattern throughout the mapped areas.

Organic matter content and fertility are low in the Talmo and Ethan soils. Permeability is rapid in the Talmo soil. It is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. Available water capacity is low in the Talmo soil and high in the Ethan soil. Runoff is medium on the Talmo soil and rapid on the Ethan soil. The shrink-swell potential is moderate in the Ethan soil.

Most of the acreage supports native grasses. These soils are best suited to range. The native vegetation on the Talmo soil dominantly is blue grama, needleandthread, sideoats grama, and little bluestem. That on the Ethan soil dominantly is little bluestem, big bluestem, and needlegrasses. Overused areas are dominated by grama grasses, Kentucky bluegrass, threadleaf sedge, and weeds.

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

The capability unit is VIIs-1; the Talmo soil is in Very Shallow range site, the Ethan soil in Silty range site.

Te—Tetonka silt loam. This deep, poorly drained soil is in depressions in the uplands. It is ponded during periods of snowmelt and heavy rainfall. Areas are 3 to 25 acres in size and are oval or oblong.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is light gray, mottled silt loam about 7 inches thick. The subsoil is about 35 inches of gray and dark gray, mottled, firm and very firm silty clay loam and silty clay. The underlying material to a depth of 60 inches is light gray, mottled clay loam.

Included with this soil in mapping are small areas of the moderately well drained Bonilla, Davison, and Onita soils and the somewhat poorly drained Chancellor and Crossplain soils. These soils make up less than 15 percent of any one mapped area. They are in swales and are slightly higher on the landscape than the Tetonka soil. Davison soils are calcareous throughout.

Organic matter content is moderate and fertility medium in the Tetonka soil. Tilth is good. Permeability is very slow. Available water capacity is high. A seasonal high water table is within a depth of 1 foot most of the year. As much as 1 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native grasses. This soil is suited to range. The native vegetation dominantly is sedges, reedgrass, and prairie cordgrass. Overused areas are dominated by foxtail barley, spikesedge, and rushes. Many areas are potential sites for excavated ponds.

This soil is poorly suited to cultivated crops and generally unsuited to windbreaks and environmental plantings unless it is drained. The best suited crops are those that mature late in the growing season. The main concern of management is improving drainage. In undrained areas, crops are likely to drown out and tillage usually is delayed for long periods.

This soil is suited to tame pasture and hay, but only the water tolerant pasture plants grow well in undrained areas. Garrison creeping foxtail and reed canarygrass are the best suited species. All climatically suited pasture plants grow well in drained areas.

The capabiliity unit is IVw-2; Wet Meadow range site.

ThC—Thurman loamy sand, 6 to 15 percent slopes. This deep, well drained, moderately sloping and strongly sloping soil is on uplands adjacent to the flood plains along the Missouri River. In some areas scattered stones and boulders are on the surface. Areas are 10 to 100

acres in size and irregular in shape. Most of the slopes are long and smooth.

Typically, the surface layer is dark grayish brown loamy sand about 14 inches thick. The next 5 inches is dark grayish brown, very friable loamy sand. The underlying material to a depth of 60 inches is light brownish gray, very pale brown, and light gray sand and fine sand. In some areas the dark colors extend below a depth of 20 inches.

Included with this soil in mapping are small areas of Davis, Delmont, Ethan, and Talmo soils. These soils make up less than 20 percent of any one mapped area. Davis soils contain more clay in the subsoil than the Thurman soil. They are on toe slopes. The somewhat excessively drained Delmont and excessively drained Talmo soils are underlain by gravelly material. They occur in a random pattern throughout some mapped areas. Ethan soils are higher on the landscape than the Thurman soil. Also, their subsoil contains more clay.

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

Most of the acreage supports native grasses. This soil is suited to range. The native vegetation dominantly is sand bluestem, little bluestem, and prairie sandreed. Overused areas are dominated by Kentucky bluegrass, sand dropseed, and blue grama.

This soil generally is unsuited to cultivated crops because of a severe hazard of wind erosion. It is suited, however, to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass.

This soil is suited to windbreaks and environmental plantings, but evergreen trees and shrubs are the only species that can be successfully established. Windbreaks can be established, but optimum growth is unlikely. Planting directly in sod helps to control wind erosion.

The capability unit is VIe-7; Sandy range site.

ThE—Thurman loamy sand, 15 to 40 percent slopes. This deep, well drained, moderately steep and steep soil is on uplands adjacent to the flood plains along the Missouri River (fig. 11). In some areas

Figure 11.—An area of Thurman loamy sand, 15 to 40 percent slopes.

scattered stones and boulders are on the surface. Areas are 10 to 300 acres in size and irregular in shape. Most of the slopes are long and smooth.

Typically, the surface layer is dark grayish brown loamy sand about 14 inches thick. The next 5 inches is dark grayish brown, very friable loamy sand. The underlying material to a depth of 60 inches is light brownish gray, very pale brown, and light gray sand and fine sand. In some areas the dark colors extend below a depth of 20 inches. In a few areas boulders cover 15 to 90 percent of the surface.

Included with this soil in mapping are small areas of Davis, Delmont, Ethan, and Talmo soils. These soils make up less than 20 percent of any one mapped area. Davis soils contain more clay in the subsoil than the Thurman soil. They are on toe slopes. The somewhat excessively drained Delmont and excessively drained Talmo soils are underlain by gravelly material. They occur in a random pattern throughout some mapped areas. Ethan soils are higher on the landscape than the Thurman soil. Also, their subsoil contains more clay.

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

Most of the acreage supports native grasses. This soil is best suited to range. The native vegetation dominantly is sand bluestem, little bluestem, and prairie sandreed. Overused areas are dominated by Kentucky bluegrass, sand dropseed, and blue grama.

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

The capability unit is VIIe-2; Sandy range site.

Wg—Worthing silty clay loam. This deep, very poorly drained, level soil is in depressions in the uplands. It is ponded during periods of snowmelt and heavy rainfall. Areas are 5 to 120 acres in size and generally are oval.

Typically, the surface layer is dark gray silty clay loam about 18 inches thick. The subsoil is about 40 inches of dark gray, firm clay and silty clay. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray, calcareous silty clay. In places the soil has a light gray subsurface layer. In some areas the surface layer is less than 8 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Chancellor and Crossplain and moderately well drained Onita soils near the edges of the depressions. These soils make up less than 15 percent of any one mapped area.

Organic matter content and fertility are high in the Worthing soil. Tilth is poor. Permeability is slow. Available water capacity is high. A seasonal high water table is within a depth of 1 foot. As much as 1 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native grasses. This soil is suited to range. The native vegetation dominantly is rivergrass, slough sedge, prairie cordgrass, and reedgrass. Overused areas are dominated by spikesedge and unpalatable grasses and weeds. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings, but it is suited to tame pasture and hay. Because the soil is frequently ponded, the number of suitable crops and pasture plants is severely limited. Garrison creeping foxtail and reed canarygrass are the best suited pasture plants.

The capability unit is Vw-2; Shallow Marsh range site.

Wo—Worthing silty clay loam, ponded. This deep, very poorly drained, level soil is in depressions in the uplands. It is ponded most of the year. Areas are 5 to 200 acres in size and generally are oval.

Typically, the surface layer is dark gray silty clay loam about 18 inches thick. The subsoil is about 40 inches of dark gray, firm clay and silty clay. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray, calcareous silty clay. In some places a thin layer of partly decomposed organic material is at the surface. In other places the subsoil and underlying material have accumulations of salts. In some areas the soil has a light gray subsurface layer. In other areas the surface layer is less than 8 inches thick.

Organic matter content and fertility are high. Permeability is slow. Available water capacity is high. A seasonal high water table is within a depth of 0.5 foot. As much as 3.0 feet of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native vegetation and are used as wetland wildlife habitat (fig.12). The natural plant cover is a luxuriant stand of bulrushes, cattails, reedgrasses, and sedges. Many areas are potential sites for excavated ponds.

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

The capability unit is VIIIw-1; no range site is assigned.

YaA—Yankton-Alcester silt loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Yankton soil is on slight rises. The moderately well drained Alcester soil is on flats and in swales. It is occasionally flooded for brief periods in the spring. Areas are 40 to more than 200 acres in size and are irregular in shape. They are 55 to 65 percent Yankton soil and 20 to 30 percent Alcester soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Yankton soil is dark grayish brown silt loam about 13 inches thick. The

Figure 12.—An area of Worthing silty clay loam, ponded, used as wetland wildlife habitat.

subsurface layer is grayish brown, calcareous silt loam about 5 inches thick. The subsoil is grayish brown and light brownish gray, friable, calcareous silt loam about 16 inches thick. It has soft accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is light gray, calcareous clay loam. In places the surface soil and subsoil contain more sand.

Typically, the surface layer of the Alcester soil is dark grayish brown silt loam about 13 inches thick. The subsoil is about 29 inches thick. It is dark gray and dark grayish brown, friable silt loam over grayish brown, firm silty clay loam. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam. In places the soil is calcareous at or near the surface.

Included with these soils in mapping are small areas of the somewhat poorly drained Chancellor soils in swales. Also included are some scattered areas of well drained soils that have gravelly sand in the underlying material. Included soils make up less than 15 percent of any one mapped area.

Organic matter content is moderate in the Yankton soil and high in the Alcester soil. Fertility is medium in the Yankton soil and high in the Alcester soil. Tilth is good in both soils. Permeability is moderate in the subsoil of the Yankton soil and moderately slow in the underlying material. It is moderate in the Alcester soil. Available water capacity is high in both soils. The Alcester soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. Runoff is slow on both soils. The shrink-swell potential is high in the underlying material of the Yankton soil. It is moderate in the Alcester soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. The soils are well suited to irrigation.

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

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems, needlegrasses, and switchgrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The capability unit is I-2; the Yankton soil is in Silty range site, the Alcester soil in Overflow range site.

YaB—Yankton-Alcester silt loams, 1 to 6 percent slopes. These deep, nearly level and gently sloping or undulating soils are on uplands. The well drained Yankton soil is on rises. The moderately well drained Alcester soil is on toe slopes and in swales. It is occasionally flooded for brief periods in the spring. Areas are 15 to 300 acres in size and are irregular in shape. They are 55 to 65 percent Yankton soil and 20 to 30 percent Alcester soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Yankton soil is dark grayish brown and grayish brown silt loam about 13 inches thick. The subsurface layer is grayish brown, calcareous silt loam about 5 inches thick. The subsoil is grayish brown and light brownish gray, friable, calcareous silt loam about 16 inches thick. It has soft accumulations of carbonate that extend into the underlying material. The underlying material to a depth of 60 inches is light gray, calcareous clay loam. In places the surface layer and subsoil contain more sand.

Typically, the surface layer of the Alcester soil is dark grayish brown silt loam about 13 inches thick. The subsoil is about 29 inches thick. It is dark gray and dark grayish brown, friable silt loam over grayish brown, firm silty clay loam. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam. In places the soil is calcareous at or near the surface.

Included with these soils in mapping are small areas of Chancellor and Ethan soils. The somewhat poorly drained Chancellor soils are in swales. Ethan soils have lime near the surface and formed in glacial till. They are on ridges and knolls. Also included are some scattered areas of well drained soils that have gravelly sand in the underlying material. Included soils make up less than 15 percent of any one mapped area.

Organic matter content is moderate in the Yankton soil and high in the Alcester soil. Fertility is medium in the Yankton soil and high in the Alcester soil. Tilth is good in both soils. Permeability is moderate in the subsoil of the Yankton soil and moderately slow in the underlying material. It is moderate in the Alcester soil. Available water capacity is high in both soils. The Alcester soil has a seasonal high water table at a depth of 3 to 6 feet during wet periods. Runoff is medium on both soils. The shrink-swell potential is high in the underlying material of the Yankton soil. It is moderate in the Alcester soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. Farming is delayed in some years because the Alcester soil receives runoff from the adjacent uplands. The soils are well suited to irrigation.

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

These soils are well suited to native grasses, but very few areas are used for range. The native vegetation dominantly is bluestems, needlegrasses, and switchgrass. Overused areas are dominated by Kentucky bluegrass and weeds.

The capability unit is IIe-3; the Yankton soil is in Silty range site, the Alcester soil in Overflow range site.

prime farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil economically to produce a sustained high yield of crops.

Prime farmland has an adequate and dependable supply of moisture. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 273,275 acres in Bon Homme County, or 76 percent of the total land area, meets the requirements for prime farmland. About 5,000 acres of this land is irrigated. The main crops are corn, soybeans, and alfalfa.

The map units in Bon Homme County that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps

at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed soil map units."

As is indicated in parentheses after some of the soil names in table 5, soils that have limitations—a high water table or flooding—qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. Onsite investigation is needed to determine whether or not these limitations have been overcome.

use and management of the soils

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

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

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

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

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

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

crops and pasture

Gary W. LaCompte, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for the arable soils.

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

About 74 percent of the acreage in Bon Homme County is used for cultivated crops or for tame pasture and hay. The major crops are alfalfa, corn, soybeans, oats, and grain sorghum. Barley and wheat also are grown. Corn is grown for grain and silage; oats, soybeans, and sorghum for grain; and alfalfa mainly for hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are grown as tame pasture plants.

The potential of the soils in the county for increased crop production is good. About 43,000 acres of potentially good cropland is used as range, pasture, and hayland (*10*). Food production could be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the management needed on the cropland in the county.

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

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that does not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion.

Terraces and diversions reduce the length of slopes and the runoff rate and help to control erosion. They are most practical on deep, well drained soils that have long, smooth slopes. Many of the soils in Bon Homme County are poorly suited to terraces and diversions because of short, irregular slopes or an unfavorable subsoil, which would be exposed in terrace channels.

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

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

Soil drainage is the major management concern on the somewhat poorly drained Chancellor, Crossplain, and Lamo soils and on the poorly drained Salmo and Tetonka soils. Unless these soils are artificially drained, wetness commonly retards plant growth. If a drainage outlet is available, open ditch drainage systems can remove the excess water. Tetonka soils generally cannot be drained by tile because they are too clayey.

The moderately well drained Alcester, Bon, Bonilla, and Onita soils, on flood plains and in upland swales, receive additional moisture when streams occasionally overflow and when water runs off higher lying adjacent soils. Tillage and planting are delayed in the spring during wet years, but in most years natural drainage is adequate and the additional moisture is beneficial for crops. Artificial drainage is rarely needed on these soils.

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

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

Field crops suited to the soils and climate of the survey area include close-grown crops and row crops. Oats and barley are the main close-grown crops. Corn, soybeans, and sorghum are the main row crops.

The deep, well drained or moderately well drained soils in the survey area are suited to all of the crops commonly grown in the county. Examples are Alcester, Bon, Bonilla, Clarno, Davis, Eltree, Graceville, Homme, Onita, and Yankton soils. Delmont and other droughty soils are better suited to early maturing small grain than to deeper rooted crops, such as corn and alfalfa, because the porous underlying material limits the depth to which roots can penetrate and the available water capacity. Davison, Sarpy, and other soils that are subject to wind erosion are better suited to close-grown crops than to other crops.

Many of the deep, well drained soils in the county are suited to irrigation. Examples are Davis, Eltree, Enet, Graceville, Homme, and Yankton soils. The main concerns of management are water quality, fertility, and tilth on all of the irrigated soils and erosion on the soils with a slope of more than 2 percent. The quality of irrigation water is a concern if water from a well is used. The best water has a low content of salt and sodium.

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

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

yields per acre

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

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

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion

control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil listed for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

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

land capability classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*8*). These levels are defined in the following paragraphs.

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

Class I soils have slight limitations that restrict their use.

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

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

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

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

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

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

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

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

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-6.

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Gary W. LaCompte, district conservationist, Soil Conservation Service, helped prepare this section.

About 17 percent of the acreage of Bon Homme County is rangeland. Most of the rangeland occurs as large tracts of Betts, Boyd, Eltree, Ethan, Gavins, Sansarc, and Thurman soils on the breaks along the Missouri River and its major tributaries, but some occurs as small tracts throughout the county. More than 69 percent of the local farm income is derived from the sale of livestock, principally cattle. Cow-calf enterprises are dominant throughout the county. On a few feedlots and farms, a small number of cattle are fed until they are ready for market. On many farms the forage produced on rangeland is supplemented by crop aftermath. In winter it is supplemented by protein concentrate.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for many soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. An explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

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

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. 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. Range condition is an ecological rating only.

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 optimum production of vegetation, control of undesirable brush species, conservation of water, and control of wind and water erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The native vegetation in most parts of the county has been greatly depleted by continued excessive use. The amount of forage produced is less than half of that originally produced. The productivity of the range can be increased by applying management that is effective on specific soils and range sites.

An adequate plant cover and ground mulch help to control erosion and increase the moisture supply by reducing the runoff rate. If the range is overgrazed, the more desirable tall grasses lose vigor and are replaced by less productive short grasses. Measures that prevent overgrazing help to keep the range in good condition. Crossfencing and properly distributed watering facilities help to obtain a uniform distribution of grazing.

native woods and windbreaks and environmental plantings

Gary W. LaCompte, district conservationist, Soil Conservation Service, helped prepare this section.

Native trees and shrubs grow on about 3,789 acres in Bon Homme County. They generally grow in areas where soil and water relationships are favorable. Most grow in the deeper drainageways on the breaks and flood plains along the Missouri River (fig. 13). Nearly all of the wooded areas are used as wildlife habitat.

Scattered individual plants or clumps of American elm, American plum, boxelder, bur oak, common chokecherry, hackberry, eastern redcedar, false indigo, green ash, western snowberry, and wild rose are common on the Betts, Boyd, Crofton, Gavins, Redstoe Variant, Sansarc, and Thurman soils in drainageways. Peachleaf willow, plains cottonwood, and sandbar willow are common on Sarpy and Waubonsie soils. Russian-olive, an introduced species, is common on nearly all of the soils in the county.

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

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility

Figure 13.—Native trees and shrubs in an area of Boyd-Sansarc clays, 15 to 40 percent slopes.

of the soil. Field windbreaks protect cropland and crops from wind, keep snow from blowing off fields, and provide food and cover for wildlife.

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

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

Grazing is detrimental to windbreaks and environmental plantings because the livestock compact the soil and remove the lower branches of the trees and shrubs. The compaction retards growth. Removal of the lower branches reduces the effectiveness of the windbreaks. Weeds and insects prevent maximum growth. Clean cultivation and applications of herbicide help to control the weeds. Fallowing a year before planting helps to provide a reserve supply of moisture, which is needed before seedlings can be established. If the trees or shrubs are planted on soils that are subject to wind erosion, the site should be prepared in the spring.

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

wildlife habitat

John B. Farley, biologist, Soil Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can

be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges and management areas, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are barley, corn, oats, sorghum, and wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are alfalfa, intermediate wheatgrass, reed canarygrass, smooth bromegrass, sweetclover, and tall wheatgrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big bluestem, indiangrass, leadplant, Maximilian sunflower, sideoats grama, switchgrass, and western wheatgrass.

Hardwood trees are planted trees and shrubs that produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of trees are bur oak, green ash, hackberry, honeylocust, plains cottonwood, Russian-olive, and Siberian crabapple. Examples of shrubs that are suitable for planting on soils rated *good* are American plum, Amur maple, Siberian peashrub, common chokecherry, silver buffaloberry, Tatarian honeysuckle, and skunkbush sumac.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are Black Hills spruce, blue spruce, eastern redcedar, ponderosa pine, and Rocky Mountain juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submersed or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, and slope. Examples of wetland plants are giant burreed, broadleaf cattail, hardstem bulrush, prairie cordgrass, and spikerush.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, ponds, and diked areas used for waterfowl feeding.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite, eastern cottontail, gray partridge, raccoon, red fox, ring-necked pheasant, and western meadowlark.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include blue jay, eastern fox squirrel, flickers, great horned owl, house wren, thrushes, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are beaver, ducks, geese, herons, mink, muskrat, and shore birds.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include badger, ground squirrels, horned lark, marsh hawk, prairie falcon, white-tailed deer, and whitetail jackrabbit.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some ofthe terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 5 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or

soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 or 20 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 17.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K in this survey area range from 0.10 to 0.43. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can

be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal 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.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 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. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

engineering index test data

Table 17 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series. The soil samples were analyzed by the South Dakota Department of Transportation, Division of Highways.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*9*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*7*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*9*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Alcester series

The Alcester series consists of deep, moderately well drained soils formed in silty alluvium in swales and on foot slopes in the uplands. Permeability is moderate. Slopes range from 0 to 9 percent.

Alcester soils are similar to Bonilla, Davis, and Eltree soils and commonly are near Chancellor, Eltree, Ethan, and Yankton soils. Bonilla soils formed in loamy material. The somewhat poorly drained Chancellor soils are slightly lower on the landscape than the Alcester soils. The well drained Davis soils contain more sand and less silt in the subsoil than the Alcester soils. The well

drained Eltree and Ethan soils are on knolls and ridges. They are not so deep to free carbonates as the Alcester soils. The well drained Yankton soils are slightly higher on the landscape than the Alcester soils. They have glacial till below a depth of 25 inches.

Typical pedon of Alcester silt loam, 1,200 feet east and 2,355 feet north of the southwest corner of sec. 3, T. 93 N., R. 59 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A—7 to 13 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable; neutral; clear smooth boundary.

Bw1—13 to 22 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

Bw2—22 to 36 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; neutral; abrupt wavy boundary.

BCk—36 to 42 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; hard, firm; strong effervescence; mildly alkaline; clear smooth boundary.

Ck—42 to 60 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; massive; hard, firm; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 36 to 60 inches. The thickness of the mollic epipedon ranges from 30 to 50 inches. Some pedons have a buried A horizon.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral. The B 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. The C horizon has hue of 2.5Y or 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 1 to 4. It is silty clay loam or clay loam. It is mildly alkaline or moderately alkaline.

Betts series

The Betts series consists of deep, well drained soils formed in calcareous, loamy glacial till on uplands. Permeability is moderate in the upper part of the soils and moderately slow in the lower part. Slopes range from 15 to 40 percent.

Betts soils are similar to Ethan soils and commonly are near Ethan and Talmo soils. Ethan soils have a mollic epipedon. Talmo soils are less than 14 inches deep over gravelly sand. They are in positions on the landscape similar to those of the Betts soils.

Typical pedon of Betts loam, in an area of Ethan-Betts loams, 15 to 40 percent slopes, 140 feet south and 120 feet west of the northeast corner of sec. 10, T. 93 N., R. 58 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

AC—4 to 9 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; few fine distinct yellow (10YR 7/6) and gray (5Y 6/1) mottles; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

Ck—9 to 28 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common medium distinct brownish yellow (10YR 6/6) and light gray (5Y 7/1) mottles; weak fine and medium subangular blocky structure; hard, friable; common medium accumulations of carbonate; violent effervescence; mildly alkaline; clear smooth boundary.

C—28 to 60 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; common medium distinct brownish yellow (10YR 6/6) and light gray (5Y 7/1) mottles; massive; hard, firm; strong effervescence; mildly alkaline.

The thickness of the solum is 6 to 10 inches. Pebbles are throughout the profile. They make up 5 to 10 percent of the volume.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is 2 to 5 inches thick. Some pedons have a B horizon. The C horizon has hue of 5Y or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is clay loam or loam. It is mildly alkaline or moderately alkaline. The mottles are inherited from the parent material.

Bon series

The Bon series consists of deep, well drained and moderately well drained soils formed in alluvium on terraces and flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Bon soils are similar to Davis soils and commonly are near Davis, Enet, Graceville, Lamo, Redstoe Variant, and Salmo soils. The well drained Davis soils are deeper to free carbonates than the Bon soils. Enet and Graceville soils are underlain by gravelly material. They are on

terraces. The somewhat poorly drained Lamo soils are slightly lower on the flood plains than the Bon soils. The well drained Redstoe Variant soils are on uplands. They have a mollic epipedon that is less than 20 inches thick. The poorly drained Salmo soils are slightly lower on the flood plains than the Bon soils. They have visible salts in the surface layer.

Typical pedon of Bon loam, 1,150 feet west and 400 feet south of the northeast corner of sec. 2, T. 93 N., R. 59 W.

A1—0 to 10 inches; dark gray (10YR 4/1) loam, very dark brown (10YR 2/2) moist; weak medium blocky structure parting to moderate fine and medium granular; slightly hard, friable; neutral; abrupt wavy boundary.

A2—10 to 30 inches; dark gray (10YR 4/1) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; few thin strata of sandy loam; strong effervescence; mildly alkaline; gradual wavy boundary.

A3—30 to 36 inches; gray (10YR 5/1) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; gradual wavy boundary.

C1—36 to 46 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—46 to 60 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; violent effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 20 to 50 inches. The depth to free carbonates ranges from 6 to 20 inches. Some pedons have a buried A horizon. Reaction is neutral to moderately alkaline throughout the profile.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam. Some pedons have a B horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 7 (2 to 5 moist), and chroma of 1 to 3.

Bonilla series

The Bonilla series consists of deep, moderately well drained soils formed in loamy alluvium over glacial till in swales on uplands. Permeability is moderate in the solum and moderately slow in the underlying material. Slopes range from 0 to 6 percent.

Bonilla soils are similar to Alcester and Davis soils and commonly are near Clarno, Crossplain, Davis, Ethan, and Tetonka soils. Alcester soils formed in silty alluvial sediments. The well drained Clarno and Ethan soils are on the higher parts of the landscape. The somewhat poorly drained Crossplain soils are slightly lower on the landscape than the Bonilla soils. Davis soils are well drained. The poorly drained Tetonka soils are in depressions.

Typical pedon of Bonilla loam, in an area of Clarno-Bonilla loams, 0 to 2 percent slopes, 567 feet north and 1,160 feet east of the southwest corner of sec. 27, T. 95 N., R. 58 W.

Ap—0 to 5 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—5 to 11 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse and medium subangular blocky structure; slightly hard, friable; slightly acid; clear wavy boundary.

Bw1—11 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak coarse and medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; slightly acid; gradual wavy boundary.

Bw2—18 to 25 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse and medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; slightly acid; gradual wavy boundary.

Bw3—25 to 31 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; few fine distinct dark yellowish brown (10YR 4/6) mottles; weak coarse and medium prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear wavy boundary.

BCk—31 to 36 inches; light gray (2.5Y 7/2) clay loam, olive brown (2.5Y 4/3) moist; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

Ck—36 to 41 inches; light gray (2.5Y 7/2) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—41 to 60 inches; light gray (2.5Y 7/2) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; massive; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 25 to 45 inches. The thickness of the mollic epipedon and the depth to free carbonates range from 20 to 40 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam. The Bw horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. It is loam or clay loam. Some pedons do not have a BCk horizon. 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 3. It is clay loam or loam. In some pedons it has gypsum crystals.

Boyd series

The Boyd series consists of moderately deep, well drained soils formed in residuum of clayey shale on uplands. Permeability is slow. Slopes range from 15 to 30 percent.

Boyd soils commonly are near Ethan, Gavins, and Sansarc soils. Ethan soils formed in clay loam glacial till. They are on the higher parts of the landscape. Gavins soils are shallow to siltstone. They are lower on the landscape than the Boyd soils. Sansarc soils do not have a mollic epipedon and have shale within a depth of 20 inches. They are on the steeper parts of the landscape.

Typical pedon of Boyd clay, in an area of Boyd-Sansarc clays, 15 to 40 percent slopes, 2,260 feet east and 1,300 feet south of the northwest corner of sec. 24, T. 93 N., R. 58 W.

A—0 to 4 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear smooth boundary.

Bw1—4 to 7 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear smooth boundary.

Bw2—7 to 17 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse prismatic structure; hard, very firm, very sticky and very plastic; few medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C—17 to 24 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; hard, firm, very sticky and very plastic; strong effervescence; few fine accumulations of carbonate; many fragments of shale; moderately alkaline; gradual wavy boundary.

Cr1—24 to 40 inches; light gray (2.5Y 7/2) shale, grayish brown (2.5Y 5/2) moist; brittle; strong effervescence; moderately alkaline; clear smooth boundary.

Cr2—40 to 60 inches; light brownish gray (2.5Y 6/2) shale, grayish brown (2.5Y 5/2) moist; brittle; strong effervescence in cracks; mildly alkaline.

The thickness of the solum ranges from 17 to 30 inches. The depth to shale ranges from 20 to 36 inches. The mollic epipedon is 7 to 10 inches thick. Reaction is neutral to moderately alkaline throughout the profile.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is 3 to 7 inches thick. It dominantly is clay but in some pedons is silty clay. The B horizon has value of 4 or 5 (3 or 4 moist) and chroma of 1 to 3. It is clay or silty clay. The C horizon has value of 4 to 6 (4 or 5 moist) and chroma of 1 to 3. Its content of shale fragments ranges from 5 to 35 percent. The Cr horizon has value of 4 to 7 (dry or moist) and chroma of 1 to 3.

Chancellor series

The Chancellor series consists of deep, somewhat poorly drained soils formed in silty and clayey alluvium in swales on uplands. Permeability is slow. Slopes range from 0 to 2 percent.

Chancellor soils are similar to Crossplain soils and commonly are near Alcester, Homme, Onita, and Tetonka soils. The moderately well drained Alcester and Onita soils are in positions on the landscape similar to those of the Chancellor soils. Crossplain soils contain more sand throughout than the Chancellor soils. The well drained and moderately well drained Homme soils are higher on the landscape than the Chancellor soils. The poorly drained Tetonka soils are in depressions.

Typical pedon of Chancellor silty clay loam, in an area of Onita-Chancellor silty clay loams, 1,850 feet east and 486 feet south of the northwest corner of sec. 34, T. 94 N., R. 60 W.

Ap—0 to 6 inches; dark gray (l0YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—6 to 13 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; slightly acid; gradual smooth boundary.

Btg1—13 to 26 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; few fine distinct olive (5Y 4/4) mottles; weak medium prismatic structure parting to weak medium and fine blocky; very hard, firm, sticky and plastic; slightly acid; gradual wavy boundary.

Btg2—26 to 33 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; few medium and common fine distinct dark yellowish brown (10YR 4/6) and light olive brown (2.5Y 5/4) mottles; moderate coarse and medium prismatic structure parting to moderate coarse and medium blocky; very hard, firm, sticky and plastic; faces of peds are very dark gray (5Y 3/1) when moist; slightly acid; gradual wavy boundary.

BCgk—33 to 39 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; common fine distinct dark yellowish brown (10YR 4/6) and light olive brown (2.5Y 5/4) mottles; weak coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cgk—39 to 50 inches; light gray (5Y 7/2) silty clay loam, olive gray (5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm, sticky and plastic; few fine accumulations of iron and manganese oxide; few fine accumulations of carbonate; few fine nests of gypsum; strong effervescence; mildly alkaline; gradual wavy boundary.

Cg—50 to 60 inches; light gray (5Y 7/2) silty clay loam, olive gray (5Y 5/2) moist; many medium and fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm, sticky and plastic; few fine accumulations of carbonate; few fine nests of gypsum; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 44 inches. The thickness of the mollic epipedon ranges from 24 to 36 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or less. The Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is slightly acid to mildly alkaline. The C horizon has hue of 2.5Y or 5Y. It is silty clay loam or clay loam. It is mildly alkaline or moderately alkaline.

Clarno series

The Clarno series consists of deep, well drained and moderately well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 6 percent.

Clarno soils commonly are near Bonilla, Crossplain, Davison, and Ethan soils. The moderately well drained Bonilla soils are in swales. The somewhat poorly drained Crossplain soils are in the deeper swales. Davison soils have a calcic horizon. They are lower on the landscape than the Clarno soils. Ethan soils have free carbonates within a depth of 12 inches. They are on knolls and ridges.

Typical pedon of Clarno loam, in an area of Clarno-Bonilla loams, 0 to 2 percent slopes, 1,568 feet west and 40 feet north of the southeast corner of sec. 29, T. 96 N., R. 58 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse and medium subangular blocky structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—6 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak medium and fine granular; slightly hard, friable; neutral; clear wavy boundary.

Bw—8 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

BCk—17 to 26 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Ck—26 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; few fine distinct gray (N 6/0) and many medium and fine distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable; few fine accumulations of carbonate; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 36 inches. The depth to free carbonates ranges from 12 to 20 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is 6 to 10 inches thick. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is loam or clay loam. It is neutral or mildly alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam or clay loam. It is mildly alkaline or moderately alkaline.

Crofton series

The Crofton series consists of deep, well drained soils formed in loess on uplands. Permeability is moderate. Slopes range from 9 to 15 percent.

Crofton soils commonly are near Eltree and Ethan soils. Both of the nearby soils have a mollic epipedon. Also, Ethan soils formed in glacial till. They are in positions on the landscape similar to those of the Crofton soils. Eltree soils are on the lower side slopes.

Typical pedon of Crofton silt loam, in an area of Eltree-Crofton silt loams, 9 to 15 percent slopes, 2,300 feet east and 1,200 feet north of the southwest corner of sec. 16, T. 93 N., R. 58 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

C1—4 to 10 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak fine and medium blocky structure; slightly hard, very friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—10 to 48 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C3—48 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; massive; hard, firm; violent effervescence; moderately alkaline.

The depth to free carbonates is less than 5 inches. The A horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. 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. Clay loam glacial till is below a depth of 40 inches in some pedons.

Crossplain series

The Crossplain series consists of deep, somewhat poorly drained soils formed in loamy alluvium in swales on uplands. Permeability is slow. Slopes range from 0 to 2 percent.

Crossplain soils are similar to Chancellor soils and commonly are near Bonilla, Clarno, Davison, and Tetonka soils. The moderately well drained Bonilla and Clarno soils are slightly higher on the landscape than the Crossplain soils. Chancellor soils contain less sand throughout than the Crossplain soils. Davison soils have a calcic horizon. They are between the Crossplain and Clarno soils on the landscape. The poorly drained Tetonka soils are in depressions.

Typical pedon of Crossplain clay loam, in an area of Clarno-Crossplain-Davison complex, 0 to 3 percent slopes, 1,480 feet north and 110 feet west of the southeast corner of sec. 18, T. 95 N., R. 59 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; few fine faint very dark grayish brown (2.5Y 3/2) mottles; weak coarse and medium subangular blocky structure; hard, friable; neutral; abrupt smooth boundary.

Btg1—9 to 19 inches; dark gray (5Y 4/1) clay, black (5Y 2/1) moist; few fine faint very dark grayish brown (2.5Y 3/2) mottles; weak coarse prismatic structure parting to moderate medium and fine blocky; very hard, firm, sticky and plastic; neutral; clear wavy boundary.

Btg2—19 to 27 inches; olive gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; few fine faint olive brown (2.5Y 4/4) mottles; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; neutral; gradual wavy boundary.

BCgk—27 to 37 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 4/2) moist; many fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few medium and large accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cgk—37 to 50 inches; pale olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; common fine distinct gray (10YR 6/1) and yellowish brown (10YR 5/6) and few fine faint olive brown (2.5Y 4/4) mottles; massive; hard, firm, sticky and plastic; few medium and fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cgky—50 to 60 inches; pale olive (5Y 6/3) clay loam that has thin strata of loam and sandy loam; olive (5Y 4/3) moist; many medium and fine distinct yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; massive; hard, firm, sticky and plastic; few medium and fine accumulations of carbonate; few medium nests of gypsum; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 48 inches. The thickness of the mollic epipedon ranges from 12 to 32 inches. The depth to free carbonates ranges from 20 to 40 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or less. It is slightly acid or neutral. The Btg horizon has hue of 2.5Y or 5Y, value of 3 to 6 (2 to 4 moist), and chroma of 1 or 2. It is clay loam or clay. It is slightly acid or neutral. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It is neutral to moderately alkaline.

Davis series

The Davis series consists of deep, well drained soils formed in loamy sediments on foot slopes and fans in the uplands. Permeability is moderate. Slopes range from 0 to 15 percent.

Davis soils are similar to Alcester, Bon, and Bonilla soils and commonly are near Bon and Ethan soils. The moderately well drained Alcester soils contain more silt

and less sand throughout than the Davis soils. The moderately well drained Bon soils are not so deep to free carbonates as the Davis soils. The moderately well drained Bonilla soils are in swales. Ethan soils have a mollic epipedon that is less than 10 inches thick. They are higher on the landscape than the Davis soils.

Typical pedon of Davis loam, in an area of Ethan-Davis loams, 9 to 15 percent slopes, 2,440 feet north and 100 feet east of the southwest corner of sec. 25, T. 96 N., R. 58 W.

A—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; clear smooth boundary.

BA—10 to 16 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse and medium prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

Bw1—16 to 26 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to coarse and medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

Bw2—26 to 40 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak very coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

BC—40 to 50 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure; slightly hard, friable; few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.

C—50 to 60 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; massive; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum and the thickness of the mollic epipedon range from 30 to more than 60 inches. The depth to free carbonates ranges from 20 to 50 inches. Some pedons have a buried A horizon.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam. It is slightly acid or neutral. The B horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is clay loam. It is slightly acid to mildly alkaline. The C horizon has value of 4 to 7 (3 to 5 moist) and chroma of 1 to 4. It is mildly alkaline or moderately alkaline.

Davison series

The Davison series consists of deep, moderately well drained soils formed in loamy glacial till near the edges of swales, drainageways, and depressions in the uplands. Permeability is moderate in the upper part of the soils and moderately slow in the lower part. Slopes range from 0 to 3 percent.

Davison soils commonly are near Clarno, Crossplain, Homme, and Tetonka soils. The moderately well drained and well drained Clarno and Homme soils are higher on the landscape than the Davison soils. The somewhat poorly drained Crossplain soils are in swales. The poorly drained Tetonka soils are in depressions.

Typical pedon of Davison loam, in an area of Clarno-Crossplain-Davison complex, 0 to 3 percent slopes, 300 feet west and l30 feet south of the northeast corner of sec. 33, T. 94 N., R. 58 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

Ck—8 to 22 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

Cky—22 to 36 inches; pale olive (5Y 6/3) loam, olive (5Y 5/3) moist; many fine distinct gray (5Y 6/1) and yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable; slight effervescence; many fine crystals of gypsum; mildly alkaline; gradual wavy boundary.

C—36 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; many medium distinct brownish yellow (10YR 6/6) and gray (5Y 6/1) mottles; massive; slightly hard, firm, slightly sticky and slightly plastic; strong effervescence; mildly alkaline.

The mollic epipedon is 7 to 12 inches thick. Typically, free carbonates are at the surface, but some pedons in areas that support native grass are leached to a depth of 6 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam. It is mildly alkaline or moderately alkaline. The C horizon has value of 5 to 8 (4 to 6 moist) and chroma of 1 to 4. It is clay loam or loam. It has few to many, faint to prominent mottles. In some pedons it does not have gypsum crystals.

Delmont series

The Delmont series consists of somewhat excessively drained soils that are shallow over gravelly sand. These soils formed in loamy alluvium over gravelly sand. They are on outwash plains and terraces. Permeability is moderate in the solum and rapid in the underlying material. Slopes range from 0 to 25 percent.

Delmont soils are similar to Enet soils and commonly are near Enet, Ethan, Graceville, and Talmo soils. Enet and Graceville soils are deeper to gravelly material than the Delmont soils. Ethan soils formed in clay loam glacial till. They are on uplands. Talmo soils generally are shallower to gravelly material than the Delmont soils.

Typical pedon of Delmont loam, in an area of Enet-Delmont loams, 0 to 2 percent slopes, 2,150 feet east and 1,100 feet south of the northwest corner of sec. 11, T. 96 N., R. 58 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; neutral; abrupt smooth boundary.

Bw—8 to 15 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse and medium prismatic structure parting to weak coarse and medium subangular blocky; soft, very friable; neutral; gradual wavy boundary.

2C—15 to 60 inches; brown (10YR 5/3) gravelly sand, dark brown (10YR 4/3) moist; single grain; loose; slight effervescence; mildly alkaline.

The thickness of the solum, the depth to gravelly material, and the depth to free carbonates range from 10 to 20 inches. The thickness of the mollic epipedon also ranges from 10 to 20 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral and is 4 to 10 inches thick. The B horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is neutral or mildly alkaline. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. In some pedons it has thin strata of loamy fine sand in the lower part.

Eltree series

The Eltree series consists of deep, well drained soils formed in loess on uplands. Permeability is moderate. Slopes range from 0 to 15 percent.

Eltree soils are similar to Alcester and Yankton soils and commonly are near Alcester, Crofton, and Ethan soils. Alcester soils are deeper to free carbonates than the Eltree soils. Crofton soils do not have a mollic epipedon. They are on knolls and ridges. Ethan soils formed in clay loam glacial till. They are higher on the landscape than the Eltree soils. Yankton soils formed in silty material 25 to 40 inches deep over clay loam glacial till.

Typical pedon of Eltree silt loam, 0 to 2 percent slopes (fig.14), 740 feet west and 246 feet north of the southeast corner of sec. 7, T. 93 N., R. 58 W.

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

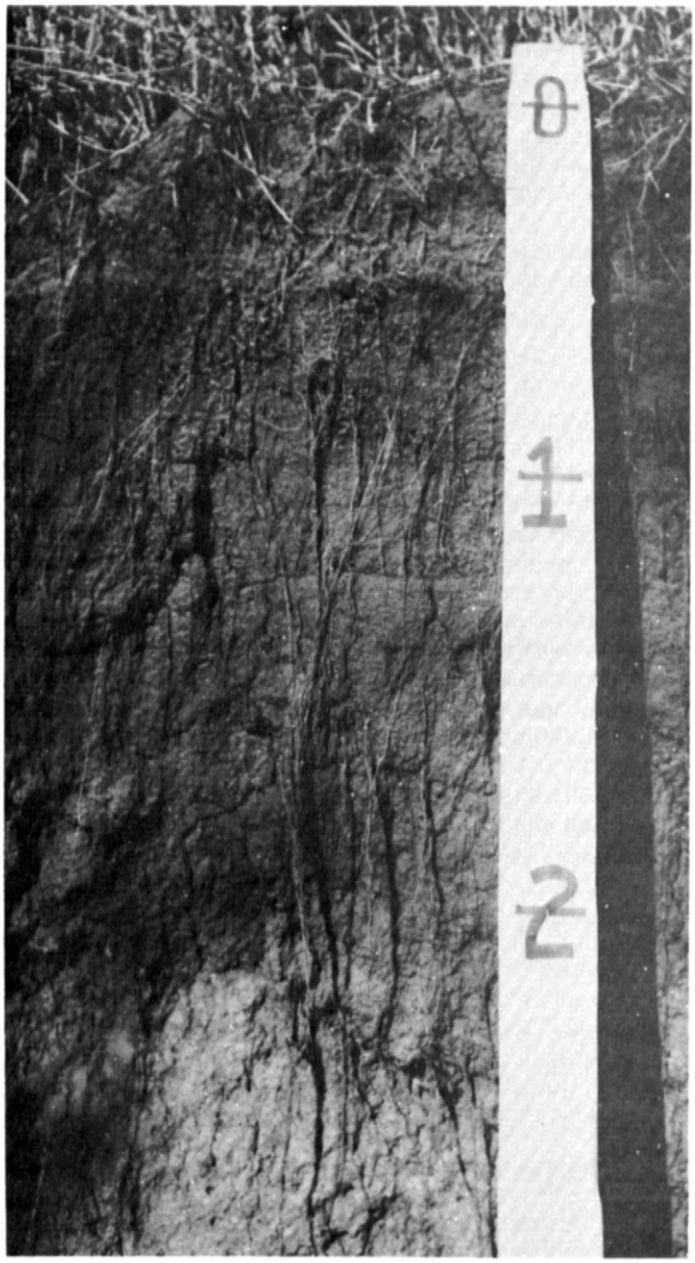

Figure 14.—Profile of Eltree silt loam, 0 to 2 percent slopes. Dark colors extend to a depth of about 26 inches. Depth is marked in feet.

Bw1—12 to 18 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

Bw2—18 to 28 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; gradual wavy boundary.
Bw3—28 to 39 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; gradual wavy boundary.
C—39 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 35 to 60 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches. Free carbonates are at the surface in some areas.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It is neutral to moderately alkaline. The B horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 to 4. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4. The B and C horizons are mildly alkaline or moderately alkaline.

Enet series

The Enet series consists of well drained soils that are moderately deep over gravelly material. These soils formed in glacial outwash or alluvial sediments on uplands and terraces. Permeability is moderate in the subsoil and rapid in the underlying material. Slopes range from 0 to 6 percent.

Enet soils are similar to Delmont soils and commonly are near Delmont and Graceville soils. Delmont soils are 10 to 20 inches deep over gravelly sand. Graceville soils are more than 40 inches deep over gravelly sand. They are on high terraces.

Typical pedon of Enet loam, in an area of Enet-Delmont loams, 2 to 6 percent slopes, 880 feet north and 2,455 feet east of the southwest corner of sec. 2, T. 94 N., R. 58 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium granular structure; soft, very friable; neutral; abrupt smooth boundary.
A—6 to 10 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium and fine granular; soft, very friable; neutral; clear smooth boundary.
Bw—10 to 22 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.
BCk—22 to 25 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear wavy boundary.
2Ck—25 to 34 inches; brown (10YR 5/3) gravelly loamy sand, dark brown (10YR 4/3) moist; single grain; loose; carbonate coatings on pebbles; strong effervescence; mildly alkaline; clear wavy boundary.
2C—34 to 60 inches; multicolored gravelly sand; single grain; loose; slight effervescence; mildly alkaline.

The thickness of the solum, or the depth to gravelly material, ranges from 22 to 35 inches. The thickness of the mollic epipedon and the depth to free carbonates range from 20 to 35 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral. It is 6 to 12 inches thick. It dominantly is loam but in some pedons is fine sandy loam. The B horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Ethan series

The Ethan series consists of deep, well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the solum and moderately slow in the underlying material. Slopes range from 2 to 40 percent.

Ethan soils are similar to Betts soils and commonly are near Alcester, Betts, Bonilla, Clarno, Davis, Eltree, Gavins, Homme, and Talmo soils. Alcester, Bonilla, Davis, and Eltree soils have a mollic epipedon that is more than 20 inches thick. They are in swales and on foot slopes. Betts soils do not have a mollic epipedon. They are on the steeper parts of the landscape. Clarno and Homme soils are deeper to carbonates than the Ethan soils. They are on the smoother parts of the landscape. Gavins soils are shallow. They are lower on the landscape than the Ethan soils. Talmo soils are shallow over gravelly sand. They are on ridges and knolls.

Typical pedon of Ethan loam, in an area of Homme-Ethan-Onita complex, 1 to 6 percent slopes, 2,300 feet north and 60 feet east of the southwest corner of sec. 2, T. 95 N., R. 61 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

Bk—7 to 17 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak coarse and medium prismatic structure; hard, firm, sticky and plastic; few fine accumulations of carbonate; violent effervescence; mildly alkaline; clear wavy boundary.

Ck—17 to 30 inches; pale yellow (2.5Y 7/4) clay loam, olive brown (2.5Y 4/4) moist; few fine faint yellowish brown (10YR 5/6) mottles; massive; hard, firm, sticky and plastic; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C—30 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; few fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 15 to 30 inches. The depth to free carbonates is 0 to 5 inches. The mollic epipedon is 7 to 10 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is loam or very stony loam. It ranges from slightly acid to mildly alkaline. 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 or clay loam. It is mildly alkaline or moderately alkaline. The mottles in this horizon are inherited from the parent material.

Gavins series

The Gavins series consists of shallow, well drained soils formed in residuum of siltstone on uplands. Permeability is moderate above the siltstone. Slopes range from 9 to 40 percent.

Gavins soils commonly are near Betts, Ethan, Redstoe Variant, and Sansarc soils. The deep Betts and Ethan soils formed in loamy glacial till. The deep Redstoe Variant soils are on side slopes. Sansarc soils contain more clay than the Gavins soils and have shale within a depth of 20 inches. Betts, Ethan, and Sansarc soils are higher on the landscape than the Gavins soils.

Typical pedon of Gavins loam, in an area of Redstoe Variant-Gavins complex, 6 to 25 percent slopes, 1,410 feet north and 600 feet east of the southwest corner of sec. 22, T. 93 N., R. 60 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; neutral; clear wavy boundary.

AC—5 to 10 inches; very pale brown (10YR 7/3) silt loam, light yellowish brown (10YR 6/4) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; clear wavy boundary.

C—10 to 16 inches; very pale brown (10YR 8/3) silt loam, very pale brown (10YR 7/4) moist; massive; soft, very friable; many medium and fine fragments of siltstone; strong effervescence; mildly alkaline; diffuse irregular boundary.

Cr—16 to 60 inches; very pale brown (10YR 7/3) siltstone, very pale brown (10YR 7/4) moist; accumulations of gypsum between bedding planes; strong effervescence; neutral.

The depth to siltstone ranges from 10 to 20 inches. Fragments of siltstone are throughout the solum. They increase in number with increasing depth. Reaction is neutral or mildly alkaline throughout the profile.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is loam or silt loam. The C horizon has value of 5 to 8 (5 to 7 moist) and chroma of 3 to 5. The bedrock plates range from one-half inch to several feet in thickness.

Graceville series

The Graceville series consists of deep, well drained soils formed in silty alluvium over gravelly sand on high terraces. Permeability is moderate in the subsoil and rapid in the underlying gravelly sand. Slopes range from 0 to 2 percent.

Graceville soils commonly are near Bon, Delmont, Enet, and Homme soils. Bon soils formed in loamy alluvium on terraces and flood plains. Delmont soils have gravelly sand within a depth of 20 inches. They are on ridges. Enet soils are 20 to 40 inches deep over gravelly sand. They are on slight rises. Homme soils formed in silty material over clay loam glacial till. They are on uplands.

Typical pedon of Graceville silty clay loam, 0 to 2 percent slopes, 1,600 feet west and 285 feet south of the northeast corner of sec. 1, T. 93 N., R. 62 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A—8 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bw1—18 to 28 inches; dark brown (10YR 4/3) silty clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bw2—28 to 34 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate fine and medium blocky; very hard, firm, sticky and plastic; neutral; clear smooth boundary.

Bwk—34 to 42 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

BC—42 to 50 inches; light yellowish brown (10YR 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; gradual smooth boundary.

2C—50 to 60 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) gravelly sand, dark brown (10YR 4/3) and dark yellowish brown (10YR 3/6) moist; single grain; loose; strong effervescence; mildly alkaline.

The thickness of the solum, or the depth to gravelly sand, ranges from 40 to 60 inches. The depth to carbonates ranges from 28 to 55 inches. The thickness of the mollic epipedon ranges from 24 to 45 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is silty clay loam or silt loam. It is slightly acid or neutral. The B horizon has value of 4 to 6 (2 to 4 moist) and chroma of 2 to 4. The 2C horizon is neutral or mildly alkaline.

Homme series

The Homme series consists of deep, well drained and moderately well drained soils formed in silty material over loamy glacial till on uplands. Permeability is moderately slow. Slopes range from 0 to 9 percent.

Homme soils commonly are near Chancellor, Davison, Ethan, Onita, and Tetonka soils. The somewhat poorly drained Chancellor soils and the moderately well drained Onita soils are in swales. They have a mollic epipedon that is more than 20 inches thick. Davison soils have a calcic horizon. They are slightly lower on the landscape than the Homme soils. Ethan soils are not so deep to free carbonates as the Homme soils and contain more sand throughout. They are on ridges and knolls. The poorly drained Tetonka soils are in depressions.

Typical pedon of Homme silty clay loam, in an area of Homme-Onita silty clay loams, 0 to 2 percent slopes, 2,190 feet south and 126 feet west of the northeast corner of sec. 28, T. 94 N., R. 60 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to weak fine and medium subangular blocky; slightly hard, friable; neutral; abrupt smooth boundary.

Bw1—8 to 18 inches; brown (10YR 4/3) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium blocky; hard, firm, sticky and plastic; neutral; clear smooth boundary.

Bw2—18 to 24 inches; light olive brown (2.5Y 5/4) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to strong medium blocky; hard, firm, sticky and plastic; neutral; abrupt wavy boundary.

BCk—24 to 36 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to moderate fine and medium blocky; hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

2C—36 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common medium distinct yellowish brown (10YR 5/6) and light gray (10YR 7/1) mottles; massive; hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 45 inches. The depth to free carbonates ranges from 20 to 32 inches. The depth to loamy glacial till ranges from 30 to 50 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral. The Bw horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 to 4. It is neutral or mildly alkaline. Some pedons have a C horizon. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is clay loam or loam. It is mildly alkaline or moderately alkaline. In some pedons it has nests of gypsum in the lower part.

Lamo series

The Lamo series consists of deep, somewhat poorly drained soils formed in calcareous, silty alluvium on flood plains. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Lamo soils commonly are near Davis and Salmo soils. The well drained Davis soils are on foot slopes and uplands. The poorly drained Salmo soils are slightly lower on the flood plains than the Lamo soils. They have visible salt crystals throughout.

Typical pedon of Lamo silt loam, 2,000 feet east and 260 feet south of the northwest corner of sec. 18, T. 93 N., R. 58 W.

A1—0 to 14 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure parting to weak fine granular; soft, friable; strong effervescence; mildly alkaline; gradual smooth boundary.

A2—14 to 24 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; few medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure parting to weak medium subangular blocky; slightly hard, friable; slight effervescence; mildly alkaline; gradual smooth boundary.

AC—24 to 38 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable; slight effervescence; mildly alkaline; gradual smooth boundary.

C—38 to 60 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; common medium distinct strong brown (7.5YR 5/6) mottles; massive; hard, firm; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 38 inches. The depth to free carbonates ranges from 0 to 10 inches. The thickness of the mollic epipedon ranges from 24 to 39 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (3 to 6 moist), and chroma of 1 or 2. It is silt loam or silty clay loam.

Onita series

The Onita series consists of deep, moderately well drained soils formed in local alluvium in swales on uplands. Permeability is moderately slow. Slopes range from 0 to 6 percent.

Onita soils commonly are near Chancellor, Homme, and Tetonka soils. The somewhat poorly drained Chancellor soils are slightly lower on the landscape than the Onita soils. The well drained and moderately well drained Homme soils are on uplands. The poorly drained Tetonka soils are in depressions.

Typical pedon of Onita silty clay loam, in an area of Homme-Onita silty clay loams, 0 to 2 percent slopes, 1,950 feet south and 140 feet west of northeast corner of sec. 28, T. 94 N., R. 60 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to weak fine and medium granular; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—10 to 15 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; slightly acid; clear smooth boundary.

Bt1—15 to 22 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; hard, firm, slightly sticky and slightly plastic; slightly acid; gradual wavy boundary.

Bt2—22 to 36 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate fine blocky; hard, firm, sticky and plastic; neutral; gradual wavy boundary.

BC—36 to 46 inches; light olive brown (2.5Y 5/4) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate fine blocky; hard, firm, sticky and plastic; neutral; abrupt wavy boundary.

C—46 to 55 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, firm, sticky and plastic; strong effervescence; moderately alkaline; clear smooth boundary.

2Ck—55 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium distinct yellowish brown (10YR 5/6) and light gray (10YR 7/1) mottles; massive; slightly hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 52 inches. The depth to free carbonates ranges from 22 to more than 40 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is 8 to 18 inches thick. It is slightly acid or neutral. It is silt loam or silty clay loam. The Bt horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). It is silty clay loam or silty clay. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline. Some pedons do not have a 2C horizon.

Redstoe Variant

The Redstoe Variant consists of deep, well drained soils formed in silty sediments on uplands. Permeability is moderate. Slopes range from 6 to 25 percent.

Redstoe Variant soils commonly are near Bon and Gavins soils. Bon soils formed in loamy sediments on narrow flood plains. Gavins soils are 10 to 20 inches deep over siltstone. They are on the steeper parts of the landscape above the Redstoe Variant soils.

Typical pedon of Redstoe Variant silt loam, in an area of Redstoe Variant-Gavins complex, 6 to 25 percent slopes, 760 feet east and 1,900 feet south of the northwest corner of sec. 24, T. 93 N., R. 58 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

A2—5 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

Bw—12 to 18 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

Bk—18 to 24 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

BCk—24 to 36 inches; light brownish gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure; hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C1—36 to 48 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C2—48 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light yellowish brown (2.5Y 6/4) moist; massive; soft, friable; few fine fragments of siltstone; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. The thickness of the mollic epipedon ranges from 6 to 20 inches. The depth to free carbonates is less than 5 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is silt loam or loam. It is neutral to moderately alkaline. The B horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 to 4. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 to 4. The B and C horizons are mildly alkaline or moderately alkaline.

Salmo series

The Salmo series consists of deep, poorly drained soils formed in silty and loamy alluvium on flood plains. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Salmo soils commonly are near Bon, Clarno, Davis, Homme, and Lamo soils. The moderately well drained Bon soils are on terraces. The well drained Clarno, Davis, and Homme soils are on foot slopes and uplands. Lamo soils do not have visible salt crystals within a depth of 30 inches. They are slightly higher on the flood plains than the Salmo soils.

Typical pedon of Salmo silty clay loam, 1,387 feet west and 120 feet south of the northeast corner of sec. 16, T. 96 N., R. 60 W.

Az1—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; few fine nests of salts; strong effervescence; mildly alkaline; clear wavy boundary.

Az2—6 to 15 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine nests of salts; strong effervescence; mildly alkaline; clear wavy boundary.

Ayz—15 to 28 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine nests of gypsum; few fine nests of salts; slight effervescence; mildly alkaline; clear wavy boundary.

ACgky—28 to 41 inches; gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; few fine distinct dark yellowish brown (10YR 4/6) and few medium distinct olive brown (2.5Y 4/4) mottles; weak medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine nests of gypsum; few fine nests of salts; common medium and few large accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

Cgky—41 to 60 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; common fine distinct dark yellowish brown (10YR 4/6) and olive brown (2.5Y 4/4) mottles; massive; hard, firm, sticky and plastic; common fine nests of gypsum; few fine nests of salts; common large and medium accumulations of carbonate; violent effervescence; mildly alkaline.

The mollic epipedon ranges from 25 to more than 60 inches in thickness. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR or 2.5Y. It is 15 to 30 inches thick. It is silty clay loam or silt loam. The C horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is silt loam, silty clay loam, or clay loam.

Sansarc series

The Sansarc series consists of shallow, well drained soils formed in residuum of clayey shale on the breaks along the Missouri River. Permeability is slow. Slopes range from 15 to 40 percent.

Sansarc soils commonly are near Boyd, Ethan, Gavins, and Thurman soils. Boyd soils are moderately deep over shale. They are on smooth slopes, generally below the Sansarc soils. Ethan and Thurman soils are on the higher parts of the landscape. Ethan soils formed in clay loam glacial till, and Thurman soils formed in sandy glacial outwash. Gavins soils are silty and have siltstone within a depth of 20 inches. They are lower on the landscape than the Sansarc soils.

Typical pedon of Sansarc clay, in an area of Boyd-Sansarc clays, 15 to 40 percent slopes, 1,860 feet east and 1,800 feet south of the northwest corner of sec. 24, T. 93 N., R. 58 W.

A—0 to 4 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure parting to moderate fine granular; hard, friable, very sticky and very plastic; strong effervescence; neutral; clear smooth boundary.

C1—4 to 10 inches; light brownish gray (10YR 6/2) shaly clay, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak medium granular; hard, friable, very sticky and very plastic; strong effervescence; mildly alkaline; clear smooth boundary.

C2—10 to 16 inches; light brownish gray (2.5Y 6/2) shaly clay, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky and plastic; more than 50 percent fragments of shale; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—16 to 60 inches; light gray (2.5Y 7/2) shale, light brownish gray (2.5Y 6/2) moist; strong effervescence; mildly alkaline.

The depth to shale ranges from 4 to 20 inches. The clay content of the horizons above the shale ranges from 55 to 65 percent. Reaction is neutral to moderately alkaline above the shale and ranges from medium acid to moderately alkaline in the shale. Some pedons do not have free carbonates.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (4 or 5 moist), and chroma of 2. The content of shale fragments ranges from 5 to 20 percent in the C1 horizon and is more than 50 percent in the C2 horizon. The shale has a wide range in color.

Sarpy series

The Sarpy series consists of deep, excessively drained soils formed in sandy alluvium on the flood plains along the Missouri River. Permeability is rapid or very rapid. Slopes range from 0 to 3 percent.

Sarpy soils commonly are near the moderately well drained Waubonsie soils on the slightly lower parts of the flood plains. These nearby soils have clayey sediments below a depth of about 20 inches.

Typical pedon of Sarpy loamy fine sand, in an area of Sarpy-Waubonsie complex, 1,700 feet north and 100 feet east of the southwest corner of sec. 16, T. 92 N., R. 60 W.

A—0 to 3 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; neutral; clear smooth boundary.

C—3 to 60 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral.

Reaction ranges from neutral to moderately alkaline throughout the profile. The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 to 3. It dominantly is loamy fine sand but in some pedons is fine sand, sand, loamy sand, or fine sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is loamy fine sand, fine sand, or sand. Some pedons contain free carbonates.

Talmo series

The Talmo series consists of excessively drained soils that are very shallow over gravelly sand. These soils formed in gravelly outwash on uplands. Permeability is rapid. Slopes range from 6 to 40 percent.

Talmo soils commonly are near Betts, Delmont, and Ethan soils. The well drained Betts and Ethan soils formed in clay loam glacial till. Their positions on the landscape are similar to those of the Talmo soils. The somewhat excessively drained Delmont soils are slightly lower on the landscape than the Talmo soils. They are 10 to 20 inches deep over gravelly sand.

Typical pedon of Talmo loam, in an area of Talmo-Delmont loams, 15 to 40 percent slopes, 1,600 feet east and 850 feet north of the southwest corner of sec. 2, T. 93 N., R. 59 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; neutral; gradual wavy boundary.

2Ck—5 to 60 inches; multicolored gravelly sand; single grain; loose; coatings of carbonate on undersides of pebbles; strong effervescence; mildly alkaline.

Gravelly sand is within a depth of 14 inches. The mollic epipedon, after mixing, is 7 to 10 inches thick. The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam or very stony loam but in some pedons is gravelly loam or gravelly sandy loam. The 2Ck horizon is mildly alkaline or moderately alkaline. The content of gravel in this horizon is 50 to 75 percent.

Tetonka series

The Tetonka series consists of deep, poorly drained soils formed in local alluvium over glacial till in depressions and deep swales on uplands. Permeability is very slow. Slopes are 0 to 1 percent.

Tetonka soils are similar to Worthing soils and commonly are near Bonilla, Chancellor, Clarno, Crossplain, Davison, Homme, and Onita soils. The moderately well drained Bonilla and Onita soils are in swales. The somewhat poorly drained Chancellor and Crossplain soils also are in swales. They do not have an E horizon. The well drained and moderately well drained Clarno and Homme soils are on uplands. Davison soils have a calcic horizon. They are on the edges of the depressions. The very poorly drained Worthing soils do not have an E horizon.

Typical pedon of Tetonka silt loam, 520 feet east and 1,250 feet south of the northwest corner of sec. 27, T. 96 N., R. 58 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; slightly acid; abrupt smooth boundary.

E—9 to 16 inches; light gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; common fine distinct dark yellowish brown (10YR 4/6) mottles; weak thick and medium platy structure parting to weak fine granular; slightly hard, friable; slightly acid; clear wavy boundary.

Bt1—16 to 20 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; thin patchy gray (10YR 6/1) coatings on faces of peds; weak medium subangular blocky structure; hard, firm, sticky and plastic; slightly acid; clear smooth boundary.

Bt2—20 to 35 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; weak coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; neutral; gradual wavy boundary.

Btg—35 to 42 inches; dark gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) moist; common large and medium distinct yellowish brown (10YR 5/6) and few medium and fine distinct olive (5Y 5/4) mottles; moderate coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; few fine concretions of iron and manganese oxide; neutral; gradual wavy boundary.

BCg—42 to 51 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; common large and medium distinct dark grayish brown (2.5Y 4/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; few fine concretions of iron and manganese oxide; neutral; clear wavy boundary.

Cg1—51 to 56 inches; light gray (5Y 7/1) clay loam, olive gray (5Y 5/2) moist; common medium and fine distinct yellowish brown (10YR 5/6) and few fine distinct pale olive (5Y 6/4) mottles; massive; very hard, firm, sticky and plastic; few fine concretions of iron and manganese oxide; few fine accumulations of carbonate; slight effervescence; neutral; gradual wavy boundary.

Cg2—56 to 60 inches; light gray (5Y 7/2) clay loam, olive gray (5Y 5/2) moist; many medium and fine distinct yellowish brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few fine concretions of iron and manganese oxide; few fine accumulations of carbonate; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 60 inches. The depth to free carbonates ranges from 48 to more than 60 inches.

The A or Ap horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is 6 to 12 inches thick. The E horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is 4 to 12 inches thick. It ranges from medium acid to neutral. The Bt 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 silty clay, silty clay loam, or clay. It is slightly acid or neutral. The C horizon has hue of 2.5Y or 5Y. It ranges from neutral to moderately alkaline. It is silty clay loam, silty clay, or clay loam.

Thurman series

The Thurman series consists of deep, well drained soils formed in glacial melt water deposits on the breaks along the Missouri River. Permeability is rapid. Slopes range from 6 to 40 percent.

Thurman soils commonly are near Ethan and Sansarc soils. Ethan soils formed in clay loam glacial till. They are on the higher parts of the landscape. Sansarc soils have shale within a depth of 20 inches and contain more clay than the Thurman soils. Also, they are lower on the landscape.

Typical pedon of Thurman loamy sand, 15 to 40 percent slopes, 1,250 feet north and 900 feet west of the southeast corner of sec. 13, T. 92 N., R. 61 W.

A—0 to 14 inches; dark grayish brown (10YR 4/2) loamy sand, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

AC—14 to 19 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C1—19 to 32 inches; light brownish gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; gradual smooth boundary.

C2—32 to 48 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 4/3) moist; single grain; loose; neutral; gradual smooth boundary.

C3—48 to 60 inches; light gray (10YR 7/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral.

The thickness of the solum ranges from 14 to 28 inches. The thickness of the mollic epipedon ranges from 14 to 20 inches. Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is loamy sand but in some pedons is loamy fine sand or fine sandy loam. 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. In some pedons it is stratified with coarse sand and fine gravel.

Waubonsie series

The Waubonsie series consists of deep, moderately well drained soils formed in loamy and clayey alluvium on the flood plains along the Missouri River. Permeability is moderately rapid in the upper part of the soils and slow or very slow in the underlying material. Slopes range from 0 to 3 percent.

Waubonsie soils commonly are near the excessively drained Sarpy soils on the slightly higher parts of the flood plains. These nearby soils formed in sandy alluvium.

Typical pedon of Waubonsie very fine sandy loam, in an area of Sarpy-Waubonsie complex, 1,600 feet north and 200 feet east of the southwest corner of sec. 16, T. 92 N., R. 60 W.

A—0 to 6 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—6 to 20 inches; light brownish gray (2.5Y 6/2) very fine sandy loam stratified with thin layers of loamy fine sand; dark grayish brown (2.5Y 4/2) moist; common medium prominent yellowish brown (10YR 5/6) mottles; massive; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

2Cg—20 to 60 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; many coarse and medium distinct light olive brown (2.5Y 5/4) mottles; massive; extremely hard, firm, sticky and plastic; slight effervescence; mildly alkaline.

The thickness of the solum is less than 10 inches and is the same as the thickness of the A horizon. Reaction is mildly alkaline or moderately alkaline throughout the profile. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2. The 2C horizon is silty clay or clay.

Worthing series

The Worthing series consists of deep, very poorly drained soils formed in alluvium in depressions on uplands. Permeability is slow. Slopes are less than 1 percent.

Worthing soils are similar to Tetonka soils and commonly are near Bonilla, Chancellor, Crossplain, Onita, and Tetonka soils. The moderately well drained Bonilla and Onita soils and the somewhat poorly drained Chancellor and Crossplain soils are in swales. Tetonka soils have an E horizon.

Typical pedon of Worthing silty clay loam, 1,500 feet south and 500 feet east of the northwest corner of sec. 5, T. 93 N., R. 61 W.

A—0 to 18 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to strong fine granular; slightly hard, very friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.

Btg1—18 to 30 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; neutral; gradual wavy boundary.

Btg2—30 to 47 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate coarse prismatic structure parting to strong medium subangular blocky; very hard, firm, sticky and plastic; neutral; gradual wavy boundary.

BCgk—47 to 58 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate coarse prismatic structure parting to strong medium subangular blocky; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cg—58 to 60 inches; gray (2.5Y 5/1) silty clay, very dark gray (2.5Y 3/1) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 35 to more than 60 inches. The depth to free carbonates ranges from 40 to more than 60 inches.

The A horizon has value of 3 or 4 (2 moist) and chroma of 1. It is slightly acid or neutral. It is 8 to 20 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1. The C horizon has hue of 2.5Y or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2. It is mildly alkaline or moderately alkaline. It is silty clay loam, clay loam, or silty clay.

Yankton series

The Yankton series consists of deep, well drained soils formed in silty material over glacial till on uplands. Permeability is moderate in the solum and moderately slow in the underlying material. Slopes range from 0 to 6 percent.

Yankton soils are similar to Eltree soils and commonly are near Alcester, Clarno, Eltree, and Ethan soils. Alcester and Eltree soils do not have glacial till within a depth of 40 inches. Alcester soils are in swales. Eltree soils are in positions on the landscape similar to those of the Yankton soils. Clarno and Ethan soils formed in glacial till. They are on the higher parts of the landscape.

Typical pedon of Yankton silt loam, in an area of Yankton-Alcester silt loams, 0 to 2 percent slopes, 1,850 feet west and 360 feet north of the southeast corner of sec. 6, T. 93 N., R. 58 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable; slightly acid; abrupt smooth boundary.

A1—7 to 13 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

A2—13 to 18 inches; grayish brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure parting to moderate fine and medium granular; hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

Bw—18 to 28 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to strong medium blocky; hard, friable; strong effervescence; mildly alkaline; clear wavy boundary.

BCk—28 to 34 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; hard, friable; common medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

2C—34 to 60 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; massive; hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 25 to 40 inches and corresponds to the depth to glacial till. The depth to free carbonates ranges from 10 to 20 inches. The thickness of the mollic epipedon ranges from 20 to 34 inches. Some pedons have a buried A horizon.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It dominantly is silt loam but in some pedons is silty clay loam. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is neutral or mildly alkaline. The 2C horizon has value of 5 to 7 (5 or 6 moist) and chroma of 2 to 4. It dominantly is clay loam but in some pedons is loam. It has few to many accumulations of carbonate.

formation of the soils

Soil forms when soil-forming processes act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material 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. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in Bon Homme County.

climate

Climate directly affects the rate of chemical and physical weathering. Bon Homme County has a continential climate, which generally is characterized by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. It also favors a moderately slow rate of weathering or soil formation. The climate generally is uniform throughout the county. Therefore, climate alone does not account for differences among the soils in the county. Detailed information about the climate is given under the heading "General nature of the county."

plant and animal life

Plants, animals, insects, earthworms, bacteria, and fungi have an important effect on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In Bon Homme County the prairie grasses have had more influence than other living organisms on soil formation. The nearly level Bon soils contain more organic matter than the more sloping Betts soils because they have a more extensive grass cover. As a result, more nutrients are released for plant food. Earthworms, insects, and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose plant residue, thus releasing plant nutrients.

parent material

Many of the soils in Bon Homme County formed in glacial material derived from preglacial formations of granite, gneiss, limestone, sandstone, and shale. The glacier ground up and mixed these materials as it transported them. It then redeposited them as it melted. Some deposits consist of material sorted either by water as the material was deposited or by wind and water after it was deposited; others consist of unsorted material, or glacial till.

Glacial deposits of Late Wisconsin age are on the surface throughout most of the county (*4*). These deposits consist mainly of silty and loamy glacial till and stratified glacial outwash. The silty glacial till has a high content of silt, weathers to light yellowish brown silt loam and silty clay loam, is friable, and contains few fragments of shale or stones. Homme soils formed in this silty material. The loamy glacial till is loam or clay loam that contains small fragments of shale, pebbles, small stones, and rocks. Betts, Clarno, and Ethan soils formed in this loamy material.

Glacial outwash consists of sand, gravel, and loamy material deposited by glacial melt water. Delmont, Enet, and Talmo soils formed in loamy glacial outwash underlain by gravelly sand within a depth of 40 inches. Thurman soils formed in loamy and sandy melt water deposits.

Some of the soils in the county formed in alluvium. Tetonka and Worthing soils formed partly or entirely in local alluvium washed in from the more sloping adjacent soils in the uplands. Bon soils formed in alluvium deposited by small streams. Fluvaquents and Sarpy and Waubonsie soils formed in alluvium on the flood plains along the Missouri River.

Loess mantles the uplands above the breaks adjacent to Lewis and Clark Lake and the Missouri River. Crofton, Eltree, and Yankton soils formed in this silty loess.

relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the steeper soils, such as Betts soils, much of the rainfall is lost through runoff and thus does not penetrate the surface. Much of the surface soil is lost through erosion. As a result, these soils have a thin surface layer and are calcareous at or near the surface. Runoff is less rapid on Clarno, Homme, and other less sloping soils, and more moisture penetrates the surface. These soils are calcareous at a greater depth than the Betts soils. Also, the horizons in which organic matter accumulates are thicker.

Bonilla soils are in swales that receive runoff from adjacent soils. The horizons in which organic matter accumulates are thicker than those in the Clarno and Homme soils. Tetonka soils are in depressions where water ponds. They have the colors and mottles characteristic of poorly drained soils.

time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that form. The degree of profile development reflects the age of a soil. The oldest soils are on the parts of the landscape that have been stable for the longest time. In Bon Homme County these are the Clarno and Homme soils. The youngest soils either are those from which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time the area is flooded. Betts soils are an example of young soils that are subject to natural erosion, and Bon soils are an example of young alluvial soils.

references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vols., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Baumberger, Rodney. 1977. South Dakota rangeland resources. Old West Reg. Comm. 150, illus.

(4) Christensen, Cleo M. 1974. Geology and water resources of Bon Homme County, South Dakota. S. Dak. Geol. Surv. Bull 21, Part I, 48 pp., illus.

(5) Flint, Richard Foster. 1955. Pleistocene geology of eastern South Dakota. U.S. Geol. Surv. Prof. Pap. 262, 173 pp., illus.

(6) South Dakota Crop and Reporting Service. 1969. Bon Homme County agriculture. 62 pp., illus.

(7) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(8) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(9) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 435, 754 pp., illus.

(10) United States Department of Agriculture. 1976. South Dakota land use—1975 estimates. Soil Conserv. Serv., 25 pp., illus.

(11) United States Department of Commerce, Bureau of the Census. 1979. 1978 census of agriculture. Vol. 1, Part 41, illus.

glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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 on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour farming. Growing crops in rows or strips that follow the contour.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are

free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, 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 through 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. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon below an O or A horizon and above a B horizon. The E horizon is characterized by a loss of some combination of silicate clay, iron, and aluminum and by a remaining concentration of sand and silt particles of quartz or other resistant minerals.

B horizon.—The mineral horizon below an A, E, or O horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or

angular or subangular blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A, E, and B horizons are generally called the solum. If a soil does not have 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, E, or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

R layer.—Hard bedrock beneath the soil. The bedrock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

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. The slope classes recognized in this survey are—

	Percent
Nearly level or gently undulating	0 to 2
Gently sloping or undulating	2 to 6
Moderately sloping	6 to 9
Strongly sloping or rolling	9 to 15
Moderately steep or hilly	15 to 25
Steep	25 to 40

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind 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 profile below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. Includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-78 at Tyndall, South Dakota]

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	27.9	6.1	17.1	57	-25	0	.38	.14	.58	2	5.4
February---	35.1	13.2	24.2	66	-19	0	.78	.25	1.21	3	7.8
March------	44.2	22.7	33.5	79	-9	36	1.32	.56	1.95	4	8.2
April------	61.8	36.1	49.0	90	16	90	2.37	1.33	3.28	6	1.3
May--------	73.8	48.2	61.0	94	28	348	3.48	1.73	4.98	7	.0
June-------	83.2	57.9	70.5	102	41	615	3.99	2.23	5.54	7	.0
July-------	88.7	62.8	75.7	104	47	797	3.52	1.60	5.15	6	.0
August-----	86.7	60.8	73.8	101	44	738	2.61	1.45	3.63	5	.0
September--	76.8	50.7	63.8	99	30	414	2.59	1.34	3.68	5	.0
October----	65.6	39.4	52.6	89	18	168	1.32	.35	2.11	3	.5
November---	47.1	24.9	36.0	76	-3	7	.82	.15	1.33	2	3.4
December---	33.3	12.8	23.1	61	-17	0	.68	.24	1.03	3	6.9
Yearly:											
Average--	60.4	36.3	48.4	---	---	---	---	---	---	---	---
Extreme--	---	---	---	105	-25	---	---	---	---	---	---
Total----	---	---	---	---	---	3,213	23.86	18.57	28.82	53	33.5

* 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 (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-78 at Tyndall, South Dakota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 22	May 8	May 20
2 years in 10 later than--	April 19	May 3	May 14
5 years in 10 later than--	April 12	April 23	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 11	October 1	September 22
2 years in 10 earlier than--	October 15	October 6	September 27
5 years in 10 earlier than--	October 25	October 16	October 7

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-78 at Tyndall, South Dakota]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	180	154	135
8 years in 10	185	161	142
5 years in 10	195	175	156
2 years in 10	205	189	170
1 year in 10	210	196	177

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AaA	Alcester silt loam	1,790	0.5
AcA	Alcester-Chancellor complex	630	0.2
Bn	Bon loam	4,945	1.4
Bo	Bon loam, channeled	6,320	1.8
Br	Bonilla-Crossplain complex	2,020	0.6
BsE	Boyd-Sansarc clays, 15 to 40 percent slopes	4,545	1.3
CmA	Clarno-Bonilla loams, 0 to 2 percent slopes	33,490	9.3
CmB	Clarno-Bonilla loams, 2 to 6 percent slopes	8,730	2.4
CnA	Clarno-Crossplain-Davison complex, 0 to 3 percent slopes	60,630	16.9
CsB	Clarno-Ethan-Bonilla loams, 2 to 6 percent slopes	28,330	7.9
DaB	Davis loam, 0 to 6 percent slopes	880	0.2
DaC	Davis loam, 6 to 15 percent slopes	490	0.1
DlC	Delmont-Talmo loams, 6 to 9 percent slopes	305	0.1
EaA	Eltree silt loam, 0 to 2 percent slopes	2,830	0.8
EaB	Eltree silt loam, 2 to 6 percent slopes	3,355	0.9
EbC	Eltree-Ethan complex, 6 to 9 percent slopes	755	0.2
EbE	Eltree-Ethan complex, 9 to 40 percent slopes	595	0.2
EcD	Eltree-Crofton silt loams, 9 to 15 percent slopes	1,075	0.3
EdA	Enet-Delmont loams, 0 to 2 percent slopes	1,700	0.5
EdB	Enet-Delmont loams, 2 to 6 percent slopes	1,625	0.4
EhB	Ethan-Alcester complex, 1 to 6 percent slopes	2,375	0.7
EhC	Ethan-Alcester complex, 1 to 9 percent slopes	1,765	0.5
EmE	Ethan-Betts loams, 15 to 40 percent slopes	12,715	3.5
EnC	Ethan-Bonilla loams, 1 to 9 percent slopes	7,960	2.2
EoD	Ethan-Davis loams, 9 to 15 percent slopes	8,160	2.3
EpC	Ethan-Homme complex, 6 to 9 percent slopes	15,090	4.2
Fv	Fluvaquents, ponded	4,844	1.3
GeE	Gavins-Ethan loams, 15 to 40 percent slopes	1,610	0.4
GrA	Graceville silty clay loam, 0 to 2 percent slopes	385	0.1
HmA	Homme-Davison-Tetonka complex, 0 to 3 percent slopes	9,960	2.8
HnB	Homme-Ethan-Onita complex, 1 to 6 percent slopes	37,120	10.4
HpB	Homme-Ethan-Tetonka complex, 0 to 6 percent slopes	21,070	5.9
HpC	Homme-Ethan-Tetonka complex, 0 to 9 percent slopes	3,530	1.0
HrA	Homme-Onita silty clay loams, 0 to 2 percent slopes	12,025	3.3
HrB	Homme-Onita silty clay loams, 1 to 6 percent slopes	14,565	4.1
HtA	Homme-Onita-Tetonka complex, 0 to 3 percent slopes	5,585	1.6
La	Lamo silt loam	560	0.2
OcA	Onita-Chancellor silty clay loams	2,680	0.7
ReD	Redstoe Variant-Gavins complex, 6 to 25 percent slopes	525	0.1
Sa	Salmo silty clay loam	2,350	0.7
Sb	Sarpy-Waubonsie complex	1,165	0.3
TaE	Talmo-Delmont loams, 15 to 40 percent slopes	630	0.2
TbE	Talmo-Ethan complex, stony, 6 to 40 percent slopes	1,370	0.4
Te	Tetonka silt loam	9,195	2.6
ThC	Thurman loamy sand, 6 to 15 percent slopes	495	0.1
ThE	Thurman loamy sand, 15 to 40 percent slopes	2,765	0.8
Wg	Worthing silty clay loam	1,385	0.4
Wo	Worthing silty clay loam, ponded	1,600	0.4
YaA	Yankton-Alcester silt loams, 0 to 2 percent slopes	5,275	1.5
YaB	Yankton-Alcester silt loams, 1 to 6 percent slopes	4,395	1.2
	Water areas less than 40 acres in size	275	0.1
	Total land area	358,464	100.0
	Water areas more than 40 acres in size	20,416	
	Total area	378,880	

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
AaA	Alcester silt loam
AcA	Alcester-Chancellor complex (where drained and protected from flooding)
Bn	Bon loam
Br	Bonilla-Crossplain complex (where drained and protected from flooding)
CmA	Clarno-Bonilla loams, 0 to 2 percent slopes
CmB	Clarno-Bonilla loams, 2 to 6 percent slopes
CnA	Clarno-Crossplain-Davison complex, 0 to 3 percent slopes (where drained and protected from flooding)
CsB	Clarno-Ethan-Bonilla loams, 2 to 6 percent slopes
DaB	Davis loam, 0 to 6 percent slopes
EaA	Eltree silt loam, 0 to 2 percent slopes
EaB	Eltree silt loam, 2 to 6 percent slopes
EhB	Ethan-Alcester complex, 1 to 6 percent slopes
GrA	Graceville silty clay loam, 0 to 2 percent slopes
HmA	Homme-Davison-Tetonka complex, 0 to 3 percent slopes (where drained)
HnB	Homme-Ethan-Onita complex, 1 to 6 percent slopes
HpB	Homme-Ethan-Tetonka complex, 0 to 6 percent slopes (where drained)
HrA	Homme-Onita silty clay loams, 0 to 2 percent slopes
HrB	Homme-Onita silty clay loams, 1 to 6 percent slopes
HtA	Homme-Onita-Tetonka complex, 0 to 3 percent slopes (where drained)
La	Lamo silt loam (where drained)
OcA	Onita-Chancellor silty clay loams (where drained and protected from flooding)
YaA	Yankton-Alcester silt loams, 0 to 2 percent slopes
YaB	Yankton-Alcester silt loams, 1 to 6 percent slopes

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Only arable soils are listed. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn		Oats	Soybeans		Alfalfa hay		Bromegrass-alfalfa
	N	I	N	N	I	N	I	N
	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*
AaA---- Alcester	89	165	83	37	56	4.0	7.5	6.7
AcA---- Alcester-Chancellor	83	---	81	34	---	3.9	---	6.4
Bn---- Bon	89	160	82	39	54	4.1	7.3	6.8
Br---- Bonilla-Crossplain	79	---	75	30	---	3.4	---	5.7
CmA---- Clarno-Bonilla	77	---	76	29	---	3.2	---	5.4
CmB---- Clarno-Bonilla	74	---	74	28	---	3.2	---	5.4
CnA---- Clarno-Crossplain-Davison	73	---	73	27	---	3.1	---	5.5
CsB---- Clarno-Ethan-Bonilla	68	---	71	26	---	3.0	---	5.0
DaB---- Davis	81	156	83	30	53	3.7	7.1	6.5
DaC---- Davis	68	---	64	26	---	3.0	---	3.8
DlC---- Delmont-Talmo	24	---	28	---	---	1.2	---	2.0
EaA---- Eltree	80	162	80	31	55	3.2	7.4	5.3
EaB---- Eltree	78	158	76	28	54	3.0	7.2	5.0
EbC---- Eltree-Ethan	60	---	62	23	---	2.8	---	4.7
EbE---- Eltree-Ethan	---	---	---	---	---	2.2	---	3.7
EcD---- Eltree-Crofton	45	---	42	20	---	2.1	---	3.5
EdA---- Enet-Delmont	45	150	53	22	42	2.1	4.2	3.5
EdB---- Enet-Delmont	43	145	50	19	40	2.0	4.0	3.5
EhB---- Ethan-Alcester	70	---	72	26	---	3.3	---	5.7
EhC---- Ethan-Alcester	62	---	63	22	---	3.0	---	5.0
EnC---- Ethan-Bonilla	58	---	59	22	---	2.8	---	4.7

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Oats	Soybeans		Alfalfa hay		Bromegrass-alfalfa
	N	I	N	N	I	N	I	N
	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*
EoD---- Ethan-Davis	---	---	---	---	---	2.3	---	3.8
EpC---- Ethan-Homme	53	---	55	20	---	2.8	---	4.7
GrA---- Graceville	72	156	72	29	53	3.3	6.8	6.3
HmA---- Homme-Davison-Tetonka	69	---	69	25	---	3.1	---	5.0
HnB---- Homme-Ethan-Onita	64	---	68	25	---	3.0	---	5.0
HpB---- Homme-Ethan-Tetonka	62	---	67	25	---	3.0	---	5.0
HpC---- Homme-Ethan-Tetonka	56	---	57	21	---	2.8	---	4.7
HrA---- Homme-Onita	73	156	73	28	53	3.2	6.8	5.3
HrB---- Homme-Onita	70	151	71	27	51	3.0	6.6	5.0
HtA---- Homme-Onita-Tetonka	68	---	72	26	---	3.2	---	5.3
La---- Lamo	80	---	73	29	---	4.1	---	---
OcA---- Onita-Chancellor	76	---	75	29	---	3.3	---	5.5
Sa---- Salmo	40	---	44	---	---	2.6	---	4.3
Sb---- Sarpy-Waubonsie	46	135	35	13	35	1.9	3.7	3.2
Te---- Tetonka	61	---	60	26	---	3.3	---	5.5
ThC---- Thurman	45	85	37	---	---	1.1	---	1.8
YaA---- Yankton-Alcester	78	162	77	31	55	3.2	7.4	5.3
YaB---- Yankton-Alcester	75	158	73	28	54	3.0	7.2	5.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils used primarily as rangeland are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Bo: Bon	Subirrigated	Favorable	5,500	Big bluestem	65
		Normal	5,000	Indiangrass	10
		Unfavorable	4,000	Switchgrass	10
				Sedge	5
BsE*: Boyd	Clayey	Favorable	4,100	Green needlegrass	30
		Normal	3,400	Western wheatgrass	25
		Unfavorable	2,400	Big bluestem	20
				Little bluestem	10
				Sideoats grama	5
				Blue grama	5
Sansarc	Shallow Clay	Favorable	3,000	Little bluestem	25
		Normal	2,500	Western wheatgrass	15
		Unfavorable	1,800	Green needlegrass	15
				Big bluestem	15
				Sideoats grama	10
				Blue grama	5
				Sedge	5
DaC: Davis	Silty	Favorable	4,600	Big bluestem	30
		Normal	3,800	Needlegrass	25
		Unfavorable	2,700	Little bluestem	25
				Sideoats grama	5
				Leadplant	5
				Sedge	5
DlC*: Delmont	Shallow to Gravel	Favorable	3,300	Needleandthread	50
		Normal	2,800	Little bluestem	10
		Unfavorable	1,700	Blue grama	10
				Sedge	10
				Prairie dropseed	5
				Plains muhly	5
Talmo	Very Shallow	Favorable	2,500	Needleandthread	40
		Normal	2,100	Blue grama	25
		Unfavorable	1,300	Sideoats grama	15
				Sedge	10
EbC*: Eltree	Silty	Favorable	4,600	Big bluestem	30
		Normal	3,800	Little bluestem	25
		Unfavorable	2,700	Needlegrass	25
				Sideoats grama	5
				Leadplant	5
Ethan	Silty	Favorable	4,300	Little bluestem	35
		Normal	3,600	Needlegrass	25
		Unfavorable	2,500	Big bluestem	20
				Sideoats grama	5
				Blue grama	5
				Sedge	5
EbE*: Eltree	Silty	Favorable	4,600	Big bluestem	30
		Normal	3,800	Little bluestem	25
		Unfavorable	2,700	Needlegrass	25
				Sideoats grama	5
				Leadplant	5

See footnote at end of table.

TABLE 7.--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
EbE*:					
Ethan	Silty	Favorable	4,100	Little bluestem	40
		Normal	3,400	Needlegrass	30
		Unfavorable	2,400	Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
EcD*:					
Eltrec	Silty	Favorable	4,600	Big bluestem	30
		Normal	3,800	Little bluestem	25
		Unfavorable	2,700	Needlegrass	25
				Sideoats grama	5
				Leadplant	5
Crofton	Thin Upland	Favorable	3,600	Little bluestem	40
		Normal	3,000	Needlegrass	20
		Unfavorable	2,100	Big bluestem	15
				Sideoats grama	10
				Blue grama	5
				Sedge	5
EmE*:					
Ethan	Silty	Favorable	4,100	Little bluestem	40
		Normal	3,400	Needlegrass	30
		Unfavorable	2,400	Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Betts	Thin Upland	Favorable	3,100	Little bluestem	45
		Normal	2,600	Sideoats grama	10
		Unfavorable	1,800	Needleandthread	10
				Prairie dropseed	10
				Big bluestem	5
				Blue grama	5
				Sedge	5
				Leadplant	5
EnC*:					
Ethan	Silty	Favorable	4,300	Little bluestem	35
		Normal	3,600	Needlegrass	25
		Unfavorable	2,500	Big bluestem	20
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Bonilla	Overflow	Favorable	4,900	Big bluestem	65
		Normal	4,500	Porcupinegrass	10
		Unfavorable	3,100	Sideoats grama	5
				Leadplant	5
				Sedge	5
				Switchgrass	5
EoD*:					
Ethan	Silty	Favorable	4,100	Little bluestem	40
		Normal	3,400	Needlegrass	30
		Unfavorable	2,400	Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5

See footnote at end of table.

TABLE 7.--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
EoD*:					
Davis	Silty	Favorable	4,600	Big bluestem	30
		Normal	3,800	Needlegrass	25
		Unfavorable	2,700	Little bluestem	25
				Sideoats grama	5
				Leadplant	5
				Sedge	5
GeE*:					
Gavins	Thin Upland	Favorable	3,600	Little bluestem	40
		Normal	3,000	Needlegrass	15
		Unfavorable	2,100	Sideoats grama	10
				Big bluestem	10
				Prairie dropseed	5
				Western wheatgrass	5
				Blue grama	5
				Sedge	5
Ethan	Silty	Favorable	4,100	Little bluestem	40
		Normal	3,400	Needlegrass	30
		Unfavorable	2,400	Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
La	Subirrigated	Favorable	6,600	Big bluestem	65
Lamo		Normal	6,000	Indiangrass	10
		Unfavorable	4,800	Switchgrass	10
				Sedge	10
				Prairie cordgrass	5
OcA*:					
Onita	Overflow	Favorable	5,600	Big bluestem	65
		Normal	4,700	Porcupinegrass	10
		Unfavorable	3,500	Sideoats grama	5
				Leadplant	5
				Sedge	5
				Switchgrass	5
Chancellor	Overflow	Favorable	6,000	Big bluestem	65
		Normal	5,000	Porcupinegrass	10
		Unfavorable	3,500	Switchgrass	10
				Leadplant	5
				Sedge	5
ReD*:					
Redstoe Variant	Thin Upland	Favorable	4,000	Little bluestem	40
		Normal	3,300	Needlegrass	15
		Unfavorable	2,300	Big bluestem	10
				Sideoats grama	10
				Western wheatgrass	5
				Prairie dropseed	5
				Blue grama	5
				Sedge	5
Gavins	Thin Upland	Favorable	3,600	Little bluestem	40
		Normal	3,000	Needlegrass	15
		Unfavorable	2,100	Sideoats grama	10
				Big bluestem	10
				Prairie dropseed	5
				Western wheatgrass	5
				Blue grama	5
				Sedge	5

See footnote at end of table.

TABLE 7.--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
Sa---------- Salmo	Saline Lowland----------	Favorable	4,800	Cordgrass----------	50
		Normal	4,400	Western wheatgrass----------	15
		Unfavorable	3,500	Switchgrass----------	10
				Nuttall alkaligrass----------	5
				Sedge----------	5
Sb*:					
Sarpy----------	Subirrigated----------	Favorable	4,900	Big bluestem----------	60
		Normal	4,500	Little bluestem----------	10
		Unfavorable	3,100	Indiangrass----------	10
				Canada wildrye----------	10
				Switchgrass----------	10
Waubonsic---------	Subirrigated----------	Favorable	4,900	Big bluestem----------	60
		Normal	4,500	Little bluestem----------	10
		Unfavorable	3,100	Indiangrass----------	10
				Canada wildrye----------	10
				Switchgrass----------	10
TaE*:					
Talmo----------	Very Shallow----------	Favorable	2,500	Blue grama----------	35
		Normal	2,100	Needleandthread----------	30
		Unfavorable	1,300	Sideoats grama----------	15
				Sedge----------	10
Delmont----------	Shallow to Gravel----------	Favorable	3,000	Needleandthread----------	50
		Normal	2,500	Little bluestem----------	10
		Unfavorable	1,500	Blue grama----------	10
				Sedge----------	10
				Prairie dropseed----------	5
				Plains muhly----------	5
TbE*:					
Talmo----------	Very Shallow----------	Favorable	1,800	Blue grama----------	35
		Normal	1,500	Needleandthread----------	30
		Unfavorable	900	Sideoats grama----------	15
				Little bluestem----------	10
				Sedge----------	10
Ethan----------	Silty----------	Favorable	3,600	Little bluestem----------	35
		Normal	3,000	Big bluestem----------	20
		Unfavorable	2,100	Green needlegrass----------	15
				Needleandthread----------	10
				Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Te---------- Tetonka	Wet Meadow----------	Favorable	5,300	Sedge----------	50
		Normal	4,800	Reedgrass----------	20
		Unfavorable	3,400	Prairie cordgrass----------	10
				Western wheatgrass----------	5
				Bluegrass----------	5
ThC, ThE---------- Thurman	Sandy----------	Favorable	4,100	Sand bluestem----------	30
		Normal	3,400	Little bluestem----------	25
		Unfavorable	2,400	Prairie sandreed----------	20
				Needleandthread----------	10
				Sideoats grama----------	5
				Sedge----------	5
Wg---------- Worthing	Shallow Marsh----------	Favorable	7,500	Rivergrass----------	40
		Normal	6,800	Slough sedge----------	30
		Unfavorable	5,400	Prairie cordgrass----------	5
				Reedgrass----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
AaA---------- Alcester	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
AcA*: Alcester---------	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
Chancellor-------	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Bn---------- Bon	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
Bo---------- Bon	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
Br*: Bonilla----------	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
Crossplain-------	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
BsE*: Boyd.					
Sansarc.					
CmA*, CmB*: Clarno----------	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Bonilla----------	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
CnA*: Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Crossplain	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Davison	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Russian-olive, hackberry, ponderosa pine, blue spruce, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
CsB*: Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Bonilla	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
DaB, DaC Davis	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
DlC*: Delmont	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mountain juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine.	Siberian elm------	---
Talmo.					
EaA, EaB Eltree	---	Lilac, eastern redcedar, Siberian peashrub, American plum.	Ponderosa pine, Russian-olive, hackberry, blue spruce, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
EbC*:					
Eltree	---	Lilac, eastern redcedar, Siberian peashrub, American plum.	Siberian crabapple, ponderosa pine, Russian-olive, hackberry, blue spruce.	Honeylocust, green ash.	Siberian elm.
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
EbE*:					
Eltree.					
Ethan.					
EcD*:					
Eltree	---	Eastern redcedar, lilac, Siberian peashrub, American plum.	Hackberry, ponderosa pine, Russian-olive, blue spruce, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Crofton.					
EdA*, EdB*:					
Enet	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mountain juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine, Siberian elm.	---	---
Delmont	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mountain juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine, Siberian elm.	---	---
EhB*, EhC*:					
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Alcester	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
EmE*:					
Ethan.					
Betts.					

See footnote at end of table.

TABLE 8.--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
EnC*:					
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Bonilla	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
EoD*:					
Ethan.					
Davis	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
EpC*:					
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Homme	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common chokecherry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Fv.					
Fluvaquents					
GeE*:					
Gavins.					
Ethan.					
GrA	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Russian-olive, hackberry, ponderosa pine, blue spruce, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Graceville					
HmA*:					
Homme	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common chokecherry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
HmA*:					
Davison	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Russian-olive, hackberry, ponderosa pine, blue spruce, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Tetonka	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
HnB*:					
Homme	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common chokecherry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Onita	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, golden willow, green ash, hackberry.	Eastern cottonwood.
HpB*, HpC*:					
Homme	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common chokecherry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Tetonka	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
HrA*, HrB*:					
Homme	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common chokecherry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
HrA*, HrB*:					
Onita	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, golden willow, green ash, hackberry.	Eastern cottonwood.
HtA*:					
Homme	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common chokecherry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Onita	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, golden willow, green ash, hackberry.	Eastern cottonwood.
Tetonka	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
La Lamo	---	Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, blue spruce, ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, green ash, honeylocust.	Eastern cottonwood.
OcA*:					
Onita	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, golden willow, green ash, hackberry.	Eastern cottonwood.
Chancellor	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
ReD*: Redstoe Variant. Gavins. Sa. Salmo					
Sb*:					
Sarpy	---	Eastern redcedar, Rocky mountain juniper.	Ponderosa pine----	---	---
Waubonsie	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--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
TaE*: Talmo.					
Delmont.					
TbE*: Talmo.					
Ethan.					
Te---------- Tetonka	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
ThC---------- Thurman	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine----	---	---
ThE. Thurman					
Wg, Wo. Worthing					
YaA*, YaB*: Yankton----------	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Alcester---------	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
AaA---- Alcester	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
AcA*:											
Alcester----	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
Chancellor----	Good	Good	Fair	Good	Poor	Poor	Poor	Good	Poor	Poor	Fair.
Bn---- Bon	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
Bo---- Bon	Very poor.	Good	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Br*:											
Bonilla----	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
Crossplain----	Good	Good	Fair	Good	Poor	Poor	Poor	Good	Poor	Poor	Fair.
BsE*:											
Boyd----	Very poor.	Poor	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.
Sansarc----	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
CmA*, CmB*:											
Clarno----	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Bonilla----	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
CnA*:											
Clarno----	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Crossplain----	Good	Good	Fair	Good	Poor	Poor	Poor	Good	Poor	Poor	Fair.
Davison----	Good	Good	Good	Good	Very poor.	Poor	Poor	Good	Very poor.	Very poor.	Good.
CsB*:											
Clarno----	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Ethan----	Fair	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
Bonilla----	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
DaB---- Davis	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
DaC---- Davis	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.

See footnote at end of table.

TABLE 9.--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	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
DlC*:											
Delmont	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor.
Talmo	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
EaA Eltree	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
EaB Eltree	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
EbC*:											
Eltree	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Ethan	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good.
EbE*:											
Eltree	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.
Ethan	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.
EcD*:											
Eltree	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good.
Crofton	Very poor.	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
EdA*:											
Enet	Good	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Delmont	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Poor.
EdB*:											
Enet	Fair	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
Delmont	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor.
EhB*:											
Ethan	Fair	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
Alcester	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
EhC*:											
Ethan	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good.
Alcester	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
EmE*:											
Ethan	Very poor.	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.

See footnote at end of table.

TABLE 9.--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	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
EmE*:											
Betts	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
EnC*:											
Ethan	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good.
Bonilla	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
EoD*:											
Ethan	Very poor.	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.
Davis	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good.
EpC*:											
Ethan	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good.
Homme	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Fv. Fluvaquents											
GeE*:											
Gavins	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Ethan	Very poor.	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.
GrA Graceville	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
HmA*:											
Homme	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Davison	Good	Good	Good	Good	Very poor.	Poor	Poor	Good	Very poor.	Poor	Good.
Tetonka	Good	Good	Fair	Poor	Very poor.	Fair	Fair	Fair	Very poor.	Fair	Fair.
HnB*:											
Homme	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Ethan	Fair	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
Onita	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
HpB*:											
Homme	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Ethan	Fair	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
Tetonka	Good	Good	Fair	Poor	Very poor.	Fair	Fair	Fair	Very poor.	Fair	Fair.

See footnote at end of table.

TABLE 9.--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	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
HpC*:											
Homme	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Ethan	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good.
Tetonka	Good	Good	Fair	Poor	Very poor.	Fair	Fair	Fair	Very poor.	Fair	Fair.
HrA*, HrB*:											
Homme	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Onita	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
HtA*:											
Homme	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Onita	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
Tetonka	Good	Good	Fair	Poor	Very poor.	Fair	Fair	Fair	Very poor.	Fair	Fair.
La	Good	Good	Fair	Good	Good	Fair	Fair	Good	Fair	Fair	Fair.
Lamo											
OcA*:											
Onita	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
Chancellor	Good	Good	Fair	Good	Poor	Poor	Poor	Good	Poor	Poor	Fair.
ReD*:											
Redstoe Variant	Very poor.	Poor	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Gavins	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Sa	Very poor.	Poor	Fair	Poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Fair	Fair.
Salmo											
Sb*:											
Sarpy	Poor	Fair	Fair	Poor	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
Waubonsie	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
TaE*:											
Talmo	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Delmont	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
TbE*:											
Talmo	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Ethan	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.

See footnote at end of table.

TABLE 9.--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	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Te---------- Tetonka	Poor	Poor	Fair	Poor	Very poor.	Fair	Fair	Poor	Very poor.	Fair	Fair.
ThC---------- Thurman	Very poor.	Fair	Good	Poor	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Good.
ThE---------- Thurman	Very poor.	Very poor.	Good	Poor	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Good.
Wg---------- Worthing	Very poor.	Poor	Fair	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Good	Fair.
Wo---------- Worthing	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
YaA*, YaB*: Yankton----------	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.	Good.
Alcester----------	Good	Good	Fair	Good	Poor	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AaA---------- Alcester	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
AcA*:					
Alcester----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
Chancellor--------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, wetness.
Bn---------- Bon	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Bo---------- Bon	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.
Br*:					
Bonilla----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
Crossplain--------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.
BsE*:					
Boyd----------	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Sansarc----------	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
CmA*:					
Clarno----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Bonilla----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
CmB*:					
Clarno----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Bonilla----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
CnA*:					
Clarno	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Crossplain	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.
Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
CsB*:					
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Bonilla	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
DaB Davis	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
DaC Davis	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
DlC*:					
Delmont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Talmo	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
EaA Eltree	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.
EaB Eltree	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
EbC*:					
Eltree	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
EbE*:					
Eltree	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.
Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
EcD*:					
Eltree	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.
Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
EdA*:					
Enet	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Delmont	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
EdB*:					
Enet	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Delmont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
EhB*, EhC*:					
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Alcester	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
EmE*:					
Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Betts	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
EnC*:					
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Bonilla	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
EoD*:					
Ethan	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
Davis	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
EpC*:					
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
EpC*:					
Homme	Slight	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Fv. Fluvaquents					
GeE*:					
Gavins	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.
Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
GrA--- Graceville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
HmA*:					
Homme	Moderate: wetness.	Severe: shrink-swell.	Moderate: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, frost action, shrink-swell.
Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.
HnB*:					
Homme	Slight	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Onita	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.
HpB*, HpC*:					
Homme	Slight	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
HrA*, HrB*:					
Homme	Slight	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
HrA*, HrB*:					
Onita	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.
HtA*:					
Homme	Slight	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Onita	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.
Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
La Lamo	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.
OcA*:					
Onita	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.
Chancellor	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, wetness.
ReD*:					
Redstoe Variant	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Gavins	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.
Sa Salmo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
Sb*:					
Sarpy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Waubonsie	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness, shrink-swell.	Severe: flooding.	Severe: flooding, frost action.
TaE*:					
Talmo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Delmont	Severe: cutbanks cave, slope.	Severe: slope	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
TbE*:					
Talmo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Te	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Tetonka					
ThC	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Thurman					
ThE	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Thurman					
Wg	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: low strength, ponding, frost action.
Worthing					
Wo	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Worthing					
YaA*:					
Yankton	Slight	Slight	Moderate: shrink-swell.	Slight	Severe: low strength.
Alcester	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
YaB*:					
Yankton	Slight	Slight	Moderate: shrink-swell.	Moderate: slope.	Severe: low strength.
Alcester	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the 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
AaA Alcester	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
AcA*: Alcester	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Chancellor	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Bn Bon	Severe: flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Severe: flooding.	Good.
Bo Bon	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: wetness.
Br*: Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
Crossplain	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
BsE*: Boyd	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, area reclaim, hard to pack.
CmA*: Clarno	Severe: percs slowly.	Slight	Slight	Slight	Good.
Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
CmB*: Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 11.--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
CnA*:					
Clarno	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Slight	Moderate: wetness.
Crossplain	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Davison	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.
CsB*:					
Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
DaB Davis	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
DaC Davis	Moderate: slope, percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
DlC*:					
Delmont	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage, too sandy.
Talmo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
EaA Eltree	Slight	Moderate: seepage.	Slight	Slight	Fair: too clayey.
EaB Eltree	Slight	Moderate: seepage, slope.	Slight	Slight	Fair: too clayey.
EbC*:					
Eltree	Slight	Severe: slope.	Slight	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
EbE*:					
Eltree	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: too clayey, slope.
Ethan	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 11.--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
EcD*:					
Eltree	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: too clayey, slope.
Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
EdA*, EdB*:					
Enet	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Delmont	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage, too sandy.
EhB*:					
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Alcester	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
EhC*:					
Ethan	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
Alcester	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
EmE*:					
Ethan	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Betts	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
EnC*:					
Ethan	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
EoD*:					
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Davis	Moderate: slope, percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
EpC*:					
Ethan	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 11.--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
EpC*: Homme	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Fv. Fluvaquents					
GeE*: Gavins	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Ethan	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
GrA Graceville	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.
HmA*: Homme	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too clayey, wetness.
Davison	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.
Tetonka	Severe: ponding, percs slowly.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
HnB*: Homme	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Good.
Onita	Severe: flooding, wetness, percs slowly.	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
HpB*: Homme	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
HpC*: Homme	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 11.--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
HpC*:					
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
HrA*:					
Homme	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Onita	Severe: flooding, wetness, percs slowly.	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
HrB*:					
Homme	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Onita	Severe: flooding, wetness, percs slowly.	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
HtA*:					
Homme	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Onita	Severe: flooding, wetness, percs slowly.	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
La Lamo	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack.
OcA*:					
Onita	Severe: flooding, wetness, percs slowly.	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Chancellor	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
ReD*:					
Redstoe Variant	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: hard to pack.
Gavins	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Sa Salmo	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 11.--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
Sb*:					
Sarpy	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Waubonsie	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, seepage, wetness.	Poor: too clayey, hard to pack.
TaE*:					
Talmo	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Delmont	Severe: slope, poor filter.	Severe: slope, seepage.	Severe: seepage, slope, too sandy.	Severe: slope, seepage.	Poor: small stones, seepage, too sandy.
TbE*:					
Talmo	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Ethan	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Te Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
ThC Thurman	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
ThE Thurman	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: too sandy, seepage, slope.	Severe: seepage, slope.	Poor: slope, too sandy, seepage.
Wg Worthing	Severe: percs slowly, ponding.	Slight	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Wo Worthing	Severe: percs slowly, ponding.	Severe: ponding.	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
YaA*:					
Yankton	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Alcester	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
YaB*:					
Yankton	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 11.--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
YaB*: Alcester	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AaA---------- Alcester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
AcA*:				
Alcester----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Chancellor----------	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Bn---------- Bon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Bo---------- Bon	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Br*:				
Bonilla----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Crossplain----------	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
BsE*:				
Boyd----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Sansarc----------	Poor: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, area reclaim.
CmA*, CmB*:				
Clarno----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bonilla----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
CnA*:				
Clarno----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Crossplain----------	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Davison----------	Fair: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
CsB*:				
Clarno----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CsB*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bonilla	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
DaB	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Davis				
DaC	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Davis				
DlC*:				
Delmont	Good	Probable	Probable	Poor: small stones, area reclaim.
Talmo	Good	Probable	Probable	Poor: small stones, area reclaim.
EaA, EaB	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Eltree				
EbC*:				
Eltree	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
EbE*:				
Eltree	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Ethan	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
EcD*:				
Eltree	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
EdA*, EdB*:				
Enet	Good	Probable	Probable	Poor: small stones, area reclaim.
Delmont	Good	Probable	Probable	Poor: small stones, area reclaim.
EhB*, EhC*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Alcester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
EmE*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EmE*:				
Betts	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
EnC*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bonilla	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
EoD*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Davis	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
EpC*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Homme	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Fv. Fluvaquents				
GeE*:				
Gavins	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
GrA	Good	Probable	Probable	Good.
Graceville				
HmA*:				
Homme	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Davison	Fair: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
HnB*:				
Homme	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Onita	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HpB*, HpC*:				
Homme	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
HrA*, HrB*:				
Homme	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Onita	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
HtA*:				
Homme	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Onita	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
La Lamo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
OcA*:				
Onita	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Chancellor	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
ReD*:				
Redstoe Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Gavins	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Sa Salmo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
Sb*:				
Sarpy	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Waubonsie	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TaE*:				
Talmo	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Delmont	Fair: slope.	Probable	Probable	Poor: small stones, slope, area reclaim.
TbE*:				
Talmo	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
Te Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
ThC Thurman	Good	Probable	Improbable: too sandy.	Poor: area reclaim.
ThE Thurman	Fair: slope.	Probable	Improbable: too sandy.	Poor: area reclaim, slope.
Wg Worthing	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wo Worthing	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
YaA*, YaB*:				
Yankton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Alcester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AaA---------- Alcester	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
AcA*:						
Alcester---------	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
Chancellor-------	Slight---------	Severe: hard to pack.	Percs slowly, flooding, frost action.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
Bn---------- Bon	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding-------	Favorable------	Favorable.
Bo---------- Bon	Moderate: seepage.	Moderate: piping.	Flooding, frost action.	Wetness, flooding.	Wetness--------	Favorable.
Br*:						
Bonilla----------	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
Crossplain-------	Slight---------	Severe: wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
BsE*:						
Boyd----------	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Sansarc----------	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Slope, depth to rock, percs slowly.	Slope, droughty, erodes easily.
CmA*:						
Clarno----------	Moderate: seepage.	Slight---------	Deep to water	Favorable------	Erodes easily	Erodes easily.
Bonilla----------	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
CmB :						
Clarno----------	Moderate: seepage, slope.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.
Bonilla----------	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
CnA*:						
Clarno----------	Moderate: seepage.	Slight---------	Deep to water	Favorable------	Erodes easily	Erodes easily.
Crossplain-------	Slight---------	Severe: wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
Davison----------	Moderate: seepage.	Severe: piping.	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
CsB*:						
Clarno----------	Moderate: slope, seepage.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.
Ethan----------	Moderate: slope, seepage.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
CsB*:						
Bonilla	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
DaB--- Davis	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
DaC--- Davis	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope	Slope.
DlC*:						
Delmont	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy	Droughty.
Talmo	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy	Droughty.
EaA--- Eltree	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
EaB--- Eltree	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
EbC*:						
Eltree	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
EbE*:						
Eltree	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Ethan	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
EcD*:						
Eltree	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Crofton	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
EdA*:						
Enet	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
Delmont	Severe: seepage.	Severe: seepage.	Deep to water	Droughty	Too sandy	Droughty.
EdB*:						
Enet	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
Delmont	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy	Droughty.
EhB*, EhC*:						
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Alcester	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
EmE*:						
Ethan	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Betts	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
EnC*:						
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Bonilla	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
EoD*:						
Ethan	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Davis	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope	Slope.
EpC*:						
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Homme	Moderate: slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
Fv.						
Fluvaquents						
GeE*:						
Gavins	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Ethan	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
GrA	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Favorable	Favorable.
Graceville						
HmA*:						
Homme	Severe: seepage.	Moderate: piping.	Deep to water	Excess salt	Favorable	Favorable.
Davison	Moderate: seepage.	Severe: piping.	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
Tetonka	Slight	Severe: ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
HnB*:						
Homme	Moderate: slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Onita	Slight	Moderate: hard to pack.	Flooding, frost action.	Wetness, flooding.	Erodes easily	Erodes easily.
HpB*, HpC*:						
Homme	Moderate: slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
HpB*, HpC*:						
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
HrA*:						
Homme	Slight	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Onita	Slight	Moderate: hard to pack.	Flooding, frost action.	Wetness, flooding.	Erodes easily	Erodes easily.
HrB*:						
Homme	Moderate: slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
Onita	Slight	Moderate: hard to pack.	Flooding, frost action.	Wetness, flooding.	Erodes easily	Erodes easily.
HtA*:						
Homme	Slight	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Onita	Slight	Moderate: hard to pack.	Flooding, frost action.	Wetness, flooding.	Erodes easily	Erodes easily.
Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
La Lamo	Slight	Moderate: piping, hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Favorable.
OcA*:						
Onita	Slight	Moderate: hard to pack.	Flooding, frost action.	Wetness, flooding.	Erodes easily	Erodes easily.
Chancellor	Slight	Severe: hard to pack.	Percs slowly, flooding, frost action.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
ReD*:						
Redstoe Variant	Severe: slope.	Severe: hard to pack.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Gavins	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Sa Salmo	Moderate: seepage.	Severe: wetness.	Percs slowly, flooding, frost action.	Wetness, flooding, excess salt.	Wetness, percs slowly.	Wetness, excess salt, percs slowly.
Sb*:						
Sarpy	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Waubonsie	Severe: seepage.	Severe: hard to pack.	Percs slowly, flooding, frost action.	Wetness, soil blowing, percs slowly.	Wetness, soil blowing, percs slowly.	Percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
TaE*:						
Talmo	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Delmont	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Droughty, slope.
TbE*:						
Talmo	Severe: seepage, slope.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Ethan	Severe: slope.	Moderate: piping, large stones.	Deep to water	Slope, large stones.	Slope, erodes easily.	Large stones, slope, erodes easily.
Te Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
ThC, ThE Thurman	Severe: slope, seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Droughty, slope.
Wg Worthing	Slight	Severe: hard to pack, ponding.	Ponding, frost action, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly, erodes easily.	Wetness, percs slowly.
Wo Worthing	Slight	Severe: hard to pack, ponding.	Percs slowly, ponding, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
YaA*:						
Yankton	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Alcester	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
YaB*:						
Yankton	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
Alcester	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AaA---------- Alcester	0-13	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	85-100	25-40	6-20
	13-36	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	36-60	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	95-100	95-100	95-100	85-100	30-50	10-20
AcA*:											
Alcester--------	0-13	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	85-100	25-40	6-20
	13-36	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	36-60	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	95-100	95-100	95-100	85-100	30-50	10-20
Chancellor------	0-13	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	85-100	35-55	15-25
	13-33	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	33-60	Silty clay loam, clay loam, loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	85-100	70-100	35-55	15-25
Bn---------- Bon	0-36	Loam----------	CL-ML, CL	A-4, A-6	0	100	95-100	80-95	55-85	25-40	5-15
	36-60	Stratified silty clay loam to fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-95	60-85	25-40	3-15
Bo---------- Bon	0-36	Loam----------	CL-ML, CL	A-4, A-6	0	100	90-100	80-95	60-85	25-40	5-15
	36-60	Stratified silty clay loam to fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-95	60-85	25-40	3-15
Br*:											
Bonilla---------	0-11	Loam----------	CL-ML, CL	A-4, A-6, A-7	0	100	95-100	75-100	50-90	25-45	5-20
	11-31	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-50	10-25
	31-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22
Crossplain------	0-9	Clay loam--------	CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-50	9-25
	9-27	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-90	40-55	15-30
	27-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
BsE*:											
Boyd----------	0-7	Clay----------	CH, MH	A-7	0	100	95-100	95-100	90-100	65-120	30-80
	7-17	Silty clay, clay	CH, MH	A-7	0	100	95-100	95-100	80-100	65-120	30-80
	17-24	Silty clay, clay, shaly clay.	CH, MH	A-7	0	95-100	80-100	75-100	60-100	65-120	30-80
	24-60	Weathered bedrock	CH, MH	A-7	0	95-100	80-100	75-100	75-100	50-120	25-80
Sansarc---------	0-4	Clay----------	CH, MH	A-7	0	100	95-100	90-100	75-100	60-90	25-55
	4-16	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	60-90	25-55
	16-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	60-90	25-55
CmA*, CmB*:											
Clarno----------	0-8	Loam----------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-20
	8-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	17-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Bonilla---------	0-11	Loam----------	CL-ML, CL	A-4, A-6, A-7	0	100	95-100	75-100	50-90	25-45	5-20
	11-31	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-50	10-25
	31-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CnA*:											
Clarno	0-8	Loam	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	3-20
	8-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	17-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Crossplain	0-9	Clay loam	CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-50	9-25
	9-27	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-90	40-55	15-30
	27-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
Davison	0-8	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-85	25-40	5-20
	8-22	Loam, clay loam, sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	95-100	85-100	45-80	25-40	5-20
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-80	25-40	5-20
CsB*:											
Clarno	0-8	Loam	CL, CL-ML, ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-20
	8-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	17-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Bonilla	0-11	Loam	CL-ML, CL	A-4, A-6, A-7	0	100	95-100	75-100	50-90	25-45	5-20
	11-31	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-50	10-25
	31-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22
DaB, DaC	0-10	Loam	CL, ML	A-6, A-7	0	100	90-100	80-100	60-85	30-45	5-20
Davis	10-40	Loam, silt loam, clay loam.	CL, ML	A-6, A-7	0	100	90-100	80-100	60-85	35-45	10-20
	40-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	55-90	30-45	10-20
DlC*:											
Delmont	0-8	Loam	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	8-15	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	15-60	Gravelly sand, gravelly loamy sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-80	15-50	3-30	<25	NP-5
Talmo	0-5	Loam	ML, CL	A-4, A-6	0-5	95-100	90-100	85-100	55-75	30-40	5-15
	5-60	Gravelly sand, very gravelly sand, gravelly loamy sand.	GW, GM, SW, SM	A-2, A-1	0-10	40-95	30-65	15-35	0-35	<25	NP-5
EaA, EaB	0-12	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-40	3-15
Eltree	12-28	Silt loam, very fine sandy loam, loam.	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	85-100	25-40	5-20
	28-60	Silt loam, loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	95-100	90-100	65-100	25-45	7-22

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EbC*, EbE*:											
Eltree	0-12	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-40	3-15
	12-28	Silt loam, very fine sandy loam, loam.	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	85-100	25-40	5-20
	28-60	Silt loam, loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	95-100	90-100	65-100	25-45	7-22
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
EcD*:											
Eltree	0-12	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-40	3-15
	12-28	Silt loam, very fine sandy loam, loam.	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	85-100	25-40	5-20
	28-60	Silt loam, loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	95-100	90-100	65-100	25-45	7-22
Crofton	0-4	Silt loam	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	4-60	Silt loam	CL	A-6, A-7	0	100	95-100	95-100	95-100	32-50	10-25
EdA*, EdB*:											
Enet	0-10	Loam	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
	10-25	Loam, clay loam, sandy clay loam.	CL, ML, SC, SM	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	25-60	Gravelly loamy sand, gravelly sand.	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0	60-95	45-90	10-60	0-15	<25	NP-5
Delmont	0-8	Loam	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	8-15	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	15-60	Gravelly sand, gravelly loamy sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-80	15-50	3-30	<25	NP-5
EhB*, EhC*:											
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Alcester	0-13	Silt loam	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	85-100	25-40	6-20
	13-36	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	36-60	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	95-100	95-100	95-100	85-100	30-50	10-20
EmE*:											
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Betts	0-4	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
	4-28	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	28-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
EnC*:											
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EnC*:											
Bonilla	0-11	Loam	CL-ML, CL	A-4, A-6, A-7	0	100	95-100	75-100	50-90	25-45	5-20
	11-31	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-50	10-25
	31-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22
EoD*:											
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Davis	0-10	Loam	CL, ML	A-6, A-7	0	100	90-100	80-100	60-85	30-45	5-20
	10-40	Loam, silt loam, clay loam.	CL, ML	A-6, A-7	0	100	90-100	80-100	60-85	35-45	10-20
	40-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	55-90	30-45	10-20
EpC*:											
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50 5	28-45	8-20
Homme	0-8	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-100	35-45	15-25
	8-24	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	80-100	40-55	15-30
	24-36	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-100	30-50	10-25
	36-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-85	30-50	10-25
Fv. Fluvaquents											
GeE*:											
Gavins	0-5	Loam	ML, MH	A-7	0-5	95-100	95-100	90-100	75-85	40-55	10-25
	5-16	Silt loam, loam, silty clay loam.	ML, MH	A-7	0	100	95-100	90-100	75-100	40-60	10-28
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
GrA	0-18	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	35-45	11-20
Graceville	18-50	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	8-20
	50-60	Gravelly sand, gravelly loamy sand.	SM, GW-GM, SW-SM, GM	A-1, A-2	0	40-80	30-70	20-50	5-30	<25	NP-4
HmA*:											
Homme	0-8	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-100	35-45	15-25
	8-24	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	85-100	40-55	15-30
	24-36	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-100	35-55	15-30
	36-60	Clay loam, loam	CL	A-6	0-5	95-100	90-100	85-100	60-85	30-55	10-25
Davison	0-8	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-85	25-40	5-20
	8-22	Loam, clay loam, sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	95-100	85-100	45-80	25-40	5-20
	22-36	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-80	25-40	5-20
	36-60	Stratified clay loam to sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0-5	90-100	80-100	65-95	40-75	20-35	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HmA*:											
Tetonka	0-11	Silt loam	ML, CL	A-4, A-6	0	100	100	90-100	80-100	27-40	5-15
	11-31	Clay, silty clay, silty clay loam.	CH, MH, CL, ML	A-7	0	100	95-100	90-100	70-100	40-70	15-35
	31-60	Clay, silty clay, silty clay loam.	CH, CL	A-6, A-7	0	95-100	90-100	85-100	65-100	30-60	15-30
HnB*:											
Homme	0-8	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-100	35-45	15-25
	8-24	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	80-100	40-55	15-30
	24-36	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-100	30-50	10-25
	36-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-85	30-50	10-25
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Onita	0-15	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	65-95	30-45	12-20
	15-36	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	75-100	35-60	10-35
	36-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
HpB*, HpC*:											
Homme	0-8	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-100	35-45	15-25
	8-24	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	80-100	40-55	15-30
	24-36	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-100	30-50	10-25
	36-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-85	30-50	10-25
Ethan	0-7	Loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	7-17	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	17-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Tetonka	0-16	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	16-42	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	42-60	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
HrA*, HrB*:											
Homme	0-8	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-100	35-45	15-25
	8-24	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	80-100	40-55	15-30
	24-36	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-100	30-50	10-25
	36-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-85	30-50	10-25
Onita	0-15	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	65-95	30-45	12-20
	15-36	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	75-100	35-60	10-35
	36-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
HtA*:											
Homme	0-8	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-100	35-45	15-25
	8-24	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	80-100	40-55	15-30
	24-36	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-100	30-50	10-25
	36-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-85	30-50	10-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HtA*:											
Onita	0-15	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	65-95	30-45	12-20
	15-36	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	75-100	35-60	10-35
	36-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
Tetonka	0-16	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	16-42	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	42-60	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
La	0-24	Silt loam	CL	A-6, A-4	0	100	100	95-100	85-95	20-35	8-20
Lamo	24-60	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-95	30-55	11-35
OcA*:											
Onita	0-15	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	65-95	30-45	12-20
	15-36	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	75-100	35-60	10-35
	36-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
Chancellor	0-13	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	85-100	35-55	15-25
	13-33	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	33-60	Silty clay loam, clay loam, loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	85-100	70-100	35-55	15-25
ReD*:											
Redstoe Variant	0-12	Silt loam	ML, MH	A-6, A-7	0	100	95-100	95-100	85-100	35-55	10-20
	12-60	Silt loam, silty clay loam.	ML, MH	A-7	0	100	100	95-100	85-100	40-55	10-20
Gavins	0-5	Loam	ML, MH	A-7	0	100	100	90-100	85-100	40-55	15-25
	5-16	Silt loam, loam, silty clay loam.	ML, MH	A-7	0	100	95-100	90-100	75-100	40-60	10-28
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Sa	0-28	Silty clay loam	ML, CL	A-6, A-7	0	100	100	90-100	85-95	30-45	10-20
Salmo	28-41	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	10-20
	41-60	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	100	95-100	90-100	75-95	40-60	15-35
Sb*:											
Sarpy	0-3	Loamy fine sand	SM	A-2-4	0	100	100	60-80	15-35	<20	NP
	3-60	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	100	100	60-80	2-35	<20	NP
Waubonsie	0-20	Very fine sandy loam.	SM, SC, SM-SC	A-4	0	100	100	80-90	36-50	15-25	2-10
	20-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
TaE*:											
Talmo	0-5	Loam	ML, CL	A-4, A-6	0-5	95-100	90-100	85-100	55-75	30-40	5-15
	5-60	Gravelly sand, very gravelly sand, gravelly loamy sand.	GW, GM, SW, SM	A-2, A-1	0-10	40-95	30-65	15-35	0-35	<25	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
TaE*:											
Delmont	0-8	Loam	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	8-15	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	15-60	Gravelly sand, gravelly loamy sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-80	15-50	3-30	<25	NP-5
TbE*:											
Talmo	0-5	Very stony sandy loam.	SM, SM-SC	A-4	10-50	95-100	90-100	85-100	40-50	<25	NP-7
	5-60	Gravelly sand, very gravelly sand, gravelly loamy sand.	GW, GM, SW, SM	A-2, A-1	5-25	40-95	30-65	15-35	0-35	<25	NP-5
Ethan	0-7	Very stony loam	CL, CL-ML	A-4, A-6	20-50	95-100	90-100	80-95	55-80	25-40	5-15
	7-17	Loam, clay loam	CL	A-6, A-7, A-4	0-5	95-100	95-100	85-100	55-80	30-45	8-20
	17-60	Loam, clay loam	CL	A-6, A-7, A-4	0-5	90-100	85-100	75-100	50-85	30-50	8-25
Te Tetonka	0-16	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	16-42	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	42-60	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
ThC, ThE Thurman	0-14	Loamy sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	90-100	5-40	<20	NP
	14-60	Loamy sand, fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	85-100	5-25	<20	NP
Wg Worthing	0-18	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-60	15-30
	18-47	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	85-100	50-70	22-35
	47-60	Silty clay, silty clay loam, clay loam.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	70-100	40-65	15-30
Wo Worthing	0-18	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-60	15-30
	18-47	Silty clay, clay	CH	A-7	0	100	100	95-100	80-100	50-70	25-40
	47-60	Silty clay, silty clay loam, clay loam.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	70-100	40-65	15-30
YaA*, YaB*:											
Yankton	0-13	Silt loam	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	3-15
	13-28	Silt loam	ML, CL	A-4, A-6	0	100	100	95-100	85-100	30-40	5-15
	28-34	Silt loam	ML, CL	A-4, A-6	0	100	95-100	95-100	85-100	30-40	5-15
	34-60	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	75-100	55-85	30-45	10-20
Alcester	0-13	Silt loam	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	85-100	25-40	6-20
	13-36	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	36-60	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	95-100	95-100	95-100	85-100	30-50	10-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	Mmhos/cm					Pct
AaA----------	0-13	0.6-2.0	0.19-0.22	5.6-7.8	<2	Moderate----	0.28	5	6	4-8
Alcester	13-36	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate----	0.28			
	36-60	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate----	0.43			
AcA*:										
Alcester--------	0-13	0.6-2.0	0.19-0.22	5.6-7.8	<2	Moderate----	0.28	5	6	4-8
	13-36	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate----	0.28			
	36-60	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate----	0.43			
Chancellor------	0-13	0.06-0.6	0.13-0.19	6.1-7.3	<2	High--------	0.28	5	7	4-6
	13-33	0.06-0.2	0.11-0.19	6.1-7.8	<2	High--------	0.28			
	33-60	0.06-0.6	0.14-0.20	7.4-8.4	2-4	High--------	0.28			
Bn, Bo----------	0-36	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low---------	0.24	5	6	4-6
Bon	36-60	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low---------	0.32			
Br*:										
Bonilla---------	0-11	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low---------	0.24	5	6	4-6
	11-31	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate----	0.24			
	31-60	0.2-2.0	0.16-0.20	7.4-8.4	<8	Moderate----	0.37			
Crossplain------	0-9	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate----	0.24	5	6	3-6
	9-27	0.06-0.6	0.11-0.17	6.1-7.3	<2	High--------	0.32			
	27-60	0.06-0.6	0.16-0.20	6.6-8.4	2-8	Moderate----	0.32			
BsE*:										
Boyd----------	0-7	<0.2	0.10-0.14	6.6-8.4	<2	Very high	0.37	4	4	2-4
	7-17	<0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	17-24	<0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	24-60	---	---	---	<2	Very high	----			
Sansarc---------	0-4	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4	1-2
	4-16	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	16-60	---	---	5.6-8.4	---	----------	----			
CmA*, CmB*:										
Clarno----------	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low---------	0.28	5	6	2-4
	8-17	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate----	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			
Bonilla---------	0-11	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low---------	0.24	5	6	4-6
	11-31	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate----	0.24			
	31-60	0.2-2.0	0.16-0.20	7.4-8.4	<8	Moderate----	0.37			
CnA*:										
Clarno----------	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low---------	0.28	5	6	2-4
	8-17	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate----	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			
Crossplain------	0-9	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate----	0.24	5	6	3-6
	9-27	0.06-0.6	0.11-0.17	6.1-7.3	<2	High--------	0.32			
	27-60	0.06-0.6	0.16-0.20	6.6-8.4	2-8	Moderate----	0.32			
Davison---------	0-8	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate----	0.28	5	4L	2-4
	8-22	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate----	0.37			
	22-60	0.6-2.0	0.16-0.20	7.4-8.4	2-8	Moderate----	0.37			
CsB*:										
Clarno----------	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low---------	0.28	5	6	2-4
	8-17	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate----	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	Mmhos/cm					Pct
CsB*:										
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Bonilla	0-11	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.24	5	6	4-6
	11-31	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24			
	31-60	0.2-2.0	0.16-0.20	7.4-8.4	<8	Moderate	0.37			
DaB, DaC	0-10	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.24	5	6	4-6
Davis	10-40	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24			
	40-60	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.24			
DlC*:										
Delmont	0-8	0.6-2.0	0.18-0.20	5.6-7.8	<2	Low	0.28	3	6	2-4
	8-15	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low	0.28			
	15-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Talmo	0-5	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low	0.20	2	6	2-4
	5-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
EaA, EaB	0-12	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	0.32	5	6	4-6
Eltree	12-28	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
	28-60	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low	0.43			
EbC*, EbE*:										
Eltree	0-12	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	0.32	5	6	4-6
	12-28	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
	28-60	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low	0.43			
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
EcD*:										
Eltree	0-12	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	0.32	5	6	4-6
	12-28	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
	28-60	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low	0.43			
Crofton	0-4	0.6-2.0	0.21-0.24	7.4-8.4	<2	Low	0.43	5	4L	.5-2
	4-60	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low	0.43			
EdA*, EdB*:										
Enet	0-10	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.28	4	6	2-4
	10-25	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low	0.28			
	25-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Delmont	0-8	0.6-2.0	0.18-0.20	5.6-7.8	<2	Low	0.28	3	6	2-4
	8-15	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low	0.28			
	15-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
EhB*, EhC*:										
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Alcester	0-13	0.6-2.0	0.19-0.22	5.6-7.8	<2	Moderate	0.28	5	6	4-8
	13-36	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate	0.28			
	36-60	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43			
EmE*:										
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Betts	0-4	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	0.28	5	4L	1-3
	4-28	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37			
	28-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate	0.37			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	Mmhos/cm					Pct
EnC*:										
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Bonilla	0-11	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.24	5	6	4-6
	11-31	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24			
	31-60	0.2-2.0	0.16-0.20	7.4-8.4	<8	Moderate	0.37			
EoD*:										
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Davis	0-10	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.24	5	6	4-6
	10-40	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24			
	40-60	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.24			
EpC*:										
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Homme	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-24	0.2-0.6	0.11-0.18	6.1-7.8	<2	High	0.32			
	24-36	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	36-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.32			
Fv. Fluvaquents										
GeE*:										
Gavins	0-5	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low	0.43	2	4L	2-4
	5-16	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low	0.43			
	16-60	---	---	---	---	---	---			
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
GrA	0-18	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	4-8
Graceville	18-50	0.6-2.0	0.17-0.22	5.6-7.3	<2	Moderate	0.32			
	50-60	6.0-20	0.03-0.06	6.1-7.8	<2	Low	0.10			
HmA*:										
Homme	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-24	0.2-6.0	0.11-0.18	6.1-7.8	<2	High	0.32			
	24-36	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	36-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.32			
Davison	0-8	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28	5	4L	2-4
	8-22	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	0.37			
	22-36	0.6-2.0	0.16-0.20	7.4-8.4	2-8	Moderate	0.37			
	36-60	0.2-2.0	0.10-0.18	7.4-8.4	2-8	Moderate	0.37			
Tetonka	0-11	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6	3-6
	11-31	<0.2	0.10-0.22	6.1-7.8	<2	High	0.32			
	31-60	0.06-0.6	0.08-0.17	6.6-8.4	2-8	High	0.32			
HnB*:										
Homme	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-24	0.2-0.6	0.11-0.18	6.1-7.8	<2	High	0.32			
	24-36	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	36-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.32			
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	Mmhos/cm					Pct
HnB*:										
Onita	0-15	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7	4-6
	15-36	0.2-0.6	0.11-0.17	6.1-7.3	<2	High	0.43			
	36-60	0.2-0.6	0.17-0.20	6.6-8.4	<2	Moderate	0.43			
HpB*, HpC*:										
Homme	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-24	0.2-0.6	0.11-0.18	6.1-7.8	<2	High	0.32			
	24-36	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	36-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.32			
Ethan	0-7	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Tetonka	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6	2-4
	16-42	<0.2	0.13-0.19	6.1-7.8	<2	High	0.32			
	42-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High	0.32			
HrA*, HrB*:										
Homme	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-24	0.2-0.6	0.11-0.18	6.1-7.8	<2	High	0.32			
	24-36	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	36-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.32			
Onita	0-15	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7	4-6
	15-36	0.2-0.6	0.11-0.17	6.1-7.3	<2	High	0.43			
	36-60	0.2-0.6	0.17-0.20	6.6-8.4	<2	Moderate	0.43			
HtA*:										
Homme	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-24	0.2-0.6	0.11-0.18	6.1-7.8	<2	High	0.32			
	24-36	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	36-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.32			
Onita	0-15	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7	4-6
	15-36	0.2-0.6	0.11-0.17	6.1-7.3	<2	High	0.43			
	36-60	0.2-0.6	0.17-0.20	6.6-8.4	<2	Moderate	0.43			
Tetonka	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6	2-4
	16-42	<0.2	0.13-0.19	6.1-7.8	<2	High	0.32			
	42-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High	0.32			
La	0-24	0.6-2.0	0.22-0.24	7.4-8.4	<2	Moderate	0.32	5	6	4-6
Lamo	24-60	0.2-0.6	0.18-0.22	7.4-8.4	<2	High	0.32			
OcA*:										
Onita	0-15	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7	4-6
	15-36	0.2-0.6	0.11-0.17	6.1-7.3	<2	High	0.43			
	36-60	0.2-0.6	0.17-0.20	6.6-8.4	<2	Moderate	0.43			
Chancellor	0-13	0.06-0.6	0.13-0.19	6.1-7.3	<2	High	0.28	5	7	4-6
	13-33	0.06-0.2	0.11-0.19	6.1-7.8	<2	High	0.28			
	33-60	0.06-0.6	0.14-0.20	7.4-8.4	2-4	High	0.28			
ReD*:										
Redstoe Variant	0-12	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low	0.28	4	4L	1-3
	12-60	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low	0.43			
Gavins	0-5	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low	0.43	2	4L	2-4
	5-16	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low	0.43			
	16-60	---	---	---	---	---	---			
Sa	0-28	0.6-2.0	0.19-0.24	6.6-8.4	4-16	Moderate	0.28	5	6	3-6
Salmo	28-41	0.2-2.0	0.17-0.20	6.6-8.4	4-16	Moderate	0.28			
	41-60	0.06-0.6	0.11-0.20	6.6-8.4	4-16	Moderate	0.28			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	Mmhos/cm					Pct
Sb*:										
Sarpy	0-3	>6.0	0.05-0.09	6.6-8.4	<2	Low	0.15	5	2	<1
	3-60	>6.0	0.05-0.09	6.6-8.4	<2	Low	0.15			
Waubonsie	0-20	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low	0.24	5	3	1-2
	20-60	<0.2	0.11-0.13	7.4-8.4	<2	High	0.24			
TaE*:										
Talmo	0-5	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low	0.20	2	6	2-4
	5-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Delmont	0-8	0.6-2.0	0.18-0.20	5.6-7.8	<2	Low	0.28	3	6	2-4
	8-15	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low	0.28			
	15-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
TbE*:										
Talmo	0-5	0.6-2.0	0.08-0.12	6.6-7.8	<2	Low	0.20	2	8	2-4
	5-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Ethan	0-7	0.6-2.0	0.11-0.15	6.1-7.8	<2	Moderate	0.28	5-4	8	1-3
	7-17	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	17-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Te	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6	2-4
Tetonka	16-42	<0.2	0.13-0.19	6.1-7.8	<2	High	0.32			
	42-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High	0.32			
ThC, ThE	0-14	6.0-20	0.10-0.12	6.1-7.3	<2	Low	0.17	5	2	1-2
Thurman	14-60	6.0-20	0.06-0.11	6.1-7.3	<2	Low	0.17			
Wg	0-18	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.37	5	7	3-5
Worthing	18-47	0.06-0.2	0.13-0.18	6.1-7.3	<2	High	0.37			
	47-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High	0.37			
Wo	0-18	0.2-0.6	0.19-0.22	5.6-7.3	<2	High	0.37	5	8	3-5
Worthing	18-47	0.06-0.2	0.13-0.18	6.1-7.8	<2	High	0.37			
	47-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High	0.37			
YaA*, YaB*:										
Yankton	0-13	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low	0.32	5	5	2-4
	13-28	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low	0.32			
	28-34	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low	0.32			
	34-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
Alcester	0-13	0.6-2.0	0.19-0.22	5.6-7.8	<2	Moderate	0.28	5	6	4-8
	13-36	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate	0.28			
	36-60	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
AaA---------- Alcester	B	Occasional	Brief-----	Mar-Oct	3.0-6.0	Apparent	Oct-Jun	High-----	Moderate	Low.
AcA*:										
Alcester---------	B	Frequent----	Brief-----	Mar-Oct	3.0-6.0	Apparent	Oct-Jun	High-----	Moderate	Low.
Chancellor--------	C	Frequent----	Brief-----	Sep-Jun	0-3.0	Perched	Sep-Jun	High-----	High-----	Moderate.
Bn---------- Bon	B	Occasional	Brief-----	Apr-Oct	>6.0	---	---	Moderate	Moderate	Low.
Bo---------- Bon	B	Frequent----	Brief-----	Apr-Oct	2.0-6.0	Apparent	Oct-Jul	High-----	Moderate	Low.
Br*:										
Bonilla----------	B	Frequent----	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate	High-----	Moderate.
Crossplain--------	C/D	Frequent----	Brief-----	Sep-Jun	0-3.0	Perched	Sep-Jun	High-----	High-----	Moderate.
BsE*:										
Boyd----------	D	None--------	---	---	>6.0	---	---	Low------	High-----	Moderate.
Sansarc----------	D	None--------	---	---	>6.0	---	---	Low------	High-----	Moderate.
CmA*, CmB*:										
Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Bonilla----------	B	Occasional	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate	High-----	Moderate.
CnA*:										
Clarno----------	B	None--------	---	---	3.0-6.0	Perched	Oct-Jul	Moderate	High-----	Moderate.
Crossplain--------	C/D	Frequent----	Brief-----	Sep-Jun	0-3.0	Perched	Sep-Jun	High-----	High-----	Moderate.
Davison----------	B	None--------	---	---	1.5-6.0	Perched	Mar-Jun	High-----	High-----	Moderate.
CsB*:										
Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Bonilla----------	B	Occasional	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate	High-----	Moderate.
DaB, DaC---------- Davis	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
DlC*:										
Delmont----------	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Talmo----------	A	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
EaA, EaB---------- Eltree	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
EbC*, EbE*:										
Eltree----------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
EcD*:										
Eltree----------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Crofton----------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	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			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
EdA*, EdB*:										
Enet	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
Delmont	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
EhB*, EhC*:										
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Alcester	B	Occasional	Brief	Mar-Oct	3.0-6.0	Apparent	Oct-Jun	High	Moderate	Low.
EmE*:										
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Betts	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
EnC*:										
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Bonilla	B	Occasional	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate	High	Moderate.
EoD*:										
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Davis	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
EpC*:										
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Homme	C	None	---	---	>6.0	---	---	Low	High	Low.
Fv.										
Fluvaquents										
GeE*:										
Gavins	D	None	---	---	>6.0	---	---	Moderate	Moderate	High.
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
GrA	B	None	---	---	>6.0	---	---	High	Moderate	Low.
Graceville										
HmA*:										
Homme	B	None	---	---	3.0-6.0	Perched	Oct-Jul	High	High	Moderate.
Davison	B	None	---	---	1.5-6.0	Perched	Mar-Jun	High	High	Moderate.
Tetonka	D	None	---	---	+1-1.0	Perched	Mar-Jul	Moderate	High	Moderate.
HnB*:										
Homme	C	None	---	---	>6.0	---	---	Low	High	Low.
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Onita	C	Occasional	Brief	Mar-Oct	2.5-6.0	Perched	Apr-Jun	High	High	Low.
HpB*, HpC*:										
Homme	C	None	---	---	>6.0	---	---	Low	High	Low.
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Tetonka	C/D	None	---	---	+1-1.0	Perched	Jan-Dec	High	High	Moderate.
HrA*, HrB*:										
Homme	C	None	---	---	>6.0	---	---	Low	High	Low.
Onita	C	Occasional	Brief	Mar-Oct	2.5-6.0	Perched	Apr-Jun	High	High	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			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
HtA*:										
Homme	C	None	---	---	>6.0	---	---	Low	High	Low.
Onita	C	Occasional	Brief	Mar-Oct	2.5-6.0	Perched	Apr-Jun	High	High	Low.
Tetonka	C/D	None	---	---	+1-1.0	Perched	Jan-Dec	High	High	Moderate.
La Lamo	C	Occasional	Brief	Mar-Aug	1.5-3.0	Apparent	Nov-May	High	High	Low.
OcA*:										
Onita	C	Frequent	Brief	Mar-Oct	2.5-6.0	Perched	Apr-Jun	High	High	Low.
Chancellor	C	Frequent	Brief	Sep-Jun	0-3.0	Perched	Sep-Jun	High	High	Moderate.
ReD*:										
Redstoe Variant	B	None	---	---	>6.0	---	---	Moderate	High	Low.
Gavins	D	None	---	---	>6.0	---	---	Moderate	Moderate	High.
Sa Salmo	C/D	Frequent	Brief	Mar-Oct	0-2.5	Apparent	Sep-Jun	High	High	High.
Sb*:										
Sarpy	A	Frequent	Brief to long.	Nov-Jun	<6.0	---	---	Low	Low	Low.
Waubonsie	B	Frequent	Very brief	Feb-Nov	2.0-4.0	Apparent	Nov-Jul	High	High	Low.
TaE*:										
Talmo	A	None	---	---	>6.0	---	---	Low	Moderate	Low.
Delmont	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
TbE*:										
Talmo	A	None	---	---	>6.0	---	---	Low	Moderate	Low.
Ethan	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Te Tetonka	C/D	None	---	---	+1-1.0	Perched	Jan-Dec	High	High	Moderate.
ThC, ThE Thurman	A	None	---	---	>6.0	---	---	Low	Low	Low.
Wg Worthing	D	None	---	---	+1-1.0	Perched	Jan-Dec	High	High	Moderate.
Wo Worthing	D	None	---	---	+3-0.5	Perched	Jan-Dec	High	High	High.
YaA*, YaB*:										
Yankton	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
Alcester	B	Occasional	Brief	Mar-Oct	3.0-6.0	Apparent	Oct-Jun	High	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available]

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
Alcester silt loam: (SHD-78-009-13)														
A,B---- 0 to 36	A-6(9)	CL	100	100	100	100	95	--	22	--	37	12	99	22
BC,C--- 36 to 60	A-6(11)	CL	100	99	99	97	89	--	34	--	39	18	106	19
Bon loam: (SHD-78-009-14)														
A------ 0 to 36	A-4(5)	CL	100	100	99	93	59	--	16	--	30	8	104	20
C------ 36 to 60	A-6(6)	CL	100	98	97	91	58	--	24	--	30	13	113	15
Boyd clay: (SHD-78-009-3)														
A,Bw1-- 0 to 7	A-7-5(20)	CH	100	100	100	100	99	--	82	--	115	76	76	38
Cr----- 24 to 60	A-7-5(20)	CH	100	100	100	99	95	--	78	--	111	74	82	32
Davison loam: (SHD-78-009-9)														
Ap----- 0 to 8	A-6(10)	CL	100	96	95	93	82	--	29	--	36	14	102	20
Ck----- 8 to 22	A-6(11)	CL	100	99	98	93	78	--	37	--	35	17	112	16
C------ 36 to 60	A-6(8)	CL	100	99	97	89	65	--	26	--	34	15	111	16
Eltree silt loam: (SHD-78-009-7)														
A----- 0 to 14	A-4(8)	CL	100	100	100	100	94	--	18	--	34	10	102	20
C----- 32 to 60	A-6(9)	ML-CL	100	100	100	99	94	--	27	--	35	13	107	18
Ethan loam: (SHD-78-009-5)														
A------- 0 to 6	A-6(7)	CL	100	95	93	86	60	--	21	--	38	14	102	20
C------- 30 to 60	A-6(6)	CL	100	98	96	87	60	--	23	--	31	12	113	15
Gavins loam: (SHD-78-009-15)														
A,AC,C--0 to 16	A-7-5(11)	ML	100	100	99	94	79	--	54	--	46	15	84	31
Homme silty clay loam: (SHD-78-009-8)														
Ap---- 0 to 8	A-7-6(13)	CL	100	100	100	99	95	--	38	--	43	19	98	22
Bw---- 8 to 24	A-7-6(16)	CL	100	100	100	99	98	--	44	--	49	25	96	24
2C---- 36 to 60	A-7-6(15)	CL	100	100	100	99	86	--	44	--	46	25	105	19

TABLE 17.--ENGINEERING INDEX TEST DATA--Continued

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
Yankton silt loam: (SHD-78-009-12)														
Ap,A1-- 0 to 13	A-4(8)	ML	100	100	100	99	92	--	23	--	31	8	105	19
B,BC--- 18 to 34	A-6(9)	ML	100	100	100	99	90	--	29	--	36	13	106	19
2C----- 34 to 60	A-6(8)	CL	100	98	96	88	59	--	26	--	36	18	112	16

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alcester	Fine-silty, mixed, mesic Cumulic Haplustolls
Betts	Fine-loamy, mixed (calcareous), mesic Typic Ustorthents
Bon	Fine-loamy, mixed, mesic Cumulic Haplustolls
Bonilla	Fine-loamy, mixed, mesic Pachic Haplustolls
Boyd	Fine, montmorillonitic, mesic Vertic Haplustolls
Chancellor	Fine, montmorillonitic, mesic Typic Argiaquolls
Clarno	Fine-loamy, mixed, mesic Typic Haplustolls
Crofton	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Crossplain	Fine, montmorillonitic, mesic Typic Argiaquolls
Davis	Fine-loamy, mixed, mesic Pachic Haplustolls
Davison	Fine-loamy, mixed, mesic Aquic Calciustolls
Delmont	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplustolls
Eltree	Fine-silty, mixed, mesic Pachic Haplustolls
Enet	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Ethan	Fine-loamy, mixed, mesic Typic Calciustolls
Fluvaquents	Loamy and sandy, mixed, mesic Typic Fluvaquents
Gavins	Loamy, carbonatic, mesic, shallow Typic Ustorthents
Graceville	Fine-silty, mixed, mesic Pachic Haplustolls
Homme	Fine-silty, mixed, mesic Typic Haplustolls
Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Onita	Fine, montmorillonitic, mesic Pachic Argiustolls
Redstoe Variant	Fine-silty, mixed, mesic Typic Calciustolls
Salmo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Sansarc	Clayey, montmorillonitic (calcareous), mesic, shallow Typic Ustorthents
Sarpy	Mixed, mesic Typic Udipsamments
Talmo	Sandy-skeletal, mixed, mesic Udorthentic Haplustolls
Tetonka	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Thurman	Sandy, mixed, mesic Udorthentic Haplustolls
Waubonsie	Coarse-loamy over clayey, mixed (calcareous), mesic Aquic Udifluvents
Worthing	Fine, montmorillonitic, mesic Typic Argiaquolls
Yankton	Fine-silty, mixed, mesic Pachic Haplustolls

*U.S. GOVERNMENT PRINTING OFFICE: 1983 - 379-103/2044

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