Soil Survey of

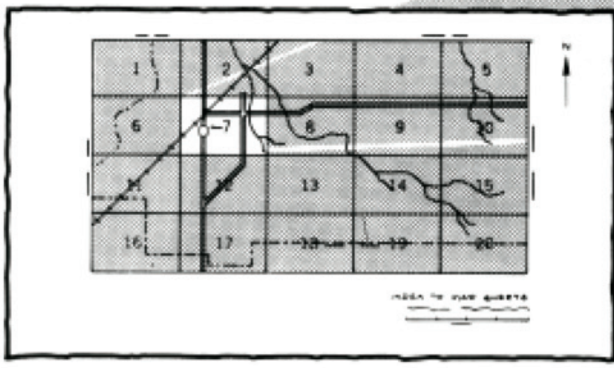
Yankton County, South Dakota

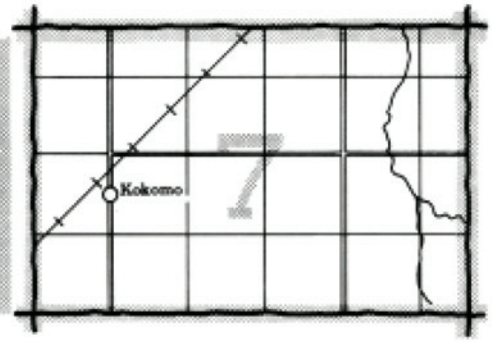
United States Department of Agriculture
Soil Conservation Service

in cooperation with
South Dakota Agricultural Experiment Station

HOW TO USE

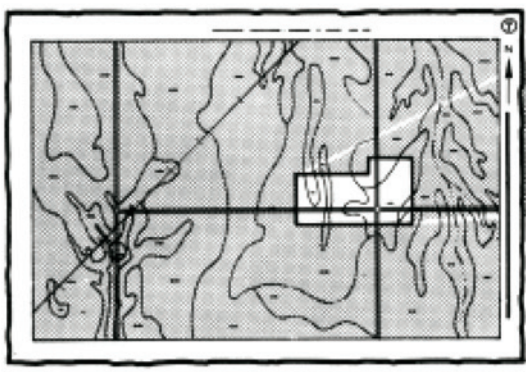
1. Locate your area of interest on the "Index to Map Sheets"

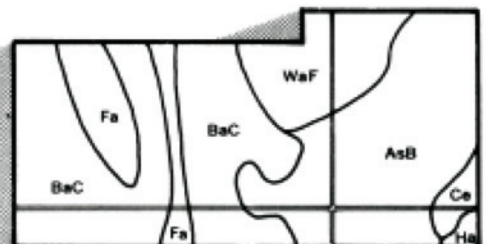




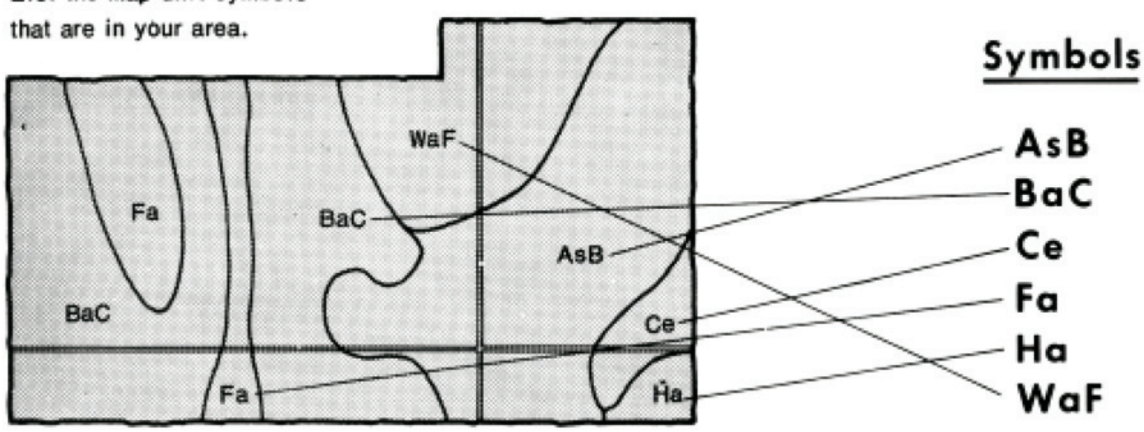
2. Note the number of the map sheet and turn to that sheet.

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



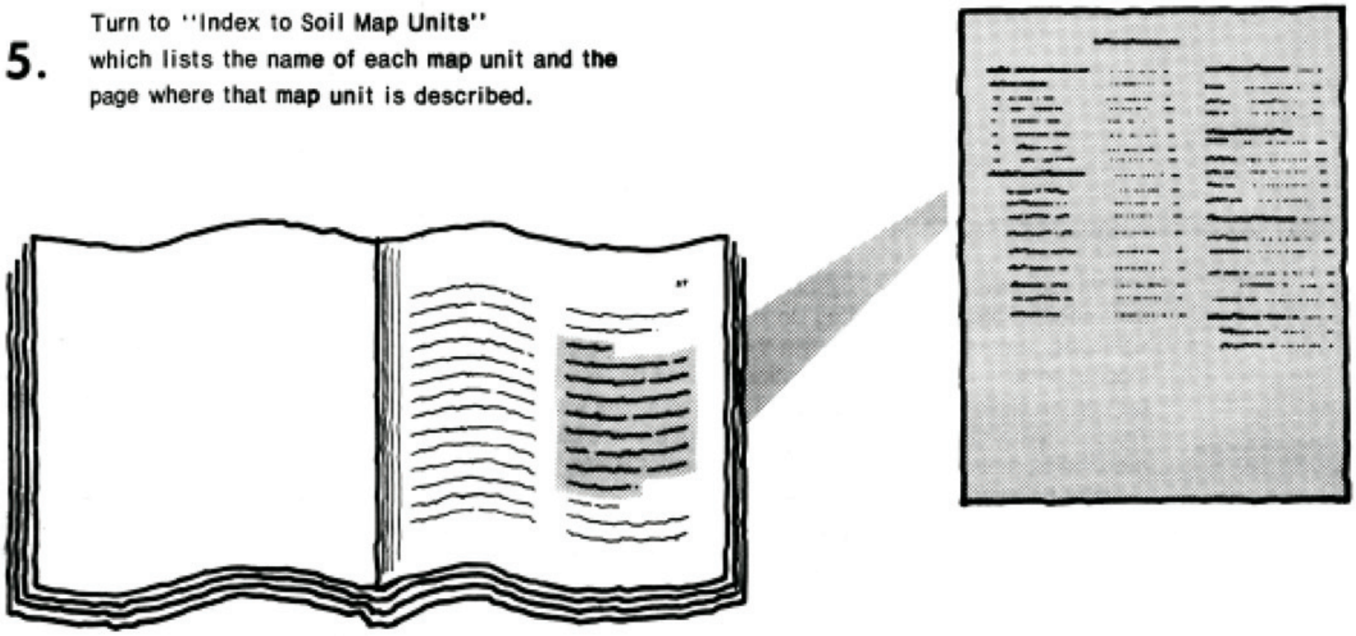


4. List the map unit symbols that are in your area.

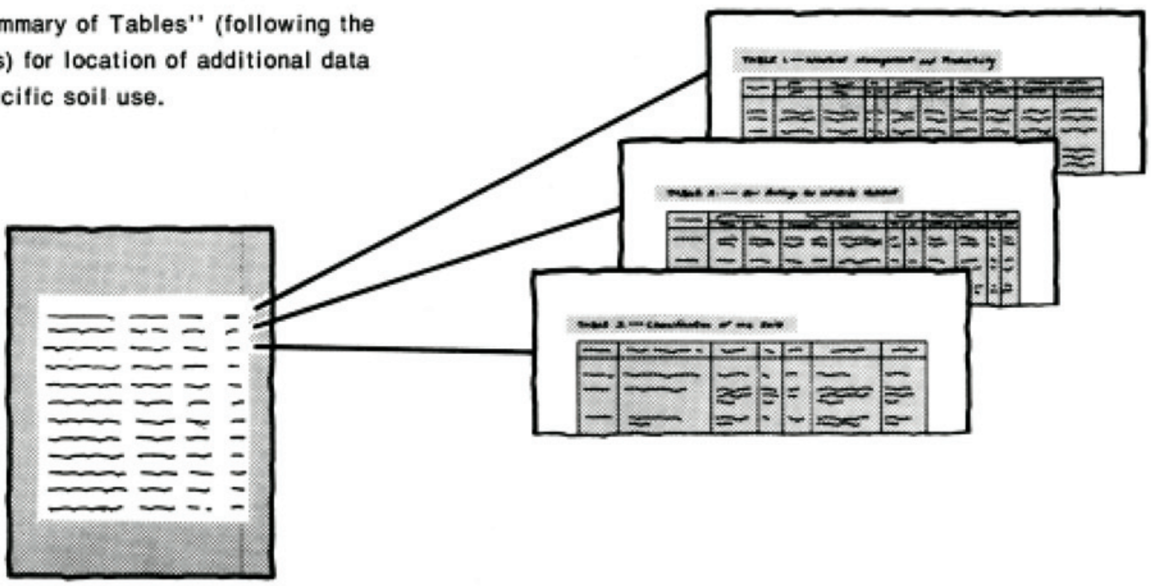


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1973-1976. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. 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 Yankton County Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue and the Yankton County Conservation District.

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

Cover: Ethan-Betts loams, 15 to 40 percent slopes, in the foreground. Beaver Lake is in the background.

Contents

Issued August 1979

Index to map units

Summary of tables

Summary of tables—Continued

Foreword

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

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

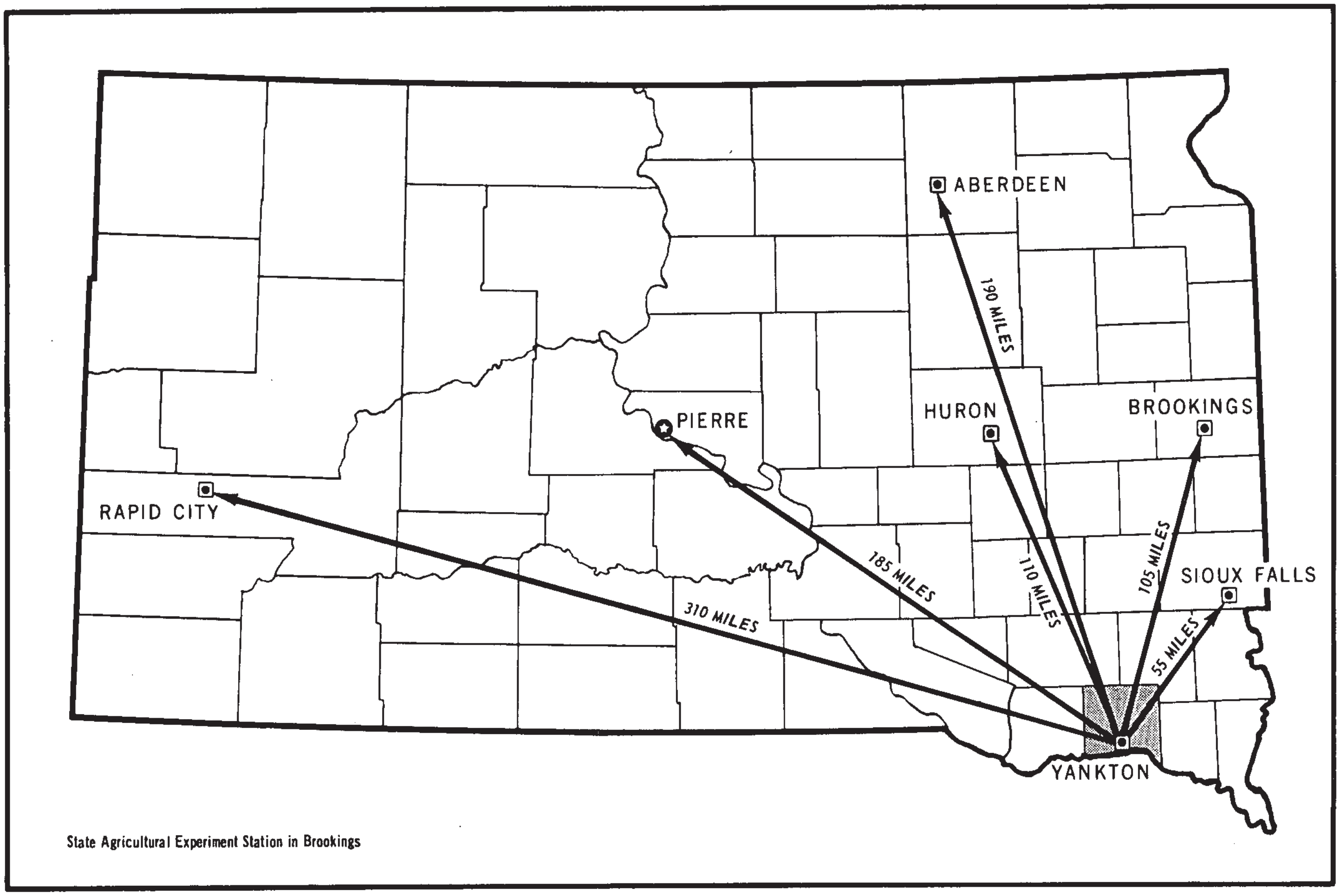
Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

R. D. Swenson

R. D. Swenson
State Conservationist
Soil Conservation Service



Location of Yankton County in South Dakota.

SOIL SURVEY OF YANKTON COUNTY, SOUTH DAKOTA

By Edgar H. Ensz, Soil Conservation Service

Fieldwork by Edgar H. Ensz, Karl J. Krueger, and Elmer M. Ward
Soil Conservation Service

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

YANKTON COUNTY is in the southeastern part of South Dakota (see map on facing page). The southern side of the county is Lewis and Clark Lake and the Missouri River, which is part of the state line between Nebraska and South Dakota. Yankton County has a land area of 519 square miles, or 332,032 acres. The population is 19,039, according to the 1970 census. Yankton, the county seat, is along the Missouri River, in the south-central part of the county. The largest town in the county, it had a population of 11,919 in 1970. Other towns and villages are Gayville, Irene, Lesterville, Mission Hill, Utica, and Volin. They range in population from 90 to 270.

About 84 percent of the county is cropland, tame pasture, and hayland. About 16 percent is rangeland. Corn, oats, soybeans, grain sorghum, alfalfa, and bromegrass are the main crops. Farming is diversified. Livestock and livestock products are the main sources of income, but cash crops also are important.

General nature of the county

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

Climate

Yankton County is cold in winter and hot in summer. Cool spells occasionally occur in summer. During the winter, precipitation frequently occurs as snowstorms. During the warm months, it occurs chiefly as showers, often heavy, when warm moist air moves in from the south. Total annual rainfall is normally adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Yankton for the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 20 degrees F, and the average daily minimum temperature is 9 degrees. The lowest temperature on record, which occurred at Yankton on January 20, 1970, is minus 29 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 108 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (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.

Of the total annual precipitation, 19 inches, or 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 4.19 inches at Yankton on June 17, 1957. Thunderstorms occur on about 45 days each year, and most occur in summer.

Average seasonal snowfall is 27 inches. The greatest snow depth at any one time during the period of record was 27 inches. On the average, 29 days have at least 1 inch of snow on the ground, but 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 prevailing wind is from the south. Average windspeed is highest, 14 miles per hour, in April.

Tornadoes and severe thunderstorms strike occasionally. These storms are local and of short duration and usually result in little damage. Hailstorms occur during the warmer part of the year in an irregular pattern and in small areas.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Physiography and relief

Yankton County is in two physiographic areas. It is dominantly in the James River Highlands, but a few areas in the southern and southeastern parts are in the Missouri River Trench (*4*). The James River Highlands consist of three ridges—Turkey Ridge in the northeast corner of the county, James Ridge in the central part, and Yankton Ridge in the southwestern part. The elevation of the ridges ranges from 150 to 400 feet above the adjacent terrain. The area between the ridges is a low, undulating glacial till plain. The James River dissected these highlands almost diagonally from northwest to southeast across the county.

The Missouri River Trench is characterized by coarse materials in the bar and point bar deposits nearest the river channel. Fine textured materials are in abandoned channels and back swamp areas, most of which are several miles from the present river channel. Relief generally is less than 5 feet between short terrace escarpments and the abandoned channels. Drainage is a problem in some areas.

Deposits of Pleistocene age cover most of the bedrock in the county. These deposits consist mainly of till and lesser amounts of alluvium, outwash, and loess. Niobrara chalk rock and Pierre shale crop out in areas where the mantle of glacial till is thin, generally on steep breaks along the major drainageways.

The elevation in the county ranges from a high of 1,676 feet on Turkey Ridge to a low of 1,155 feet on the bottom land along the Missouri River, at a point downstream from where the James River empties into the Missouri River.

Other than the Missouri River and the James River, the principal streams that drain the county are Turkey, Clay, Smokey Run, Beaver, and Marne Creeks. These generally flow in a southeasterly direction.

Settlement

Lewis and Clark, traveling up the Missouri River in 1804, passed by what is now Yankton County on their way to examine the land acquired through the Louisiana Purchase. At a site near Gavins Point Dam, they met for several days with the Sioux (*5*). The lake formed by Gavins Point Dam was named after Lewis and Clark.

The city of Yankton, on the banks of the Missouri River, was established by Capt. J. B. S. Todd, a cousin of Mary Todd Lincoln, and his partner, Col. Daniel Frost, in 1858. On March 2, 1861, President James Buchanan signed a bill establishing the Territory of Dakota. Yankton was made the capitol.

Yankton County was organized in 1862. The Homestead Act of 1862 had a large impact on the settlement of the county. After a railroad reached Yankton in 1872, many immigrants settled in the area. Yankton College, the first college in the territory, was founded in 1881 by Joseph Ward. The area remained a territory until 1889, when South Dakota became a state.

Farming

The first settlers in Yankton County mainly were farmers. They plowed grassland and raised small grain and some livestock. After a few years, corn started to replace some of the small grain, and the number of livestock increased. During the depression and dry years of the 1930's, the number of farms started to drop from a high of 1,648 (*8*). At this time, soil blowing was a severe problem, resulting in loss of fertile topsoil. Another serious problem, when rain fell during this period, was the water erosion resulting from the lack of plant cover. Soil was washed off sloping areas by sheet and gully erosion, sediments were carried away by the rivers, and natural drainageways became clogged.

In 1937, the Soil Conservation District Law was enacted by Congress and implemented through a law passed by the South Dakota Legislature (*7*). In Yankton County, a conservation district was organized on March 25, 1944. The townships of Volin, Marindahl, Turkey Valley, Walshtown, Mission Hill, and Mayfield were included in the district. In 1946, the rest of the county joined the district. The people of the district began solving the problems by seeding grass on eroding cropland, shaping and seeding gullies, contour farming, and terracing. Dams were constructed to provide water for livestock and recreation. Trees were planted to provide protection for farmsteads, and shelterbelts were planted to help control soil blowing. The dams and tree plantings provide habitat for many types of wildlife.

Farming is the main occupation in the county. About 215,000 acres, or 65 percent of the county, is cropland (*13*). The trend is toward fewer and larger farms. The number of farms in 1974 was 940, and the average size was 335 acres (*9*). Corn for grain was harvested on 82,000 acres, oats on 46,100 acres, soybeans on 24,800 acres, sorghum on 2,000 acres, alfalfa hay on 23,000 acres, and wild hay on 12,000 acres.

In 1975, the estimated number of livestock in the county included 65,000 cattle, 50,800 hogs, and 3,800 sheep. This number included 2,800 milk cows.

Natural resources

Soil is the most important natural resource in the county. Crops and livestock are marketable products affected by the soil.

The water resources in the county generally are adequate for domestic use and for livestock. The principal surface water resources are Lewis and Clark Lake, Marindahl Lake, Beaver Lake, the Missouri River, and the James River. Many small dams, dugouts, and flows of Clay, Turkey, Beaver, and Marne Creeks provide livestock water in most years. Ground water from wells is available in most parts of the county. The source of water for shallow wells, ranging in depth from 15 to 200 feet, is the glacial till deposits in the uplands or the alluvial sediments on the bottom land along the Missouri River. The source of water for deep wells is sandstone, at a depth of 225 to 630 feet. Water quantity generally is greater and quality poorer in the deep wells. A few of the aquifers have enough water to meet the demands of large-scale irrigation systems.

Mineral resources in the county consist of sand and gravel deposits, Pierre shale, and Niobrara chalk rock. The sand and gravel deposits are mined for road construction material and concrete aggregate. Some Niobrara chalk rock is mined for use as agricultural lime. During the period 1891 to 1910, a quarry in the Niobrara chalk rock near Gavins Point Dam produced 1,900,000 barrels of cement (*6*).

Wildlife resources include the whitetail deer throughout the county and such upland game birds as bobwhite, ring-necked pheasant, and gray partridge. Most areas of permanent water contain various species of fish, such as bass, bluegill, northern pike, perch, and walleye. Lewis and Clark Lake and the Missouri River provide excellent fishing and boating opportunities. The potholes and wetland areas serve as wildlife production areas.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

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

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

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

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

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

General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

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

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The units on the general soil map of this county are described on the pages that follow. The names of the map units do not coincide exactly with those on the general soil maps in the published surveys of adjacent Clay and Hutchinson Counties. They do not coincide because of differences in detail of the general soil maps and because of changes in the concepts of soil series.

1. Clarno-Bonilla-Tetonka

Deep, nearly level to undulating, well drained, moderately well drained, and poorly drained loamy and silty soils on uplands

This map unit is on a glacial till plain that is characterized by gentle rises, swales, and enclosed depressions (fig. 1). Slopes generally are short and convex. The drainage pattern commonly is poorly defined in areas where small drainageways terminate in the many enclosed depressions. In areas where larger drainageways occur, the drainage pattern is well defined. Flooding commonly occurs for brief periods on the Bonilla soils and very long periods on the Tetonka soil.

This map unit makes up about 40 percent of the county. It is about 40 percent Clarno soils, 15 percent Bonilla soils, 10 percent Tetonka soils, and 35 percent minor soils.

Clarno soils are well drained and are on the higher parts of the landscape. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is grayish brown, brown, and pale brown, friable clay loam. The underlying material is pale yellow, calcareous clay loam.

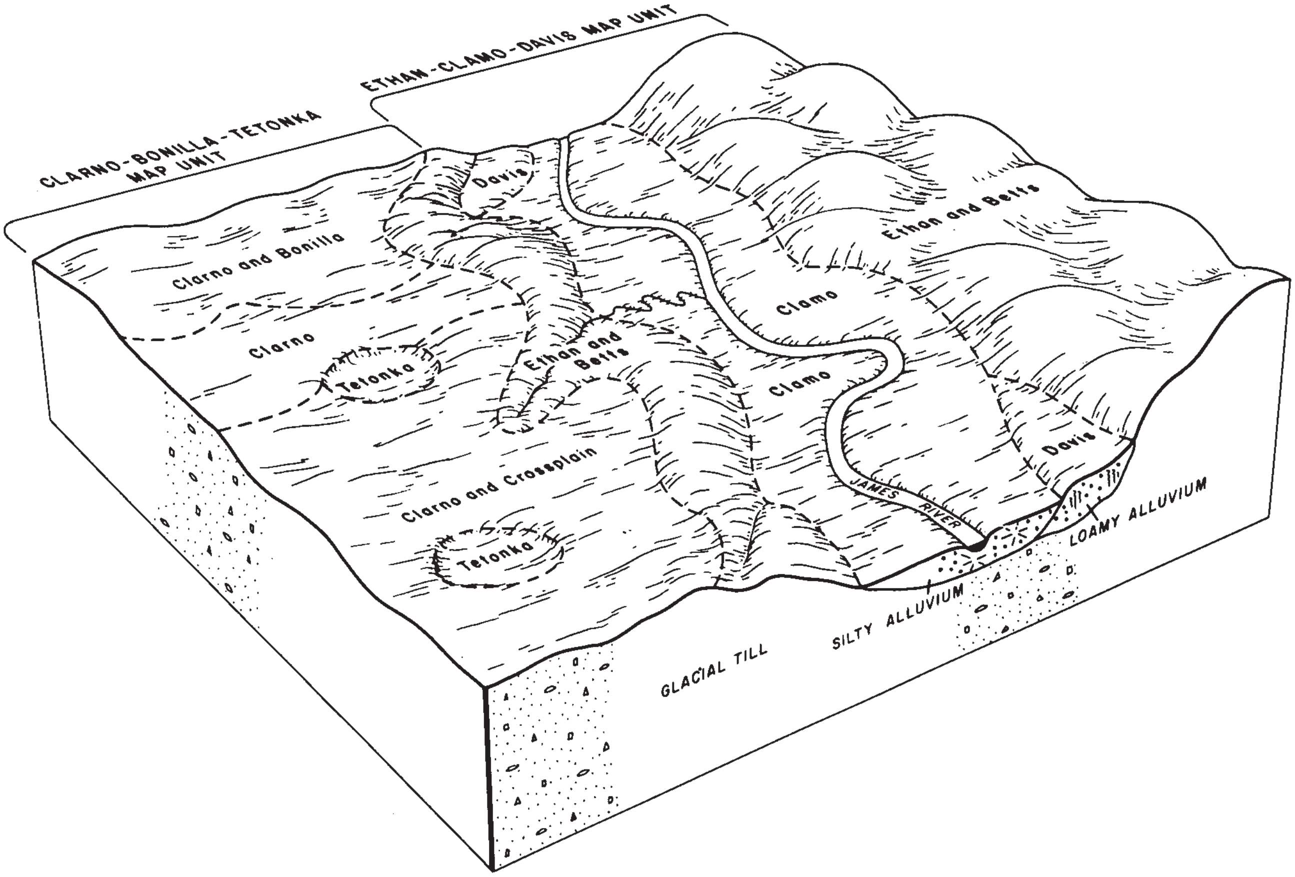


Figure 1.—Pattern of soils in the Clarno-Bonilla-Tetonka and Ethan-Clamo-Davis map units.

Bonilla soils are moderately well drained and are in swales. Slopes are concave and range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is dark grayish brown, friable loam over grayish brown, brown, and pale olive, firm clay loam. The underlying material is pale yellow, mottled, calcareous loam and clay loam.

Tetonka soils are poorly drained and are in enclosed depressions. They are ponded in the spring and after heavy rains. Slopes are less than 2 percent. Typically, the surface layer is dark gray silt loam. The subsurface layer is dark gray and gray silt loam. The subsoil is dark gray and gray. It is friable silty clay loam and silt loam over firm silty clay. The underlying material is grayish brown, mottled silty clay loam.

Minor in this map unit are the calcareous, well drained Ethan soils on some of the high knobs and along entrenched drainageways, the moderately well drained Bon and somewhat poorly drained Crossplain soils in the swales, and the well drained Davis soils on the slightly concave foot slopes of the entrenched drainageways.

Permeability is moderate in the subsoil and moderately slow in the underlying material of the Clarno and Bonilla soils and very slow in the Tetonka soils. Available water capacity is high in all three soils. Fertility is high in the Clarno and Bonilla soils and medium in the Tetonka soils.

Most of this map unit is used for cultivated crops. Corn, oats, soybeans, and alfalfa are the main crops. Some of the steeper areas bordering the larger drainageways and creeks support native grass and are used as rangeland. Conserving moisture, maintaining fertility, and controlling erosion in undulating areas and draining areas of Tetonka soils are the main concerns of management if the soils are used for crops. Terracing and contouring are not suitable in some areas because of the short, irregular slopes and the small depressions.

This map unit generally has good potential for cultivated crops, tame pasture and hay, and rangeland. The Clarno and Bonilla soils have good potential and the Tetonka soils poor potential for openland wildlife habitat. The Clarno soils generally have fair potential for building sites and sanitary facilities. The Bonilla and Tetonka soils generally have poor potential for building sites and sanitary facilities because of flooding, wetness, and restricted permeability.

2. Egan-Ethan-Trent

Deep, nearly level to gently rolling, well drained and moderately well drained silty and loamy soils on uplands

This map unit is on a glacial till plain that has been reworked by wind and water and has a silty mantle overlying loamy glacial till. It is characterized by gentle rises, swales, and enclosed depressions in most areas (fig. 2). Slopes generally are short and convex. The drainage pattern generally is poorly defined, but it is well defined in the areas where entrenched drainageways occur. Rare flooding occurs on the Trent soils in the spring and after heavy rains.

This map unit makes up about 15 percent of the county. It is about 40 percent Egan soils, 20 percent Ethan soils, 10 percent Trent soils, and 30 percent minor soils.

Egan soils are well drained and are on convex and plane slopes in the uplands. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is brown, pale brown, and light yellowish brown, friable silty clay loam. It is calcareous in the lower part. The underlying material is pale yellow, mottled, calcareous clay loam.

Ethan soils are well drained and are on knobs and along drainageways. Slopes range from 2 to 9 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is grayish brown and pale brown, friable, calcareous loam. The underlying material is pale brown and very pale brown, mottled, calcareous clay loam.

Trent soils are moderately well drained and are in swales. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is grayish brown and light brownish gray, friable silty clay loam. It is calcareous in the lower part. The underlying material is pale yellow, mottled, calcareous clay loam.

Minor in this map unit are Chancellor, Salmo, Tetonka, Wentworth, Whitewood, and Worthing soils. The somewhat poorly drained Chancellor and Whitewood soils and the poorly drained Salmo soils are in sluggish drainageways. The poorly drained Tetonka soils and the very poorly drained Worthing soils are in depressions. The well drained Wentworth soils are adjacent to Egan soils on the less sloping parts of the landscape.

Permeability is moderate in the subsoil and moderately slow in the underlying material of the major soils. Available water capacity is high. Fertility is high in the Egan and Trent soils and low or moderate in the Ethan soils.

Most of this map unit is used for crops. Corn, oats, soybeans, and alfalfa are the main crops. Some of the steeper areas bordering the larger creeks and drainageways support native grass and are used as rangeland. Conserving moisture, maintaining fertility, and controlling erosion are the main concerns of management if the soils are used for crops.

This map unit generally has good potential for crops, tame pasture, and rangeland. The Egan and Trent soils have good potential for openland wildlife habitat. The Egan and Ethan soils have fair potential for most building sites and sanitary facilities. The Trent soils have poor potential for building sites and most sanitary facilities because of flooding and wetness.

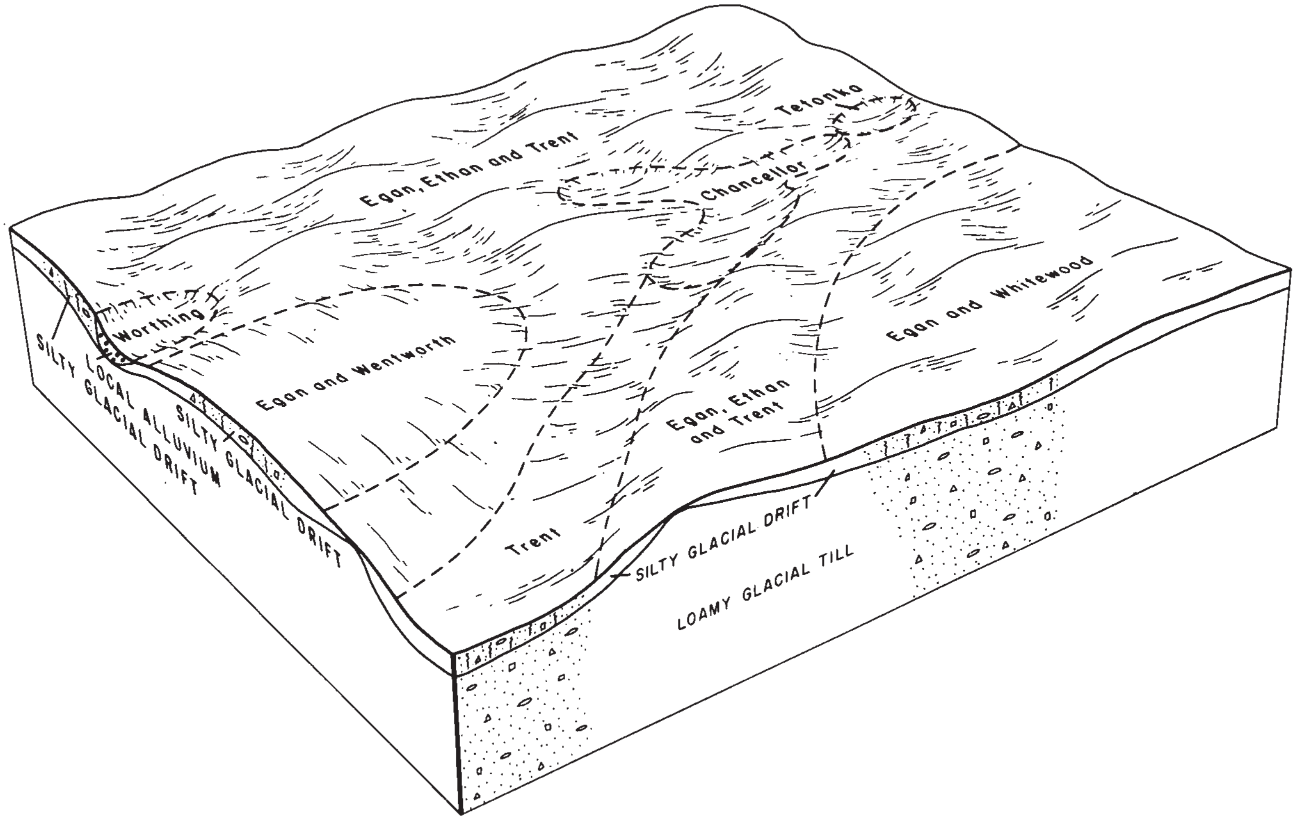


Figure 2.—Pattern of soils in the Egan-Ethan-Trent map unit.

3. Egan-Wentworth

Deep, nearly level and gently sloping, well drained silty soils on uplands

This map unit is on a glacial till plain that has been reworked by wind and water and has a silty mantle overlying loamy glacial till. Slopes are mainly long and smooth. The drainage pattern is well defined, and there are very few enclosed depressions.

This map unit makes up about 9 percent of the county. It is about 45 percent Egan soils, 25 percent Wentworth soils, and 30 percent minor soils.

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

Wentworth soils are well drained and are on the lower parts of the landscape. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is grayish brown, brown, and light olive brown, friable silty clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, calcareous silty clay loam.

Minor in this map unit are Clarno, Ethan, Trent, and Whitewood soils. The well drained Clarno and Ethan soils are intermingled in areas where glacial till is near the surface. The moderately well drained Trent soils and the somewhat poorly drained Whitewood soils are in swales.

Permeability is moderate in the subsoil of the Egan soils and moderately slow in the underlying material. It is moderate in the Wentworth soils. Fertility and available water capacity are high in both soils.

Most of this map unit is used for crops. Corn, oats, soybeans, and alfalfa are the main crops. Conserving moisture, maintaining fertility, and controlling erosion in the more sloping areas are the main concerns of management if the soils are used for crops.

This map unit has good potential for crops, tame pasture and hay, rangeland, openland wildlife habitat, and rangeland wildlife habitat. It has fair potential for most building sites and most sanitary facilities.

4. Ethan-Betts

Deep, moderately steep and steep, well drained and excessively drained loamy soils on uplands

This map unit is on breaks, ridges, and escarpments along the major creeks and drainageways. It is dissected by many well defined drainageways. Narrow bottom land and terraces are along the drainageways. Slopes generally are long and slightly convex. Scattered glacial boulders are on the surface throughout much of the map unit.

This map unit makes up about 7 percent of the county. It is about 40 percent Ethan soils, 25 percent Betts soils, and 35 percent minor soils.

Ethan soils are well drained and are on side slopes and in the less steep areas. Slopes range from 15 to 25 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is grayish brown and pale brown, friable, calcareous loam. The underlying material is pale brown and very pale brown, mottled, calcareous clay loam.

Betts soils are excessively drained and are on the convex ridges and in the steeper areas. Slopes range from 15 to 40 percent. Typically, the surface layer is grayish brown, calcareous loam. Below this is a transitional layer of pale brown, friable, calcareous clay loam. The underlying material is light brownish gray, light gray, and pale yellow clay loam.

Minor in this map unit are Davis, Enet, Roxbury, Talmo, and Thurman soils. The dark colored, well drained Davis soils are on the lower parts of the landscape. The well drained Enet soils are on terraces along the major creeks. They are underlain with sand and gravel. The moderately well drained Roxbury soils are on flood plains along some of the smaller drainageways. Talmo and Thurman soils are on the mid and upper parts of the landscape. Talmo soils have sand and gravel near the surface. Thurman soils are underlain by sand.

Permeability is moderate in the upper part of the major soils and moderately slow in the underlying material. Available water capacity is high. Fertility is low or moderate in the Ethan soils and low in the Betts soils.

Most of this map unit is rangeland. The native vegetation is mainly mid and short grasses, but scattered stands of bur oak are along some drainageways. Some of the less sloping areas are used for hay, and a few are used for feed and forage crops. Maintaining an adequate vegetative cover and ground mulch, maintaining fertility, and controlling erosion are the main concerns of management.

The Ethan soils have good potential and the Betts soils fair potential for rangeland and rangeland wildlife habitat. Good sites for dams, for livestock water, and for fishing are in some of the deeper draws. These soils have poor potential for crops, tame pasture and hay, and openland wildlife habitat. They generally are too steep for buildings and most sanitary facilities.

5. Crofton-Boyd-Ethan

Deep and moderately deep, strongly sloping to steep, well drained silty, clayey, and loamy soils on uplands

This map unit is on breaks, ridges, and escarpments adjacent to Lewis and Clark Lake. It is dissected by many well defined, deeply entrenched drainageways (fig. 3). Slopes are long and slightly convex. Very steep escarpments border some drainageways and some of the shoreline of Lewis and Clark Lake.

This map unit makes up about 3 percent of the county. It is about 15 percent Crofton soils, 10 percent Boyd soils, 10 percent Ethan soils, and 65 percent minor soils.

Crofton soils are well drained and are on the convex upper slopes. Slopes range from 9 to 40 percent. Typically, the surface layer is grayish brown and brown, calcareous silt loam. Below this is a transitional layer of brown, friable, calcareous silt loam. The underlying material is light yellowish brown, calcareous silt loam.

Boyd soils are well drained and are on the lower side slopes. Slopes range from 15 to 40 percent. Typically, the surface layer is dark grayish brown silty clay. The subsoil is dark grayish brown and grayish brown, firm and very firm, calcareous silty clay. The upper part of the underlying material is light olive gray, calcareous clay that contains shale chips, and the lower part is light olive gray, calcareous shale.

Ethan soils are well drained and are on convex ridges and knobs. Slopes range from 9 to 25 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is grayish brown and pale brown, friable, calcareous loam. The underlying material is pale brown and very pale brown, mottled, calcareous clay loam.

Minor in this map unit are Betts, Davis, Gavins, Nora, Redstoe Variant, Roxbury, and Talmo soils. The excessively drained Betts soils are on the convex upper slopes. The dark colored, well drained Davis soils are on the lower foot slopes. The excessively drained Gavins soils are in areas, generally near the lake, where soft chalk rock is near the surface. The well drained Nora and Redstoe Variant soils are on side slopes below Crofton soils. The moderately well drained Roxbury soils are on terraces along some of the drainageways. Talmo soils have sand and gravel near the surface. Their position on the landscape is similar to that of Ethan soils.

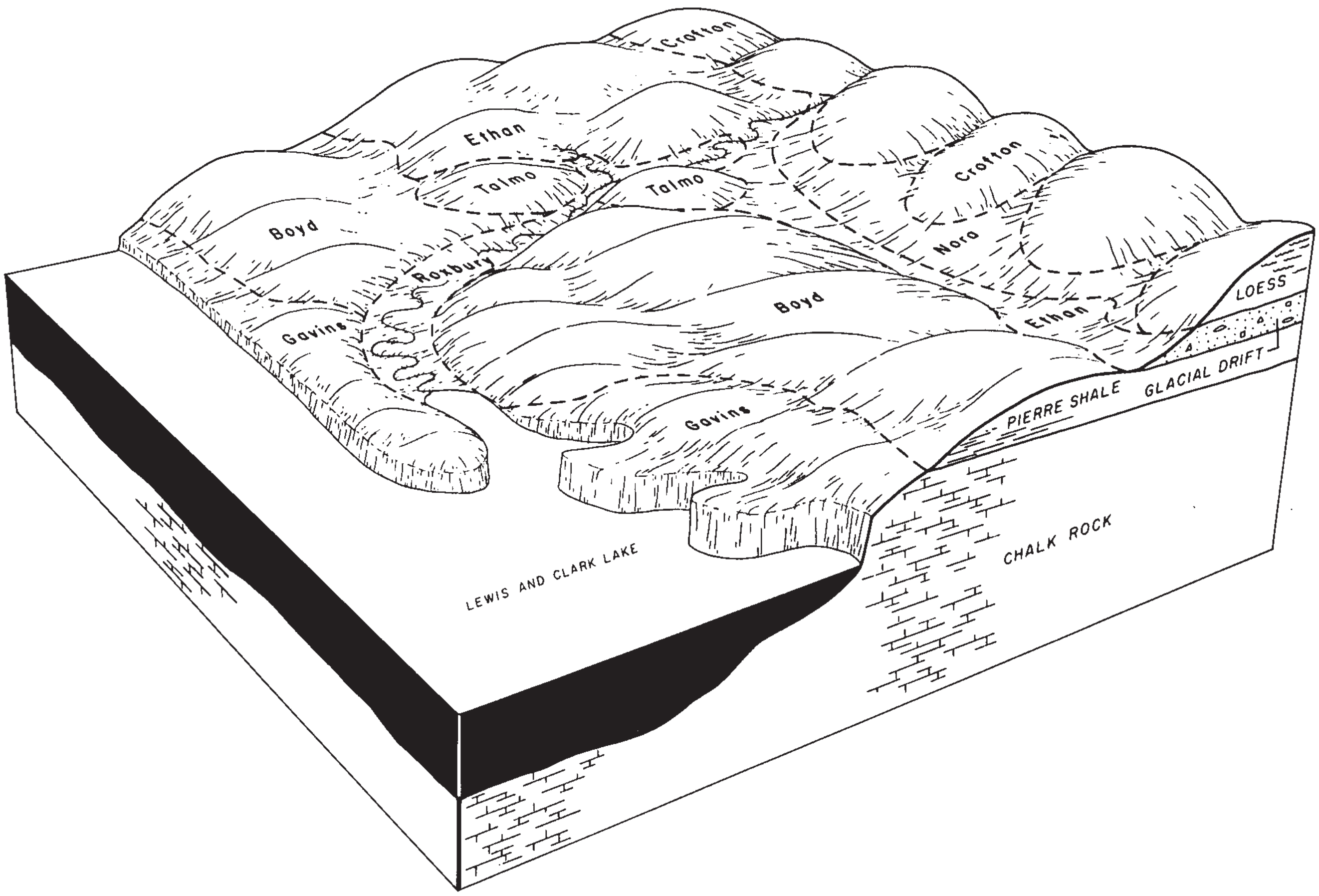


Figure 3.—Pattern of soils in the Crofton-Boyd-Ethan map unit.

Permeability is moderate in the Crofton soils and slow or very slow in the Boyd soils. It is moderate in the subsoil of the Ethan soils and moderately slow in the underlying material. Available water capacity is high in the Crofton and Ethan soils and moderate in the Boyd soils. Fertility is medium in all three soils.

Most of this map unit is rangeland. The native vegetation is mainly mid grasses on the higher slopes and trees on the lower slopes along the entrenched drainageways. Maintaining an adequate vegetative cover and ground mulch, increasing the water intake rate, and controlling erosion are the main concerns of management.

The Boyd and Ethan soils have good potential and the Crofton soils fair potential for rangeland and rangeland wildlife habitat. All three soils have poor potential for crops, tame pasture and hay, and openland wildlife habitat. They have poor potential for building sites and sanitary facilities. Davis and other minor soils can provide sites for buildings and sanitary facilities.

6. Ethan-Clamo-Davis

Deep, nearly level to moderately steep, well drained and poorly drained loamy and silty soils on uplands and flood plains

This map unit is on the flood plain and adjacent breaks along the James River. It occurs as a long and narrow area along the meandering James River, which dissects the bottom land (fig. 1). Deeply entrenched drainageways cut into the adjacent breaks. Flooding occurs on the Clamo soils during snowmelt and after having rains.

This map unit makes up about 13 percent of the county. It is about 35 percent Ethan soils, 15 percent Clamo soils, 10 percent Davis soils, and 40 percent minor soils.

Ethan soils are well drained and are on side slopes and the convex upper slopes. Slopes range from 2 to 25 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is grayish brown and pale brown, friable, calcareous loam. The underlying material is pale brown and very pale brown, mottled, calcareous clay loam.

Clamo soils are poorly drained and are on flood plains. Slopes are 0 to 2 percent. Typically, the surface layer is dark gray silty clay loam. The subsoil is dark gray, firm silty clay loam. It is calcareous in the lower part. The underlying material is gray and dark gray, calcareous silty clay loam.

Davis soils are well drained and are on foot slopes. Slopes range from 2 to 9 percent. Typically, the surface layer is very dark gray silt loam. The subsoil is, in sequence downward, dark gray, friable silt loam; dark grayish brown, friable loam; and light grayish brown, friable, calcareous clay loam. The underlying material is light brownish gray and pale brown, calcareous clay loam.

Minor in this map unit are Betts, James, Lamo, Talmo, and Thurman soils. The excessively drained Betts soils are on some of the crests and ridgetops. The poorly drained James soils and the somewhat poorly drained Lamo soils occur as areas intermingled with areas of the Clamo soils on bottom land. The James soils have salts throughout, and the Lamo soils are silty. Talmo and Thurman soils are on the mid and upper parts of the breaks. Talmo soils have gravel near the surface, and Thurman soils are underlain with sand.

Permeability is moderate in the subsoil of the Ethan soils and moderately slow in the underlying material. It is slow in the Clamo soils and moderate in the Davis soils. Available water capacity is high in all three soils. Fertility is low or medium in the Ethan soils and is high in the Clamo and Davis soils.

Most areas of the Ethan and Davis soils are used for rangeland. The native vegetation is mainly mid and short grasses. Some of the less sloping areas are used for hay, and a few are used for feed and forage crops. Controlling erosion and maintaining fertility are the main concerns of management. Most areas of the Clamo soils are farmed. Removing excess water, maintaining fertility, and improving tilth are the main concerns of management on these soils.

The Ethan soils have poor potential for crops, tame pasture and hay, and openland wildlife habitat. They have good potential for rangeland and rangeland wildlife habitat. If drained, the Clamo soils have good potential for crops, tame pasture and hay, rangeland, and openland wildlife habitat. They have fair potential for rangeland wildlife habitat. The Davis soils have good potential for crops, tame pasture and hay, rangeland, and openland and rangeland wildlife habitat. The Ethan and Clamo soils have poor potential and the Davis soils fair potential for most building sites and sanitary facilities.

7. Baltic-Roxbury-Lakeport

Deep, nearly level, very poorly drained to moderately well drained loamy, silty, and clayey soils on flood plains

This map unit is on bottom land (fig. 4). It is a broad flat that has very little relief and is dissected by drainage ditches that intercept runoff when flooding occurs. The soils are subject to flooding during snowmelt and after heavy rains.

This map unit makes up about 5 percent of the county. It is about 30 percent Baltic soils, 25 percent Roxbury soils, 15 percent Lakeport soils, and 30 percent minor soils.

Baltic soils are poorly drained and very poorly drained and are on the lower parts of the landscape. Slopes are less than 1 percent. Typically, the surface layer is dark gray and gray, calcareous silty clay. The subsoil is dark gray, firm, calcareous silty clay. The underlying material is gray and light gray, calcareous silty clay.

Roxbury soils are moderately well drained and are on alluvial fans. Slopes are 0 to 2 percent. Typically, the surface layer is dark grayish brown, calcareous silt loam. The subsoil is grayish brown, very friable silty clay loam. The underlying material is grayish brown, very pale brown, and dark gray silty clay loam.

Lakeport soils are somewhat poorly drained and are on the higher parts of the flood plain. Slopes are 0 to 2 percent. Typically, the surface layer is dark gray silty clay loam. The subsoil is grayish brown and light brownish gray, friable silty clay loam. It is calcareous in the lower part. The underlying material is light gray, calcareous silt loam.

Minor in this map unit are Blyburg, Bon, and Luton soils. The well drained Blyburg soils are near the Lakeport soils. The moderately well drained Bon soils occur as areas intermingled with areas of the Roxbury soils. They are loamy. The poorly drained Luton soils are adjacent to the Baltic soils. They do not have lime in the surface layer or the subsoil.

Permeability is slow in the Baltic soils, moderate in the Roxbury soils, and moderately slow in the Lakeport soils. Available water capacity is moderate in the Baltic soils and high in the Roxbury and Lakeport soils. Fertility is high in all three soils.

Most of this map unit is used for crops. Corn, soybeans, and alfalfa are the main crops. Spring flooding and ponding are common on the Baltic soils and in other low lying areas. Improving tilth, maintaining fertility, and removing excess water are the main concerns of management if crops are grown.

The Baltic soils generally have fair potential for crops, rangeland, and rangeland and openland wildlife habitat. They have good potential for wetland wildlife habitat and tame pasture and hay. The Roxbury and Lakeport soils have good potential for crops, tame pasture and hay, rangeland, and rangeland and openland wildlife habitat.

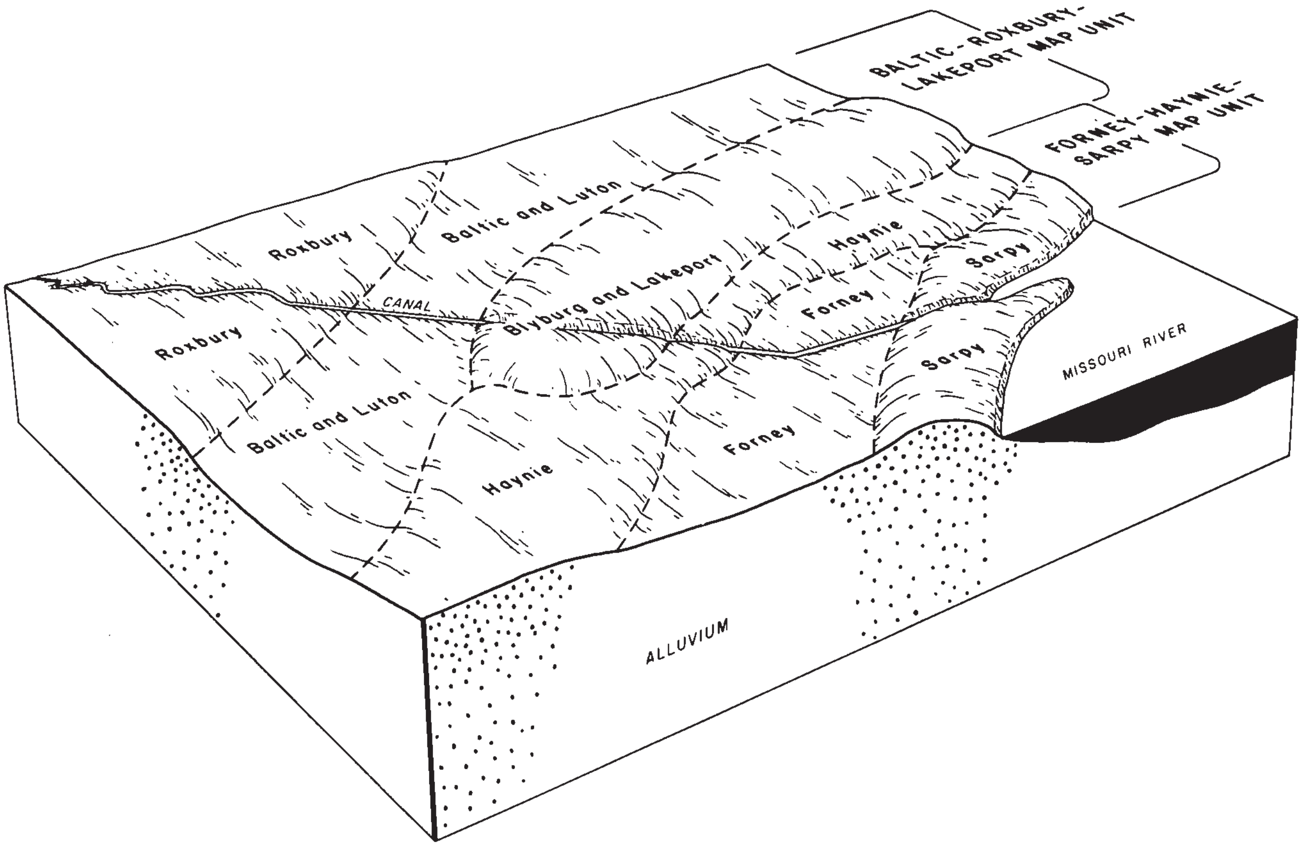


Figure 4.—Pattern of soils in the Baltic-Roxbury-Lakeport and Forney-Haynie-Sarpy map units.

All three soils generally have poor potential for building sites and sanitary facilities.

8. Forney-Haynie-Sarpy

Deep, nearly level and gently undulating, poorly drained to excessively drained silty and sandy soils on flood plains

This map unit is on bottom land along the Missouri River (fig. 4). It is nearly level in most areas, but gently undulating areas are adjacent to the river channel. These soils are protected from the potential floodwater in the Missouri River by Gavins Point Dam, but they are subject to the flooding that occurs as local runoff. Also, areas adjacent to the river can be flooded during periods when the discharge rate from the dam is high.

This map unit makes up about 8 percent of the county. It is about 30 percent Forney soils, 30 percent Haynie soils, 10 percent Sarpy soils, and 30 percent minor soils.

Forney soils are poorly drained and are on the lower parts of the landscape. Slopes are 0 to 2 percent. Typically, the surface layer is grayish brown silty clay loam. The underlying material is dark gray, light olive gray, and light gray silty clay loam and silty clay.

Haynie soils typically are moderately well drained and are on the higher parts of the landscape. Slopes are 0 to 4 percent. Typically, the surface layer is grayish brown and pale brown, calcareous silt loam. To a depth of 53 inches, the underlying material is pale brown and very pale brown, calcareous silt loam. Below 53 inches, it is light brownish gray, mottled silty clay.

Sarpy soils are excessively drained and are in the hummocky areas near the river. Slopes are 0 to 4 percent. Typically, the surface layer is grayish brown, calcareous loamy fine sand. The underlying material is light brownish gray fine sand.

Minor in this map unit are Blake, Grable, Onawa, and Owego soils. The somewhat poorly drained Blake, Onawa, and Owego soils occur as areas intermingled with areas of the Forney soils. The well drained Grable soils occur as areas intermingled with areas of the Haynie and Sarpy soils.

Permeability is very slow in the Forney soils, moderate in the upper part of the Haynie soils and slow in the lower part, and rapid in the Sarpy soils. Available water capacity is moderate in the Forney soils, high in the Haynie soils, and low in the Sarpy soils. Fertility is medium in the Forney soils and low in the Haynie and Sarpy soils.

Most of this map unit is used for crops. Many areas of the Haynie and Sarpy soils are used for truck gardening. The chief crops are corn, soybeans, and alfalfa. Wetness is a problem on the Forney soils and in low lying areas. Improving tilth, increasing the water intake rate, maintaining fertility, and controlling soil blowing are the main concerns of management if the major soils are farmed.

These soils have good potential for rangeland and for tame pasture and hay. Forney and Sarpy soils have fair potential and Haynie soils good potential for cultivated crops. Forney and Haynie soils have good potential and Sarpy soils poor potential for openland wildlife habitat. All three soils have fair potential for rangeland wildlife habitat. Forney and Sarpy soils have poor potential and Haynie soils only fair potential for most building sites and sanitary facilities because of flooding.

Soil maps for detailed planning

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

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

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils having profiles that are almost alike make up a *soil series.* Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Gayville series, for example, was named for the town of Gayville in Yankton County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Baltic clay loam is one of several phases within the Baltic series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Clarno-Bonilla loams, 1 to 6 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Crofton-Boyd association, 15 to 40 percent slopes, is an example.

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

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

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

The names of some map units on the detailed soil maps do not fully agree with those in the published surveys of adjacent Clay and Hutchinson Counties. Differences are the result of changes in concepts of the soil series or the map units.

Ba—Baltic clay loam. This deep, poorly drained, nearly level soil is in backwater areas on bottom land along the Missouri River. It is frequently flooded during periods of heavy rain or rapid snowmelt. Areas of this soil range from 10 to 160 acres in size and are irregular in shape.

Typically, the surface layer is black, calcareous clay loam about 16 inches thick. The subsoil is about 24 inches of dark gray, firm, calcareous silty clay. The underlying material to a depth of 60 inches is dark gray, calcareous silty clay. In places, the surface layer is loam, silt loam, or silty clay loam. In some areas, the underlying material is stratified.

Included with this soil in mapping are small areas of Luton and Roxbury soils. These soils make up less than 15 percent of any one mapped area. Luton soils have no lime in the surface layer and subsoil. Roxbury soils contain less clay throughout than the Baltic soil. Both included soils are on the slightly higher parts of the landscape.

Permeability is slow in the Baltic soil. Available water capacity is moderate. The shrink-swell potential is high. Organic-matter content and fertility also are high. Runoff is slow. The water table is within 5 feet of the surface most of the year.

Almost all areas are farmed. This soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, tame pasture and hay, and openland wildlife habitat. It has poor potential for building sites and most sanitary facilities.

This soil is suited to cultivated crops. Returning crop residue to the soil improves water infiltration and tilth and maintains fertility. Planting and harvesting may be delayed during wet periods. Timely fieldwork is necessary to avoid puddling of the soil during wet periods.

This soil is well suited to tame grasses for pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil generally is unsuited to building site development and most onsite waste disposal systems because of the susceptibility to flooding. It is poorly suited to local roads. The high shrink-swell potential in the underlying material, wetness, and low strength are the major problems. Strengthening the base material and grading the roads help overcome the low strength and the wetness and flooding. Sewage lagoons function well on this soil; their embankments provide protection from flooding. Capability unit IIw-3; Overflow range site.

Bb—Baltic silty clay. This deep, poorly drained, nearly level soil is in backwater areas on bottom land along the Missouri River. It is frequently flooded during periods of heavy rain or rapid snowmelt. Areas of this soil range from 10 to several hundred acres in size and are irregular in shape.

Typically, the surface layer is calcareous silty clay about 24 inches thick. It is dark gray in the upper part and gray in the lower part. The subsoil is about 12 inches of dark gray, firm, calcareous silty clay. The underlying material to a depth of 60 inches is calcareous silty clay. It is gray in the upper part and light gray in the lower part. In places, the surface layer is less than 24 inches thick and the surface layer and subsoil contain less clay. Some areas have about 12 inches of overwash.

Included with this soil in mapping are small areas of Luton and Roxbury soils. These soils make up less than 15 percent of any one mapped area. Luton soils are leached of lime in the surface layer and subsoil. Roxbury soils contain less clay throughout than the Baltic soil and are moderately well drained. Both included soils are on the slightly higher parts of the landscape.

Permeability is slow in the Baltic soil, and available water capacity is moderate. The shrink-swell potential is high. Organic-matter content and fertility also are high. Runoff is slow. The water table is within 5 feet of the surface most of the year.

Almost all areas are farmed. This soil has fair potential for cultivated crops, rangeland, openland wildlife habitat, and wetland wildlife habitat. It has good potential for tame pasture and hay. It has poor potential for windbreaks and environmental plantings, building sites, and most sanitary facilities.

This soil is suited to cultivated crops. Returning crop residue to the soil improves water infiltration and tilth and maintains fertility. Planting and harvesting may be delayed during wet periods. Removing excess surface water reduces wetness. Timely fieldwork is necessary to avoid puddling of the soil during wet periods.

This soil generally is too wet for windbreaks and environmental plantings. It is well suited to tame grasses for pasture and hay. If pasture is grazed during wet periods, the soil puddles and the grasses deteriorate.

This soil generally is not suitable for building site development or for most onsite waste disposal systems because of the susceptibility to flooding. It is poorly suited to local roads. The high shrink-swell potential, wetness, and low strength are the major problems. Strengthening or replacing the base material and grading the roads help overcome the low strength and the wetness and flooding. Sewage lagoons function well on this soil; their embankments provide protection from flooding. Capability unit IIIw-1; Wetland range site.

Bc—Baltic silty clay, depressional. This nearly level, very poorly drained soil is in backwater areas on bottom land along the Missouri River. It is frequently flooded during periods of heavy rain or rapid snowmelt. It occurs as an area that is approximately 900 acres in size and is long and broad.

Typically, the surface layer is calcareous silty clay about 24 inches thick. It is dark gray in the upper part and gray in the lower part. The subsoil is about 12 inches of dark gray, firm, calcareous silty clay. The underlying material to a depth of 60 inches is calcareous silty clay. It is gray in the upper part and light gray in the lower part.

Included with this soil in mapping are small areas of Luton soils. These soils make up less than 15 percent of any one mapped area. They are leached of lime in the surface layer and subsoil. They are on the slightly higher parts of the landscape.

Permeability is slow, and available water capacity is moderate. The shrink-swell potential is high. This soil is ponded during wet periods. During dry periods, the water table may be as deep as 5 feet.

All areas are used for rangeland or for wildlife habitat. Marsh plants and willows grow in most areas. This soil has poor potential for cultivated crops and windbreaks and environmental plantings. It has fair potential for rangeland, rangeland wildlife habitat, and tame pasture and hay. It has good potential for wetland wildlife habitat and poor potential for building sites and most sanitary facilities.

This soil is well suited to wetland wildlife habitat. Management practices that provide food and cover for wetland wildlife are needed to enhance the habitat.

This soil is poorly suited to cultivated crops, windbreaks and environmental plantings, and pasture because water ponds for long periods during the spring and summer.

This soil is poorly suited to building sites because of the frequency of flooding and the slow runoff. Sewage lagoons function well on this soil unless they receive runoff. Because of the frequency of flooding and the high water table, this soil is undesirable as a site for other kinds of sanitary facilities. Capability unit Vw-2; Wetland range site.

BdE—Betts-Gavins complex, 15 to 40 percent slopes. These deep and shallow, excessively drained, moderately steep and steep soils are on breaks adjacent to rivers and creeks. Scattered stones and boulders are common in some areas. Individual areas of this unit range from 10 to 80 acres in size. They are about 45 to 55 percent Betts soil and 25 to 35 percent Gavins soil. The Betts soil is on the higher parts of the landscape where a thin layer of glacial till overlies Niobrara chalk rock. The Gavins soil formed in material weathered from Niobrara chalk rock. It generally is below the Betts soil on the landscape. The two soils occur as areas so closely intermingled so small that it is not practical to separate them in mapping.

Typically, the Betts soil has a surface layer of grayish brown, calcareous loam about 3 inches thick. Next is a transitional layer of pale brown, friable, calcareous clay loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam over light gray and pale yellow, calcareous clay loam. In places, the surface layer is thicker and darker.

Typically, the Gavins soil has a surface layer of grayish brown, calcareous silt loam about 4 inches thick. Next is a transitional layer, about 7 inches thick, of light gray and grayish brown, very friable, calcareous silt loam that has many fragments of chalk rock. The underlying material, to a depth of 16 inches, is white silt loam that has many fragments of chalk rock. Below this is white, soft chalk rock. In places, the depth to soft chalk rock is about 24 inches.

Included with these soils in mapping are small areas of Davis and Redstoe Variant soils. These included soils make up less than 20 percent of any one mapped area. Davis soils have a thicker, darker surface layer than the Betts and Gavins soils and are well drained. They are on foot slopes. The Redstoe Variant is deeper to bedrock than the Gavins soil. It is on the lower side slopes. Also included are small areas where chalk rock crops out and a 50-acre area near the powerhouse of Gavins Point Dam where slopes are less than 15 percent.

Permeability is moderate in the upper part of the Betts soil and moderately slow in the underlying material. In the Gavins soil, it is moderate above the bedrock. Available water capacity is high in the Betts soil and low in the Gavins soil. Organic-matter content and fertility are low in both soils. Runoff is rapid.

Most areas support native grass (fig. 5) and are used for grazing. Stands of native trees growing on the side slopes and in the draws provide habitat for woodland wildlife, such as deer and squirrels. Chalk rock is quarried in some areas. These soils have fair potential for rangeland and rangeland wildlife habitat. They have poor potential for cultivated crops, windbreaks and environmental plantings, tame pasture and hay, building sites, and sanitary facilities.

These soils are best suited to rangeland. The major problems of range management are erosion and low fertility. Also, the soils tend to be droughty because of the rapid runoff. If rangeland is overgrazed, bluestems and other tall species are replaced by needleandthread and sideoats grama. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing keep the range and the soil in good condition.

These soils are poorly suited to crops, windbreaks and environmental plantings, and tame pasture and hay because of the steep slopes and low fertility and the shallowness of the Gavins soil.

These soils generally are not suitable as building sites because of the moderately steep and steep slopes. If roads are constructed in areas of these soils, the road cuts should be seeded to prevent excessive roadside erosion. Capability unit VIIe-1; Thin Upland range site.

Figure 5.—Little bluestem and yucca on Betts-Gavins complex, 15 to 40 percent slopes.

Be—Blake silty clay loam. This deep, somewhat poorly drained, nearly level soil is on bottom land near the present channel of the Missouri River. Rare flooding is a hazard, but it occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 10 to 300 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown silty clay loam about 8 inches thick. The subsurface layer is about 9 inches of grayish brown, mottled, calcareous silty clay loam. The underlying material to a depth of 60 inches is pale yellow and light brownish gray, mottled, calcareous silt loam and silty clay loam over light yellowish brown, calcareous loamy very fine sand. In places, the material below 40 inches is dark colored silty clay loam. In some areas, the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Grable, Haynie, and Owego soils. These soils make up less than 15 percent of any one mapped area. Grable soils have sand below a depth of 24 inches. Haynie soils contain less clay and Owego soils more clay than the Blake soil. Included soils occur in a random pattern throughout the map unit.

Permeability is moderate in the Blake soil, and available water capacity is high. The shrink-swell potential is moderate in the surface and subsurface layers and low in the underlying material. Organic-matter content is moderate, and fertility is medium. Runoff is slow. This soil has a seasonal high water table at a depth of 2 to 4 feet in most years.

Almost all areas of this soil are farmed. The soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, tame pasture and hay, and openland wildlife habitat. It has poor potential for building sites and most sanitary facilities.

This soil is well suited to cultivated crops. The major concerns of management are maintaining tilth and the organic-matter content. Returning crop residue to the soil improves fertility, maintains tilth, and increases the water intake rate.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees grow well on this soil. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame grasses for pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pastures in good condition.

If buildings are constructed on this soil, the site should be built up and runoff should be diverted. Ground water can seep into basements during wet periods. If roads are constructed across areas of this soil, the base material should be strengthened and the roads should be graded to shed water. The effluent from sanitary facilities can pollute the ground water. Capability unit I-1; Silty range site.

Bf—Blencoe silty clay. This deep, nearly level, somewhat poorly drained soil is on the higher parts of the bottom land along the Missouri River. Flooding is a hazard, but it occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 10 to 40 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray silty clay about 14 inches thick. The subsoil is about 13 inches thick. It is dark gray, firm silty clay in the upper part and light brownish gray, friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, calcareous very fine sandy loam. In places, the dark colors extend below a depth of 24 inches.

Included with this soil in mapping are small areas of Blyburg, Gayville, Lakeport, and Salix soils. These soils make up less than 15 percent of any one mapped area. Blyburg soils contain less clay throughout than the Blencoe soil. Gayville soils have a claypan subsoil. Lakeport and Salix soils are not coarse textured in the underlying material. Included soils occur in a random pattern throughout the map unit.

Permeability is very slow in the upper part of the Blencoe soil and moderate in the underlying material. Available water capacity is high. Organic-matter content is moderate, and fertility is medium. The shrink-swell potential is high in the surface layer and subsoil. This soil has a seasonal high water table at a depth of 1 to 3 feet in most years.

Almost all areas are farmed. This soil has good potential for cultivated crops, rangeland, tame pasture and hay, openland wildlife habitat, and windbreaks and environmental plantings. It has poor potential for building sites and sanitary facilities.

This soil is well suited to cultivated crops. Returning crop residue to the soil improves tilth, maintains fertility, and increases the infiltration rate. Fieldwork may be delayed during wet periods because of the flooding and the high water table.

This soil is well suited to windbreaks and environmental plantings. Trees that need a large amount of moisture, such as cottonwood and willows, grow well on this soil. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame grasses for pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pasture in good condition.

Buildings constructed on this soil should be protected from local flooding. The foundations and footings should be reinforced to prevent the structural damage caused by the shrinking and swelling of the soil. Ground water can seep into basements during wet periods. If roads are constructed across areas of this soil, the base material should be strengthened. Also, the roads should be graded to shed water.

Sewage lagoons function well if the clayey upper part of the soil is 2 feet or more thick. If this part is less than 2 feet thick, however, the effluent can pollute the ground water. The effluent from all other sanitary facilities can pollute the ground water because of the moderately permeable underlying material. Capability unit IIw-1; Overflow range site.

Bg—Blencoe-Gayville complex. These deep, somewhat poorly drained, nearly level soils are on the higher parts of the bottom land along the Missouri River. Areas range from 5 to 40 acres in size and are irregular in shape. They are about 45 to 55 percent Blencoe soil and 25 to 35 percent Gayville soil. The Blencoe soil is on the higher parts of the landscape, and the Gayville soil is in small, slightly depressed areas (fig. 6). The Blencoe soil is subject to rare flooding and the Gayville soil to common flooding. The flooding occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. The two soils occur as areas so closely intermingled that it is not practical to separate them in mapping.

Typically, the Blencoe soil has a surface layer of very dark gray silty clay about 14 inches thick. The subsoil is about 13 inches thick. It is dark gray, firm silty clay in the upper part and light brownish gray, friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, calcareous very fine sandy loam.

Typically, the Gayville soil has a surface layer of dark grayish brown, calcareous silty clay loam about 6 inches thick. The subsoil is firm, calcareous silty clay loam about 16 inches thick. It is dark gray in the upper part and dark grayish brown in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous, silt loam over pale brown very fine sandy loam.

Included with these soils in mapping are small areas of

Figure 6.—An area of Blencoe-Gayville complex. The light spots are Gayville soil.

Lakeport and Salix soils. These soils make up less than 15 percent of any one mapped area. They contain more clay in the underlying material than the Blencoe and Gayville soils. They occur in a random pattern throughout this map unit.

Permeability is very slow in the subsoil of the Blencoe and Gayville soils and moderate in the underlying material. Available water capacity is high in the Blencoe soil and moderate in the Gayville soil. Organic-matter content is moderate and natural fertility medium in both soils. The shrink-swell potential is high in the surface layer and subsoil. Runoff is slow. These soils have a seasonal high water table at a depth of 1 to 3 feet in most years.

Almost all areas of these soils are farmed. The Blencoe soil has good potential for cultivated crops, rangeland, tame pasture and hay, openland wildlife habitat, and windbreaks and environmental plantings. The Gayville soil has poor potential for cultivated crops, tame pasture and hay, openland wildlife habitat, and windbreaks and environmental plantings. Both soils have poor potential for building sites and sanitary facilities.

This map unit is poorly suited to cultivated crops and tame pasture and hay because the Gayville soil is so closely intermingled with the Blencoe soil throughout the mapped areas that farming the two soils separately is not practical. Returning crop residue to the soil improves tilth, maintains fertility, and increases the infiltration rate. Fieldwork may be delayed during wet periods because of the flooding and the high water table.

The Blencoe soil is well suited to windbreaks and environmental plantings, but trees grow poorly on the Gayville soil because of the dense claypan subsoil and the large amount of salts. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Buildings constructed on these soils should be protected from local flooding. The foundations and footings should be reinforced to prevent the structural damage caused by the shrinking and swelling of the soil. Ground water can seep into basements during wet periods. If roads are constructed across areas of these soils, the base material should be strengthened. Also, the roads should be graded to shed water.

Sewage lagoons function well where the clayey upper part of the soil is 2 feet or more thick. If this part is less than 2 feet thick, however, the effluent can pollute the ground water. The effluent from all other sanitary facilities can pollute the ground water because of the moderately permeable underlying material. Blencoe soil in capability unit IIw-1, Overflow range site; Gayville soil in capability unit VIw-3, Saline Lowland range site.

BhB—Blendon-Thurman complex, 0 to 6 percent slopes. These deep, well drained and somewhat excessively drained, nearly level and gently sloping soils are on uplands. Areas of these soils range from 15 to 100 acres in size and are irregular in shape. They are about 40 to 50 percent Blendon soil and about 25 to 35 percent Thurman soil. The Thurman soil is on the higher parts of the landscape, and the Blendon soil is on the lower parts. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Blendon soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is about 25 inches thick. It is dark grayish brown, very friable loam in the upper part and dark grayish brown and brown, very friable fine sandy loam in the lower part. The underlying material to a depth of 60 inches is yellowish brown and light yellowish brown loamy fine sand. In places, the dark colors extend to a depth of less than 20 inches.

Typically, the Thurman soil has a surface layer of dark grayish brown fine sandy loam about 10 inches thick. Next is a transition layer about 20 inches thick. The upper part is dark grayish brown, very friable sandy loam; the lower part is brown, loose loamy sand. The underlying material to a depth of 60 inches is very pale brown, calcareous loamy sand.

Included with these soils in mapping are small areas of Bonilla and Clarno soils. These included soils make up less than 25 percent of any one mapped area. Bonilla and Clarno soils contain more silt and clay than the Blendon and Thurman soils and formed in glacial till. Bonilla soils are on toe slopes and in slight swales. Clarno soils are on the higher parts of the landscape.

Permeability is moderately rapid in the Blendon soil and rapid in the Thurman soil. Available water capacity is moderate in both soils. The Blendon soil is high in fertility and in organic-matter content. The Thurman soil is moderate in fertility and medium in organic-matter content. Runoff is slow on both soils.

Most areas are cultivated or are used for tame pasture and hay. These soils have fair potential for cultivated crops and openland wildlife habitat. They have good potential for rangeland, rangeland wildlife habitat, tame pasture and hay, and windbreaks and environmental plantings. They have good potential for most building sites and poor potential for most sanitary facilities.

These soils are suited to cultivated crops, but they are subject to soil blowing. Returning crop residue to the soil improves fertility, increases organic-matter content, and controls soil blowing. Stripcropping also can control soil blowing.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to rangeland. The native vegetation is of a mixture of mid and tall grasses. Controlling soil blowing is the main concern of management. Management that maintains an adequate vegetative cover and ground mulch helps prevent excessive soil loss. If rangeland is overgrazed, bluestems are replaced by prairie sandreed and sideoats grama. If overgrazing continues, Kentucky bluegrass and blue grama dominate. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

These soils are well suited to windbreaks and environmental plantings. They are subject to soil blowing unless a protective plant cover is maintained until the planting is established. Evergreen trees are well suited.

These soils are well suited to most kinds of building site development, but the sides of shallow excavations can cave in. Roads constructed across areas of these soils should be graded to shed water and thus reduce the potential frost action in the Blendon soil. Cuts should be seeded to control soil blowing. Septic tank absorption fields function well in these soils, but the effluent from all sanitary facilities can pollute shallow ground water because of seepage through the underlying sand. Capability unit IIIe-7; Sandy range site.

Bk—Blyburg silt loam. This deep, well drained, nearly level soil is on the higher parts of the bottom land along the Missouri River. Rare flooding is a hazard, but it occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 5 to 500 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is about 11 inches of very friable silt loam. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is grayish brown, light brownish gray, and light gray, calcareous silt loam and very fine sandy loam. In places, the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Blencoe, Gayville, Lakeport, and Salix soils. These soils make up less than 15 percent of any one mapped area. Blencoe soils contain more clay in the upper part and Lakeport and Salix soils more clay throughout than the Blyburg soil. Gayville soils have a claypan subsoil. Included soils occur in a random pattern throughout the map unit.

Permeability is moderate in the Blyburg soil, and available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow.

Almost all areas of this soil are farmed. The soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and openland wildlife habitat. It has poor potential for most building sites and fair potential for most sanitary facilities.

This soil is well suited to cultivated crops. Returning crop residue to the soil helps maintain fertility, improve tilth, and increase the infiltration rate. The soil is well suited to truck gardening and to growing nursery stock. Irrigation is essential to meet the peak water demands of garden crops.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

Buildings constructed on this soil should be protected from local flooding. Roads constructed across areas of this soil should be graded to shed water and thus prevent the damage caused by frost action. Enlarging septic tank absorption fields helps to overcome the slow absorption rate. Sealing the bottom and sides of sewage lagoons helps prevent seepage. Capability unit I-1; Silty range site.

Bm—Bon loam. This deep, moderately well drained, nearly level soil is on bottom land. It is commonly flooded for brief periods during the summer. Areas of this soil range from 15 to 150 acres in size and generally are long and narrow.

Typically, the surface layer is very dark grayish brown loam about 19 inches thick. The subsurface layer is about 17 inches of very dark grayish brown, very friable, calcareous loam. The underlying material to a depth of 60 inches is very dark grayish brown and grayish brown, stratified, calcareous loam and loamy sand. In some places, the surface layer and subsurface layer are silt loam. In other places, the depth to lime is more than 20 inches. In some areas, strata of sand and gravel are in the underlying material.

Included with this soil in mapping are small areas of Lamo soils, which make up less than 10 percent of any one mapped area. These soils are more poorly drained than the Bon soil and contain less sand throughout the profile. They are in slightly lower lying areas.

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

Most areas are farmed. This soil has good potential for cultivated crops, rangeland, tame pasture and hay, windbreaks and environmental plantings, and openland wildlife habitat. It has poor potential for building sites and sanitary facilities.

This soil is well suited to cultivated crops. Common flooding is a hazard. Because the flooding is brief, however, fieldwork is disrupted for only a short time. Returning crop residue to the soil helps maintain fertility, improve tilth, and increase the infiltration rate.

The soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pasture in good condition.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is flooded too frequently to be used as a building site. If roads are constructed across areas of this soil, considerable grading and filling are needed to prevent flood damage. This soil is not suited to any kind of waste disposal system because of flooding. It is an excellent source of fill material for sanitary landfills and for topsoil. Capability unit I-1; Overflow range site.

BnA—Bonilla-Crossplain complex, 0 to 2 percent slopes. These deep, moderately well drained and somewhat poorly drained, nearly level soils are in swales and on flats in shallow drainageways. They are commonly flooded for brief periods after heavy rain or snowmelt. Areas are long and narrow and range from 15 to 100 acres in size. They are about 45 to 55 percent Bonilla soil and 30 to 40 percent Crossplain soil. The Bonilla soil is on the higher side slopes of the swales. The Crossplain soil is on the lower, more entrenched part of the swales. The two soils occur as areas so closely intermingled that it is not practical to separate them in mapping.

Typically, the Bonilla soil has a surface layer of dark grayish brown loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown, friable loam; the middle part is grayish brown and brown, firm clay loam; the lower part is pale olive, firm, calcareous clay loam that has small spots of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous loam or clay loam that has accumulations of lime. In places, salts are at or near the surface. In some areas, the depth to lime is greater.

Typically, the Crossplain soil has a surface layer of dark gray clay loam about 14 inches thick. The subsoil is about 28 inches thick. It is gray, firm clay in the upper part and light brownish gray clay loam in the lower part. The underlying material to a depth of 60 inches is pale olive, calcareous clay loam that has accumulations of lime.

Included with these soils in mapping are small areas of Clarno soils, which make up less than 15 percent of any one mapped area. Clarno soils have a thinner subsoil than the Bonilla and Crossplain soils and are in slightly higher positions. Also included are some areas, generally high lying areas next to the more entrenched swales, where lime is nearer the surface.

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. Fertility and the content of organic matter also are high. The shrink-swell potential is moderate in the Bonilla soil and high in the Crossplain soil. Runoff is slow on the Bonilla soil and very slow on the Crossplain soil. The Bonilla soil has a water table at a depth of 3 to 6 feet, and the Crossplain soil has one at a depth of 1 to 4 feet.

Most areas of these soils are farmed. The soils have good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and openland wildlife habitat. They have poor potential for building sites and most sanitary facilities.

These soils are well suited to all crops commonly grown in the county. Corn, soybeans, and alfalfa are the main crops. Planting and harvesting may be delayed in the spring and during wet periods because of the flooding that occurs as runoff from adjacent slopes. This type of flooding generally is beneficial to crops. Returning crop residue to the soil helps maintain fertility and increases the infiltration rate.

These soils are well suited to tame grasses for pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by cultivation and by herbicides.

These soils are poorly suited to building site development because of flooding. Buildings should be constructed on the adjacent well drained soils. Roads constructed across areas of these soils should be graded to prevent flooding. The base material should be strengthened. Additional drainage may be needed on the Crossplain soil to prevent the damage caused by frost action. Because of the wetness and flooding, these soils are unsuitable as sites for most sanitary facilities. Sewage lagoons, however, function adequately; their embankments provide protection from flooding. Capability unit IIw-1; Overflow range site.

BoE—Boyd-Ethan association, 15 to 40 percent slopes. These moderately deep and deep, well drained, moderately steep and steep soils are on upland ridges and along entrenched drainageways. Areas are irregularly shaped and range from 80 to 800 acres in size. They are about 45 to 55 percent Boyd soil, 30 to 40 percent Ethan soil, and 15 percent minor soils. The Boyd soil is on the mid and lower side slopes. The Ethan soil is on the upper side slopes and on ridgetops. The minor soils are in areas as much as 20 acres in size, but as a result of the potential of all the soils for various uses, separately mapping the larger areas of the Ethan soil and of the minor soils is not practical.

Typically, the Boyd soil has a surface layer of dark grayish brown silty clay about 3 inches thick. The subsoil is about 20 inches thick. The upper part is dark grayish brown, firm, calcareous silty clay, and the lower part is grayish brown, very firm, calcareous silty clay that has spots of lime. The underlying material to a depth of 30 inches is light olive gray, calcareous clay and shale chips. Below this to a depth of 60 inches is light olive gray, calcareous shale. In places, the shale is closer to the surface.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 4 inches thick. The subsoil is about 12 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam that has spots of lime. In places, the surface layer is lighter in color.

Included with these soils in mapping are small areas of Crofton, Gavins, and Talmo soils. These included soils make up less than 20 percent of any one mapped area. They occur in a random pattern throughout the map unit. Crofton soils formed in silty material. Gavins soils have soft chalk rock at a depth of 20 inches or less. Talmo soils have loose sand and gravel at a depth of 10 inches or less. Also included are areas where shale and siltstone crop out as steep escarpments.

Permeability is slow or very slow in the Boyd soil. It is moderate in the subsoil of the Ethan soil and moderately slow in the underlying material. Available water capacity is low in the Boyd soil and high in the Ethan soil. In the Boyd soil, fertility is medium and the content of organic matter moderate. In the Ethan soil, fertility is low or medium and the content of organic matter moderate or moderately low. The shrink-swell potential and the susceptibility to landslides are high in the Boyd soil. Runoff is rapid on both soils.

All areas of these soils support native grass and trees and are used for grazing. These soils have good potential for rangeland and rangeland wildlife habitat. They have poor potential for cultivated crops, tame pasture and hay, openland wildlife habitat, and windbreaks and environmental plantings.

These soils are well suited to rangeland. The natural plant cover is a mixture of mid grasses on the ridges and on the upper and mid slopes. The lower slopes have an overstory of bur oak and green ash and an understory of mixed shrubs. Management that maintains an adequate vegetative cover and ground mulch helps prevent excessive soil loss and increases the infiltration rate. If rangeland is overgrazed, bluestems and green needlegrasses are replaced by short grasses and less palatable species. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition and control erosion. Good sites for stock water dams are in some of the deeper draws.

These soils are too steep for cultivated crops. Soil loss is too great under present farming practices.

These soils are well suited to rangeland wildlife habitat. The native trees growing on the side slopes and in the draws provide habitat for woodland wildlife, such as deer and squirrels. Providing winter food and cover increases the population of desired wildlife species. Excluding or limiting livestock for all or part of the grazing season enhances the habitat.

These soils are too steep and too unstable for most buildings and sanitary facilities. If roads are constructed across areas of these soils, the base material should be strengthened to overcome the low strength of the soils. Cut and borrow areas should be seeded to prevent excessive erosion. Seeding and mulching of road ditches are necessary to keep gullies from forming. Capability unit VIe-4; Boyd soil in Clayey range site, Ethan soil in Silty range site.

Ca—Chancellor silty clay loam. This deep, somewhat poorly drained, nearly level soil is in upland drainageways. It is frequently flooded for brief periods after heavy rain or rapid snowmelt. Individual areas of this soil range from 5 to 50 acres in size. They generally are long and narrow, but some are oval.

Typically, the surface layer is dark gray silty clay loam about 19 inches thick. The subsoil is about 18 inches thick. The upper part is grayish brown, mottled, firm silty clay, and the lower part is light brownish gray, mottled, friable silty clay. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam. In places, the subsoil and underlying material contain less clay.

Included with this soil in mapping are small areas of Tetonka and Trent soils. These soils make up less than 15 percent of any one mapped area. Tetonka soils have a gray and dark gray subsurface layer. They are poorly drained and are in the more entrenched positions where water ponds. Trent soils are better drained than the Chancellor soil and are in slightly higher positions.

Permeability is slow in the Chancellor soil, and available water capacity is high. The shrink-swell potential is high. Organic-matter content and fertility are high. This soil has a perched water table at a depth of 1.5 to 3 feet most of the year. Runoff is slow.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture or hay, rangeland, windbreaks and environmental plantings, and openland wildlife habitat. It has poor potential for building sites and most sanitary facilities.

This soil is well suited to cultivated crops. Planting and harvesting may be delayed during wet periods because of the high water table and the flooding that occurs as local runoff. Returning crop residue to the soil improves water infiltration, tilth, and fertility. Timely fieldwork is necessary to avoid puddling of the soil during wet periods.

This soil is well suited to tame grasses for pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help to keep the pasture in good condition. Grazing should be limited during wet periods to prevent puddling of the surface soil.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil generally is unsuited to building site development and most onsite waste disposal systems because of the susceptibility to flooding and the high water table. It is poorly suited to local roads. The high shrink-swell potential, wetness, and low strength are the major problems. Strengthening the base material and grading the roads help overcome the low strength and the wetness and flooding. Sewage lagoons function well on this soil; their embankments provide protection from flooding. Capability unit IIw-1; Overflow range site.

Cb—Clamo silty clay loam. This deep, poorly drained, nearly level soil is on bottom land along the major drainageways (fig. 7). It is commonly flooded for long periods. Areas are 50 to 150 acres in size and generally are long and narrow.

Typically, the surface layer is dark gray silty clay loam about 7 inches thick. The subsoil is about 19 inches of dark gray, firm silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray and dark gray, calcareous silty clay loam that has accumulations of carbonate. It is mottled in the upper part. In places, the surface layer, subsoil, and underlying material are silty clay. In some areas, thin strata of silt or very fine sand are in the underlying material. In places, the dark colors do not extend below 24 inches.

Included with this soil in mapping are small areas of James and Lamo soils. These soils make up less than 15 percent of any one mapped area. James soils have

Figure 7.—An area of Clamo silty clay loam on bottom land along the James River.

salts near the surface. They occur in a random pattern throughout the map unit. Lamo soils contain less clay than the Clamo soil and are slightly higher on the landscape.

Permeability is slow in the Clamo soil, and available water capacity is high. The shrink-swell potential is high. Organic-matter content and fertility are high. Runoff is slow. This soil has a water table within a depth of 3 feet in most years.

Most of the drained areas are farmed. If drained, this soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and openland wildlife habitat. It has poor potential for building sites and sanitary facilities.

This soil is suited to cultivated crops. The major management problem is the seasonal wetness caused by common flooding or the high water table. Because of the slow permeability, the soil dries slowly after a rain. Providing good surface drainage helps remove excess water. Returning crop residue helps maintain tilth and aerates the soil.

This soil is suited to tame pasture and hay. Control of grazing during wet periods, proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pasture in good condition.

This soil generally is not suitable as a site for buildings and sanitary facilities because of the susceptibility to flooding and the high water table. Roads constructed across areas of this soil should be graded to prevent flooding. The base material should be strengthened. Capability unit IIw-3; Subirrigated range site.

Cc—Clamo Variant silty clay loam. This deep, poorly drained, nearly level soil is on the bottom land along the James River. It is frequently flooded by stream overflow for long periods. Areas of this soil range from 10 to 40 acres in size. Most are long and follow the course of the river.

Typically, the surface layer is dark gray, calcareous silty clay loam about 16 inches thick. The subsoil is about 10 inches of grayish brown, firm, calcareous silty clay loam. To a depth of 38 inches, the underlying material is grayish brown, calcareous silt loam. Below this to a depth of 60 inches, it is gray, calcareous silt loam. In places, the soil contains more clay throughout.

Included with this soil in mapping are small areas of James soils, which make up less than 10 percent of any one mapped area. These soils contain more clay in the subsoil and underlying material than the Clamo Variant and have salts near the surface. They occur in a random pattern throughout the map unit.

Permeability is slow in the subsoil of the Clamo Variant and moderate in the underlying material. Available water capacity is high. The shrink-swell potential is high in the surface layer. Organic-matter content and fertility are high. Runoff is slow. The seasonal high water table is within 1 foot of the surface.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and rangeland and for openland wildlife habitat. It has poor potential for building sites and sanitary facilities.

This soil is suited to cultivated crops. The major management problem is the seasonal wetness caused by the frequent flooding or the high water table. Because of a slow infiltration rate, this soil dries slowly after a rain. Returning crop residue helps maintain tilth and aerates the soil.

This soil is suited to tame pasture and hay. Controlled grazing during wet periods, proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pasture in good condition.

This soil generally is not suitable as a site for buildings and sanitary facilities because of the susceptibility to flooding and the high water table. Buildings without basements can be constructed if the site is built up and protected from flooding. Roads constructed across areas of this soil should be graded to prevent flooding. The base material should be strengthened. Capability unit IIw-3; Subirrigated range site.

CdA—Clarno loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas of this soil range from 5 to 120 acres in size and are irregular in shape. Slopes generally are smooth.

Typically, the surface layer is dark grayish brown loam about 11 inches thick. The subsoil is friable clay loam about 22 inches thick. The upper part is grayish brown, the middle part is brown, and the lower part is pale brown, is calcareous, and has spots and streaks of soft lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, calcareous clay loam containing accumulations of lime. In some of the swales, the soil is dark colored to a greater depth. In places, the underlying material is stratified. In some areas, the surface layer and subsoil contain more silt.

Included with this soil in mapping are small areas of Tetonka soils. These soils make up less than 15 percent of any one mapped area. They are poorly drained and are in depressions.

Permeability is moderate in the subsoil of the Clarno soil and moderately slow in the underlying material. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow.

Almost all areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and openland wildlife habitat. It has fair potential for most building sites and sanitary facilities.

This soil is well suited to cultivated crops. It has few limitations. Returning crop residue to the soil helps maintain fertility, improves tilth, and increases the infiltration rate.

The soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, bluestems and needlegrasses are replaced by less palatable species. If overuse continues, Kentucky bluegrass and weeds occupy the site.

If buildings are constructed on this soil, the foundations and footings should be reinforced to prevent the structural damage caused by shrinking and swelling. Also, the base material should be strengthened. The base material should be replaced or strengthened if the soil is used as a site for local roads and streets. Enlarging the absorption area helps overcome the slow absorption rate in septic tank absorption fields. Sewage lagoons function well on this soil. Capability unit I-2; Silty range site.

CeB—Clarno-Bonilla loams, 1 to 6 percent slopes. These deep, well drained and moderately well drained, very gently sloping and undulating soils are on uplands. They are dissected by well defined drainageways. Most slopes are short and complex, but some are long and smooth. Individual areas of this unit range from 15 to 1,200 acres in size and are irregular in shape. They are about 55 to 65 percent Clarno soil and 15 to 25 percent Bonilla soil.

The Clarno soil is on the upper and middle slopes and in some of the flatter areas. The Bonilla soil is on toe slopes and in swales. It receives runoff from the adjacent Clarno soil and is subject to common, very brief flooding after periods of heavy rain or rapid snowmelt. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Clarno soil has a surface layer of dark grayish brown loam about 11 inches thick. The subsoil is friable clay loam about 22 inches thick. The upper part is grayish brown, the middle part is brown, and the lower part is pale brown, is calcareous, and has spots and streaks of soft lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, calcareous clay loam containing accumulations of lime. In places, the underlying material has strata of silt and very fine sand. In some areas, the surface layer and subsoil contain more silt.

Typically, the Bonilla soil has a surface layer of dark grayish brown loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown, friable loam; the middle part is grayish brown and brown, firm clay loam; the lower part is pale olive, firm, calcareous clay loam that has spots of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous loam or clay loam that has accumulations of lime.

Included with these soils in mapping are small areas of Enet, Ethan, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. Enet soils have sand and gravel at a depth of 20 to 40 inches. Their position on the landscape is similar to that of the Clarno and Bonilla soils. Ethan soils are on the high parts of the landscape. They are not so deep to lime as the Clarno and Bonilla soils. Tetonka soils are poorly drained and are in entrenched swales and small, enclosed depressions.

Permeability is moderate in the subsoil of the Clarno and Bonilla soils and moderately slow in the underlying material. Available water capacity, organic-matter content, and fertility are high. Runoff is medium on the Clarno soil and slow on the Bonilla soil. The Bonilla soil has a perched water table at a depth of 3 to 6 feet most of the year.

Almost all areas of these soils are farmed. The soils have good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and openland wildlife habitat.

These soils are well suited to cultivated crops. The major concerns of management are erosion on the Clarno soil and flooding on the Bonilla soil. Minimum tillage, contour farming, crop residue management, grassed waterways, and inclusion of grasses and legumes in the cropping system help control erosion. Planting and harvesting may be delayed during periods when the Bonilla soil is wet.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to windbreaks and environmental plantings (fig. 8). Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Though these soils are well suited to rangeland, very few areas are rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, the tall grasses lose vigor and are replaced by less palatable species.

Buildings should be constructed only on the Clarno soil because of flooding on the Bonilla soil. Foundations and footings should be reinforced to prevent the structural damage caused by the shrinking and swelling of the soil. Roads should be shaped to shed water. Low strength and instability limit the ability of these soils to support vehicular traffic. Strengthening the base material helps overcome these limitations. Drainage is needed on the Bonilla soil.

Septic tank absorption fields should be installed only in the Clarno soil because of the flood hazard on the Bonilla soil. Enlarging the absorption area helps over-

Figure 8.—Windbreak on Clarno-Bonilla loams, 1 to 6 percent slopes.

come the slow absorption rate in the Clarno soil. Sewage lagoons function well on both soils. Runoff should be diverted away from lagoons constructed on the Bonilla soil. Capability unit IIe-2; Clarno soil in Silty range site, Bonilla soil in Overflow range site.

ChA—Clarno-Crossplain-Stickney complex, 0 to 3 percent slopes. These deep, well drained, somewhat poorly drained, and moderately well drained, gently undulating soils are on glacial till uplands. Slopes are short and complex, and drainageways are poorly defined. Individual areas of this unit range from l0 to more than 1,000 acres in size and are irregular in shape. They are about 50 percent Clarno soil, 20 percent Crossplain soil, and 15 percent Stickney soil.

The Clarno soil is on the higher parts of the landscape. The Crossplain soil is in swales on the lowest part of the landscape. It is commonly flooded for brief periods after heavy rain or rapid snowmelt. The Stickney soil is on the lower part of the slopes and around the edges of the swales. The three soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Clarno soil has a surface layer of dark grayish brown loam about 11 inches thick. The subsoil is friable clay loam about 22 inches thick. The upper part is grayish brown, the middle part is brown, and the lower part is pale brown, is calcareous, and has spots and streaks of soft lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, calcareous clay loam containing accumulations of lime. In some places, the underlying material is stratified. In other places, the surface layer and subsoil contain more silt. In some areas, a water table is perched at a depth of 3 to 5 feet.

Typically, the Crossplain soil has a surface layer of dark gray clay loam about 14 inches thick. The subsoil is about 28 inches thick. It is gray, firm clay in the upper part and light brownish gray clay loam in the lower part. The underlying material to a depth of 60 inches is pale olive, calcareous clay loam that has accumulations of lime.

Typically, the Stickney soil has a dark grayish brown silt loam surface layer about 10 inches thick. The subsoil is about 16 inches thick. The upper part is dark gray and grayish brown, firm silty clay loam, and the lower part is grayish brown, friable, calcareous silty clay loam containing accumulations of lime and crystals of gypsum that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, calcareous silty clay loam over clay loam containing accumulations of lime and crystals of gypsum. In places, the soil has a water table at a depth of 3 to 5 feet.

Included with these soils in mapping are small areas of Bonilla and Tetonka soils. The moderately well drained Bonilla soils lack gypsum and contain less clay in the subsoil than the Crossplain and Stickney soils. Their position on the landscape is similar to that of the Stickney soil. Their surface layer is thicker than that of the Clarno soil. The poorly drained Tetonka soils are in depressions. They contain more clay in the subsoil than the Clarno soil and have a less clayey surface layer than the Crossplain soil.

Permeability is moderate in the upper part of the Clarno soil and moderately slow in the lower part. It is slow in the Crossplain and Stickney soils. Available water capacity is high in all three soils. Organic-matter content and fertility are high in the Clarno and Crossplain soils and moderate in the Stickney soil. The shrink-swell potential is moderate in the subsoil of the Clarno soil and high in the Crossplain and Stickney soils. Runoff is slow. The Crossplain soil has a perched water table at a depth of 1 to 4 feet most of the year.

Most areas of these soils are farmed. The soils have good potential for cultivated crops, openland wildlife habitat, rangeland, and tame pasture and hay. The Clarno and Crossplain soils have good potential and the Stickney soil fair potential for windbreaks and environmental plantings. The Clarno soil has fair potential and the Crossplain and Stickney soils poor potential for most building sites and sanitary facilities.

These soils are suited to cultivated crops. The major concerns of management are controlling seasonal wetness and maintaining or improving tilth. Providing adequate drainage helps overcome the slow surface drainage. Planting and harvesting may be delayed during wet periods. Returning crop residue to the soil helps maintain fertility, improves tilth, and increases the infiltration rate.

These soils are well suited to tame pasture and hay. Grazing should be deferred during wet periods to prevent puddling of the surface layer. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

In most areas these soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Buildings should be constructed only on the Clarno soil because of flooding on the Crossplain soil and the high shrink-swell potential and low strength of the Stickney soil. Reinforcing the footings and foundations helps overcome the moderate shrink-swell potential and low strength of the Clarno soil. If local roads are constructed across areas of these soils, the base material should be strengthened. Also, the roads should be graded to shed water.

Septic tank absorption fields function adequately in the Clarno soil if they are enlarged to overcome the slow absorption rate. Sewage lagoons function well on all three soils. Those on the Crossplain soil are protected from flooding by their own embankments. Capability unit IIw-1; Clarno soil in Silty range site, Crossplain soil in Overflow range site, Stickney soil in Clayey range site.

CkA—Clarno-Crossplain-Tetonka complex, 0 to 3 percent slopes. These deep, well drained, somewhat poorly drained, and poorly drained, gently undulating soils are on uplands. Surface drainage is poorly defined; many small swales end in enclosed depressions. Individual areas range from 50 to several hundred acres in size and are irregular in shape. They are about 40 to 50 percent Clarno soil, 20 to 30 percent Crossplain soil, and 10 to 25 percent Tetonka soil.

The Clarno soil is on the higher parts of the landscape. The Crossplain soil is in the narrow swales. The Tetonka soil is in entrenched depressions. The Crossplain and Tetonka soils are commonly flooded during periods of heavy rain or rapid snowmelt. The three soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Clarno soil has a surface layer of dark grayish brown loam about 11 inches thick. The subsoil is friable clay loam about 22 inches thick. The upper part is grayish brown, the middle part is brown, and the lower part is pale brown, is calcareous, and has spots and streaks of soft lime that extend into the underlying material. The underlying material to a depth of about 60 inches is pale yellow, calcareous clay loam containing accumulations of carbonate. In places, a perched water table is at a depth of 3 to 5 feet. In some areas, the underlying material is stratified silt and very fine sand.

Typically, the Crossplain soil has a surface layer of dark gray clay loam about 14 inches thick. The subsoil is about 28 inches thick. It is gray, firm clay in the upper part and light brownish gray clay loam in the lower part. The underlying material to a depth of about 60 inches is pale olive, calcareous clay loam that has accumulations of lime.

Typically, the Tetonka soil has a dark gray silt loam surface layer about 10 inches thick. The subsurface layer is gray and dark gray silt loam about 7 inches thick. The subsoil is about 31 inches thick. The upper part is dark gray, friable silty clay loam; the lower part is dark gray and gray, firm silty clay. The underlying material to a depth of about 60 inches is grayish brown, mottled silty clay loam.

Included with these soils in mapping are small areas of Bonilla soils. These included soils make up less than 20 percent of any one mapped area. They have a thicker surface layer than the Clarno soil and contain less clay and are better drained than the Crossplain and Tetonka soils. They occur in a random pattern throughout the map unit.

Permeability is moderate in the upper part of the Clarno soil and moderately slow in the underlying material. It is slow in the Crossplain soil and very slow in the Tetonka soil. Available water capacity is high in all three soils. Organic-matter content and fertility are high in the Clarno and Crossplain soils. Organic-matter content is moderate and fertility medium in the Tetonka soil. The shrink-swell potential is moderate in the Clarno soil and high in the Crossplain and Tetonka soils. Runoff is slow on all three soils. The Tetonka soil is ponded after snowmelt and heavy rains. The Crossplain soil has a perched water table at a depth of 1 to 4 feet.

Most areas of these soils are cultivated. The soils have good potential for cultivated crops, tame pasture and hay, and rangeland. The Clarno and Crossplain soils have good potential for openland wildlife habitat and for windbreaks and environmental plantings. The Tetonka soil has fair potential for wetland wildlife habitat and poor potential for windbreaks and environmental plantings. The Clarno soil has fair potential and the Crossplain and Tetonka soils poor potential for most building sites and sanitary facilities.

These soils are well suited to farming. Returning crop residue to the soil improves fertility and tilth and increases the infiltration rate. Planting and harvesting may be delayed on the Crossplain and Tetonka soils because of flooding. Ponding occurs early in the spring and after rains in some areas of the Tetonka soil. Improving surface drainage helps overcome the flood hazard.

In most areas these soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides. The small areas of the Tetonka soil are not suitable for windbreaks.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition. Grazing should be deferred during wet periods to prevent puddling of the surface layer.

Buildings should be constructed only on the Clarno soil because of flooding on the Crossplain and Tetonka soils. Reinforcing the footings and foundations helps overcome the moderate shrink-swell potential and low strength of the Clarno soil. If local roads are constructed across areas of these soils, the base material should be strengthened. Also, the roads should be graded to shed water. Additional drainage is needed on the Tetonka soil.

Septic tank absorption fields function adequately in the Clarno soil if they are enlarged to overcome the slow absorption rate. Sewage lagoons function well on all three soils. Those on Crossplain and Tetonka soils are protected from flooding by their own embankments. Capability unit IIw-1; Clarno soil in Silty range site, Crossplain soil in Overflow range site, Tetonka soil in Wetland range site.

CoE—Crofton-Boyd association, 15 to 40 percent slopes. These deep and moderately deep, well drained, moderately steep and steep soils are on upland ridges and along entrenched drainageways. Areas are irregularly shaped and range from 60 to several hundred acres in size. They are about 45 to 55 percent Crofton soil, 30 to 40 percent Boyd soil, and 15 percent minor soils. The Crofton soil is on the ridges and upper side slopes. The Boyd soil is on the mid and lower side slopes. The minor soils are in areas as much as 20 acres in size, but as a result of the potential of all the soils for various uses, separately mapping the larger areas of the Boyd soil and of the minor soils is not practical.

Typically, the Crofton soil has a surface layer of calcareous silt loam about 6 inches thick. The upper part is grayish brown, and the lower part is brown. Below the surface layer is a transitional layer of brown, friable, calcareous silt loam about 6 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silt loam. In places, the soil has a thicker surface layer and is leached of lime to a greater depth. In some areas, it is not so silty.

Typically, the Boyd soil has a surface layer of dark grayish brown silty clay about 3 inches thick. The subsoil is about 20 inches thick. The upper part is dark grayish brown, firm, calcareous silty clay, and the lower part is grayish brown, very firm, calcareous silty clay that has spots of lime. The underlying material to a depth of 30 inches is light olive gray, calcareous clay and shale chips. Below this to a depth of 60 inches is light olive gray, calcareous shale. In places, the shale is closer to the surface.

Included with these soils in mapping are small areas of Ethan, Gavins, and Talmo soils. These included soils make up less than 15 percent of any one mapped area. They occur in a random pattern throughout the map unit. Ethan soils contain more clay and sand than the Crofton soil and formed in glacial till. Gavins soils have soft siltstone at a depth of 20 inches or less. Talmo soils have loose sand and gravel at a depth of 10 inches or less.

Permeability is moderate in the Crofton soil and slow or very slow in the Boyd soil. Available water capacity is high in the Crofton soil and low in the Boyd soil. Both soils are medium in fertility and moderate in content of organic matter. The shrink-swell potential and the susceptibility to landslides are high in the Boyd soil. Runoff is rapid on both soils.

All areas of these soils support native grass or native trees and are used for grazing. The Boyd soil has good potential and the Crofton soil fair potential for rangeland and rangeland wildlife habitat. Both soils have poor potential for cultivated crops, tame pasture and hay, openland wildlife habitat, and windbreaks and environmental plantings. They have poor potential for building sites and sanitary facilities.

These soils are best suited to rangeland. The native vegetation on the ridges and the upper slopes is a mixture of tall and mid grasses. The mid and lower slopes have an overstory of bur oak and green ash and an understory of mixed shrubs and mid and tall grasses. Management practices that maintain an adequate vegetative cover and ground mulch help prevent excessive soil losses and increase the infiltration rate. If rangeland is overgrazed, bluestems and other tall grasses are replaced by needleandthread, sideoats grama, and blue grama. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition and control erosion.

These soils are poorly suited to cultivated crops, windbreaks and environmental plantings, and tame pasture and hay because of the steep slopes. The erosion resulting from these uses would be excessive.

The native trees growing on the side slopes and in the draws provide habitat for woodland wildlife, such as deer and squirrels. These soils are well suited to rangeland and woodland wildlife habitat. Providing winter food and cover improves the habitat for wildlife. Measures that exclude livestock or limit the number of livestock for all or part of the grazing season also improve the habitat.

These soils generally are too steep and too unstable for buildings and sanitary facilities. If roads are constructed in areas of these soils, the road cuts should be seeded to prevent excessive roadside erosion. Capability unit VIIe-1; Crofton soil in Thin Upland range site, Boyd soil in Clayey range site.

CmE—Crofton-Nora silt loams, 9 to 25 percent slopes. These deep, well drained, strongly sloping or hilly soils are on upland ridges and along entrenched drainageways. Areas are irregularly shaped and range from 10 to several hundred acres in size. They are about 45 to 55 percent Crofton soil and 30 to 40 percent Nora soil. The Crofton soil is on ridges and the upper side slopes. The Nora soil is on the lower side slopes. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Crofton soil has a surface layer of calcareous silt loam about 6 inches thick. The upper part is grayish brown, and the lower part is brown. Below the surface layer is a transitional layer of brown, friable, calcareous silt loam about 6 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silt loam. In places, the soil is not so silty.

Typically, the Nora soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is about 23 inches thick. It is brown, friable silt loam in the upper part and light olive brown, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silt loam. In places, the dark colors extend deeper than 20 inches. In some areas, lime is within a depth of l2 inches.

Included with these soils in mapping are small areas of Boyd, Ethan, and Talmo soils. These included soils make up less than 15 percent of any one mapped area. Boyd soils are on some of the lower side slopes. They contain more clay than the Crofton and Nora soils and formed in clayey shale. Ethan and Talmo soils are on some mid slopes and on small, convex rises or ridges lower on the landscape. Ethan soils contain more clay and sand than the Crofton and Nora soils and formed in glacial till. Talmo soils are underlain with sand and gravel at a depth of 10 inches or less.

Permeability is moderate and available water capacity high in the Crofton and Nora soils. Organic-matter content and fertility are medium in the Crofton soil and high in the Nora soil. Runoff is rapid on both soils.

Most areas support native grass and trees and are used for grazing. These soils have poor potential for cultivated crops, windbreaks and environmental plantings, and openland wildlife habitat. The Crofton soil has fair potential and the Nora soil good potential for tame pasture and hay, rangeland, and rangeland wildlife habitat. Both soils have poor potential for building sites and most sanitary facilities.

These soils are best suited to rangeland. The native vegetation on the ridges and on the upper and mid slopes is a mixture of tall and mid grasses. The lower slopes have an overstory of bur oak and green ash and an understory of mixed shrubs and mid and tall grasses. Management practices that maintain an adequate vegetative cover and ground mulch help prevent excessive soil losses and increase the infiltration rate. If rangeland is overgrazed, bluestems and other tall grasses are replaced by needleandthread, sideoats grama, and blue grama. A planned grazing system that includes proper grazing use and deferred grazing helps to maintain or improve the range condition and control erosion.

These soils are suited to tame pasture and hay, but they are highly susceptible to erosion because of the strong slopes. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to rangeland and woodland wildlife habitat. Providing winter food and cover improves the habitat for wildlife. Measures that exclude livestock or limit the number of livestock for all or part of the grazing season also improve the habitat.

These soils generally are too steep for buildings and most sanitary facilities. If roads are constructed in areas of these soils, the road cuts should be seeded to prevent excessive roadside erosion. Capability unit Vle-3; Crofton soil in Thin Upland range site, Nora soil in Silty range site.

DaB—Davis silt loam, 2 to 9 percent slopes. This deep, well drained, gently sloping and moderately sloping soil is on fans and foot slopes in the uplands (fig. 9). Individual areas of this soil range from 10 to 80 acres in size and are generally long and narrow.

Figure 9.—Typical area of Davis silt loam, 2 to 9 percent slopes. Clamo silty clay loam is in the background.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsoil is about 29 inches thick. It is dark gray, friable silt loam in the upper part; dark grayish brown, friable loam in the middle part; and light brownish gray, friable, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray and pale brown, calcareous clay loam. Some areas have as much as 14 inches of calcareous loamy overwash. In places, the soil contains lime throughout.

Included with this soil in mapping are small areas of Blendon, Clamo, Clarno, and Ethan soils. These soils make up less than 15 percent of any one mapped area. Blendon soils contain more sand in the subsoil and in the underlying material than the Davis soil. Clamo soils contain more clay throughout than the Davis soil and are poorly drained. They are in flat areas on the lower parts of the landscape. Clarno soils are shallower to lime than the Davis soil and formed in glacial till. Ethan soils have a thinner surface layer than the Davis soil and have lime at or near the surface. Clarno and Ethan soils are on the steeper slopes and on slight rises.

Permeability is moderate in the Davis soil. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is medium.

Most areas are native rangeland because this soil is on foot slopes closely associated with nonarable soils. The soil has good potential for cultivated crops, tame pasture and hay, rangeland, windbreaks and environmental plantings, and openland and rangeland wildlife habitat. It has fair potential for most building sites and sanitary facilities.

This soil is well suited to crops. Farming is difficult, however, because the soil occurs as small, long and narrow areas that generally are adjacent to areas of nonarable soils. The main concern of management is controlling erosion. Crop residue management helps maintain fertility, improve tilth, and control erosion. Contour farming and terraces help control erosion in the moderately sloping areas.

This soil is well suited to rangeland. The native vegetation is a mixture of tall and mid grasses. If rangeland is overgrazed, bluestems and needlegrasses are replaced by less palatable species. If overuse continues for many years, Kentucky bluegrass and weeds occupy the site. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

If buildings are constructed on this soil, reinforcing the foundations and footings helps overcome the moderate shrink-swell potential and low strength. Strengthening the base material helps overcome the low strength on sites for roads. Road cuts should be seeded to prevent excessive roadside erosion in the moderately sloping areas.

Enlarging the absorption area helps overcome the slow absorption rate in septic tank absorption fields. If sewage lagoons are constructed on this soil, reshaping of some of the moderately sloping areas is needed. Sealing the bottom and sides of lagoons helps prevent seepage. This soil is a good source of cover for landfills or for topsoil. Capability unit IIe-1; Silty range site.

DbB—Davis Variant loam, 0 to 6 percent slopes. This deep, well drained, nearly level and gently sloping soil is on alluvial fans and bottom land. It is frequently flooded for very brief periods after heavy rains. Areas are fan shaped and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, calcareous loam about 12 inches thick. The underlying material to a depth of 60 inches is light gray sandy loam over very pale brown very fine sandy loam and loamy fine sand. In places, the underlying material is stratified, multicolored loamy, silty, and sandy sediment. In some areas, a buried soil is below a depth of 24 inches. In places, the soil is loam throughout and the depth to lime is as much as 30 inches.

Included with this soil in mapping are small areas of Clamo and Delmont soils. These soils make up less than 15 percent of any one mapped area. Clamo soils contain more clay throughout than the Davis Variant. They are in the flatter areas on the lower part of the landscape. Delmont soils have sand and gravel at a depth of 10 to 20 inches. Their position on the landscape is similar to that of the Davis Variant.

Permeability is moderately rapid in the Davis Variant, and available water capacity is moderate or high. This soil is low or moderate in content of organic matter and low or medium in fertility. Runoff is medium.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, windbreaks and environmental plantings, and openland wildlife habitat. It has poor potential for building sites and most sanitary facilities.

This soil is well suited to cultivated crops. Generally, it occurs as a small area within a larger field and is not managed separately. The main concerns of management are improving fertility and controlling erosion. Crop residue management improves fertility. Contour farming helps control erosion. Planting and harvesting may be delayed by frequent flooding during wet periods.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to rangeland. The native vegetation is a mixture of tall and mid grasses. If rangeland is overgrazed, bluestems and needlegrasses are replaced by less palatable species. If overuse continues for many years, Kentucky bluegrass and weeds occupy the site. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

This soil is not suitable as a site for buildings and most sanitary facilities because of the flood hazard. Seepage is an additional hazard on sites for sanitary facilities. If roads are constructed across areas of this soil, the cuts should be seeded to control soil blowing. Deep cuts can expose the underlying material. Capability unit IIe-1; Silty range site.

EaB—Egan-Chancellor silty clay loams, 1 to 6 percent slopes. These deep, well drained and somewhat poorly drained, very gently sloping and undulating soils are on uplands. Slopes are complex and short. Individual areas of this unit range from 10 to several hundred acres in size. They are about 45 to 55 percent Egan soil and 20 to 30 percent Chancellor soil. The Egan soil is on the higher parts of the landscape, and the Chancellor soil is in swales or on the lower parts of the landscape. The Chancellor soil is frequently flooded for brief periods in the spring and after heavy rains. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Egan soil has a surface layer of dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 21 inches of friable silty clay loam. The upper part is brown; the middle part is pale brown; the lower part is light yellowish brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places, lime is at or near the surface.

Typically, the Chancellor soil has a surface layer of dark gray silty clay loam about 19 inches thick. The subsoil is about 18 inches thick. The upper part is grayish brown, mottled, firm silty clay, and the lower part is light brownish gray, mottled, friable silty clay. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam. In places, the subsoil and underlying material contain less clay. Some areas are more poorly drained.

Included with these soils in mapping are small areas of Ethan and Trent soils. These included soils make up less than 25 percent of any one mapped area. Ethan soils have a thinner surface layer than the Egan and Chancellor soils and are shallower to glacial till. Trent soils are more poorly drained than the Egan soil and better drained than the Chancellor soil. Ethan soils are on the higher parts of the landscape, and Trent soils are in areas between the Egan and Chancellor soils.

Permeability is moderate in the upper part of the Egan soil and moderately slow in the underlying material. It is slow in the Chancellor soil. Available water capacity is high in both soils. Organic-matter content and fertility also are high. The shrink-swell potential is moderate in the Egan soil and high in the Chancellor soil. Runoff is medium on the Egan soil and slow on the Chancellor soil. The Chancellor soil has a seasonal high water table at a depth of 1.5 to 3 feet.

Almost all areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, rangeland, openland wildlife habitat, and windbreaks and environmental plantings. The Egan soil has fair potential and the Chancellor soil poor potential for most building sites and sanitary facilities.

These soils are well suited to cultivated crops. The main concerns of management are erosion on the Egan soil and frequent flooding and wetness on the Chancellor soil. Contour farming helps control erosion in the steeper areas of the Egan soil. Returning crop residue to the soil helps maintain fertility, control erosion, improve tilth, and increase the infiltration rate. Planting and harvesting may be delayed during wet periods because of flooding on the Chancellor soil.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control keep pastures in good condition. Grazing should be limited during wet periods to prevent puddling of the Chancellor soil.

These soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Though used as rangeland in very few areas, these soils are well suited to rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, the tall grasses lose vigor and are replaced by less palatable species.

Buildings should be constructed only on the Egan soil because of flooding on the Chancellor soil. Reinforcing the footings and foundations helps overcome the moderate shrink-swell potential and low strength of the Egan soil. If local roads are constructed across areas of these soils, the base material should be strengthened. Also, the roads should be graded to shed water and thus prevent the damage caused by frost action.

Septic tank absorption fields function adequately in the Egan soil if they are enlarged to overcome the slow absorption rate. Sewage lagoons function well on both soils. Those located on the Chancellor soil are protected from flooding by their own embankments. Capability unit IIe-3; Egan soil in Silty range site, Chancellor soil in Overflow range site.

EbB—Egan-Ethan-Trent complex, 1 to 6 percent slopes. These deep, well drained and moderately well drained, very gently sloping and undulating soils are on uplands that are dissected by well defined drainageways. Slopes generally are complex. Individual areas of this unit range from 10 to 500 acres in size and are irregular in shape. They are about 45 to 55 percent Egan soil, 20 percent Ethan soil, and 20 percent Trent soil.

The Egan soil is on the upper and middle slopes and in some of the flat areas. The Ethan soil is on the crest of the slopes and knobs. The Trent soil is in slight swales and on toe slopes. It is subject to brief, rare or common flooding in periods of heavy rain or rapid snowmelt. The three soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Egan soil has a surface layer of dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 21 inches of friable silty clay loam. The upper part is brown, the middle part is pale brown, and the lower part is light yellowish brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places, strata of silt and very fine sand are in the underlying material. In some areas, clay loam glacial till is at a depth of 40 to 60 inches.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 8 inches thick. The subsoil is about 8 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam that has spots of lime. In places, the surface layer is lighter in color.

Typically, the Trent soil has a surface layer of dark grayish brown silty clay loam about 13 inches thick. The subsoil is friable silty clay loam about 32 inches thick. The upper part is grayish brown, and the lower part is light brownish gray, is calcareous, and has spots and streaks of soft lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places, strata of silt and very fine sand are in the underlying material.

Included with these soils in mapping are small areas of Chancellor soils. These included soils make up less than 10 percent of any one mapped area. They are somewhat poorly drained and are in the deeper swales.

Permeability is moderate in the subsoil and moderately slow in the underlying material of the Egan, Ethan, and Trent soils. Available water capacity is high. Organic-matter content and fertility are high in the Egan and Trent soils. In the Ethan soil, organic-matter content is moderate or moderately slow and fertility low or medium. Runoff is medium on all three soils. The Trent soil has a perched water table at a depth of 4 to 6 feet part of the year.

Nearly all areas of these soils are farmed. The soils have good potential for cultivated crops and rangeland. The Egan and Trent soils have good potential and the Ethan soil fair potential for tame pasture and hay, windbreaks and environmental plantings, and openland wildlife habitat. The Egan and Ethan soils have fair potential and the Trent soil poor potential for most building sites and sanitary facilities.

These soils are well suited to cultivated crops. The main concerns of management are erosion on the Egan and Ethan soils and frequent flooding and wetness on the Trent soil. Contour farming helps control erosion in the steeper areas of Egan and Ethan soils. Returning crop residue to the soil improves fertility, helps to control erosion, improves tilth, and increases the infiltration rate. Planting and harvesting may be delayed during wet periods because of wetness on the Trent soil.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Though used as rangeland in very few areas, these soils are well suited to rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, the tall grasses lose vigor and are replaced by less palatable species.

Buildings should be constructed only on the Egan and Ethan soils because of flooding on the Trent soil. Reinforcing the footings and foundations helps overcome the moderate shrink-swell potential and low strength of the Egan and Ethan soils. If local roads are constructed across areas of the three soils, the base material should be strengthened. Also, the roads should be graded to shed water and thus prevent the damage caused by frost action.

Septic tank absorption fields function adequately in the Egan and Ethan soils if they are enlarged to overcome the slow absorption rate. Sewage lagoons function well on all three soils. Those on the Trent soil are protected from flooding by their own embankments. Sealing the bottom of lagoons helps prevent seepage. The undulating areas should be leveled and shaped. Capability unit IIe-3; Egan and Ethan soils in Silty range site, Trent soil in Overflow range site.

EbC—Egan-Ethan-Trent complex, 2 to 9 percent slopes. These deep, well drained and moderately well drained, undulating and gently rolling soils are on uplands. Scattered stones are on the surface of some knolls and ridges. Slopes generally are short and convex. Individual areas of this unit range from 15 to several hundred acres in size and are irregular in shape. They are about 35 to 45 percent Egan soil, 25 to 35 percent Ethan soil, and 15 percent Trent soil.

The Egan soil is on the smooth middle parts of the landscape. The Ethan soil is on the crests of convex ridges and knolls. The Trent soil is in swales and on foot slopes. It is subject to brief, rare or common flooding in periods of heavy rain or rapid snowmelt. The three soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Egan soil has a surface layer of dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 21 inches of friable silty clay loam. The upper part is brown; the middle part is pale brown; the lower part is light yellowish brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places, clay loam glacial till is below a depth of 40 inches.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 8 inches thick. The subsoil is about 8 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam that has spots of lime.

Typically, the Trent soil has a surface layer of dark grayish brown silty clay loam about 13 inches thick. The subsoil is friable silty clay loam about 32 inches thick. The upper part is grayish brown, and the lower part is light brownish gray, is calcareous, and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Chancellor soils. These included soils make up less than 15 percent of any one mapped area. They are in some of the more deeply entrenched swales and are somewhat poorly drained.

Permeability is moderate in the subsoil of the Egan, Ethan, and Trent soils and moderately slow in the underlying material. Available water capacity is high. The Egan and Trent soils are high in fertility and in organic-matter content. The Ethan soil is medium or low in fertility and moderate or moderately low in organic-matter content. Runoff is medium on all three soils. The less sloping Trent soil has a perched water table at a depth of 4 to 6 feet part of the year.

Nearly all areas of these soils are farmed. The soils have fair potential for cultivated crops and rangeland. The Egan and Trent soils have good potential and the Ethan soil fair potential for tame pasture and hay and for windbreaks and environmental plantings. The Egan and Trent soils have good potential and the Ethan soil poor potential for openland wildlife habitat. The Egan and Ethan soils have fair potential and the Trent soil poor potential for most building sites and sanitary facilities.

These soils are suited to small grain, alfalfa, and tame grasses. The main concerns of management are controlling erosion and maintaining fertility. Crop residue management, minimum tillage, and grassed waterways help control erosion, conserve moisture, and maintain fertility and tilth. Contour farming and terracing help control erosion in the steeper areas. Planting and harvesting may be delayed during periods when the Trent soil is wet.

Using these soils for tame pasture and hay is an effective way to control erosion. All climatically adapted pasture plants can grow well. Proper stocking rates, pasture rotation, timely deferment of grazing, applications of fertilizer, and weed control help keep the pasture in good condition.

These soils are suited to windbreaks and environmental plantings. Optimum growth, however, should not be expected on the Ethan soil. A year of fallow prior to planting helps control grass and weeds and helps store moisture. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

These soils are well suited to rangeland, but very few areas are used for rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, bluestems and needlegrasses are replaced by less palatable species. If overuse continues for many years, Kentucky bluegrass and weeds occupy the site.

Buildings should be constructed only on the Egan and Ethan soils because of flooding on the Trent soil. Reinforcing the footings and foundations helps overcome the moderate shrink-swell potential and low strength of the Egan and Ethan soils. If local roads are constructed across areas of the three soils, the base material should be strengthened. Also, the roads should be graded to shed water and thus prevent the damage caused by frost action. Road cuts should be seeded to prevent excessive roadside erosion.

Septic tank absorption fields function adequately in the Egan and Ethan soils if they are enlarged to overcome the slow absorption rate. Sewage lagoons function on these soils, but considerable land shaping is necessary in the areas of Egan and Ethan soils. The lagoons on the Trent soil are protected from flooding by their own embankments. Sealing the bottom of lagoons helps prevent seepage. Capability unit IIIe-2; Egan and Ethan soils in Silty range site, Trent soil in Overflow range site.

EcA—Egan-Wentworth silty clay loams, 0 to 2 percent slopes. These deep, well drained, nearly level soils are on uplands. Slopes generally are smooth, but some are slightly undulating. Individual areas of this unit range from 15 to 500 acres in size and are irregular in shape. They are about 45 to 55 percent Egan soil and 30 to 40 percent Wentworth soil. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Egan soil has a surface layer of dark grayish brown silty clay loam about 7 inches thick. The subsoil is friable silty clay loam about 21 inches thick. The upper part is brown; the middle part is pale brown; the lower part is light yellowish brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam.

Typically, the Wentworth soil has a surface layer of dark grayish brown silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 28 inches thick. The upper part is grayish brown, the middle part is brown, and the lower part is light olive brown and is calcareous. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam. In places, strata of silt and very fine sand are below a depth of 50 inches.

Included with these soils in mapping are small areas of Chancellor, Ethan, and Trent soils. These included soils make up less than 15 percent of any one mapped area. Chancellor and Trent soils are wetter than the Egan and Wentworth soils and are in swales. Ethan soils are not so silty as the Egan and Wentworth soils and have lime closer to the surface. They are on knobs.

Permeability is moderate in the subsoil of the Egan soil and moderately slow in the underlying material. It is moderate through the Wentworth soil. Available water capacity is high in both soils. Organic-matter content and fertility also are high. Runoff is slow.

Almost all areas are farmed. These soils have good potential for cultivated crops, rangeland, windbreaks and environmental plantings, tame pasture and hay, and openland wildlife habitat. They have fair potential for most building sites and most sanitary facilities.

These soils are well suited to cultivated crops. Returning crop residue to the soil helps to maintain fertility, improve tilth, and increase the infiltration rate.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

These soils are well suited to rangeland, but very few areas are used as rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, the tall grasses lose vigor and are replaced by less palatable species.

Reinforcing the footings and foundations of buildings helps to prevent the structural damage caused by the low strength and shrinking and swelling of these soils. On sites for local roads and streets, the base material should be strengthened or replaced to help prevent the damage caused by frost action and low strength. Enlarging the absorption area of septic tank absorption fields helps overcome the slow absorption rate of these soils. Sewage lagoons function well on the Egan soil. Sealing the bottom and sides helps control seepage from the lagoons built in areas of the Wentworth soil. Capability unit I-2; Silty range site.

EcB—Egan-Wentworth silty clay loams, 2 to 6 percent slopes. These, deep, well drained, gently sloping soils are on uplands. Slopes are long and smooth. Individual areas of this unit range from 50 to 300 acres in size and are irregular in shape. They are about 45 to 55 percent Egan soil and 35 to 45 percent Wentworth soil. The Egan soil is on the upper parts of the landscape. The Wentworth soil is on the middle and lower parts of the landscape. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Egan soil has a surface layer of dark grayish brown silty clay loam about 7 inches thick. The subsoil is friable silty clay loam about 21 inches thick. The upper part is brown; the middle part is pale brown; the lower part is light yellowish brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam.

Typically, the Wentworth soil has a surface layer of dark grayish brown silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 28 inches thick. The upper part is grayish brown, the middle part is brown, and the lower part is light olive brown and is calcareous. The underlying material to a depth of 60 inches is light yellowish brown silty clay loam. In places, strata of silt and very fine sand are below a depth of 50 inches.

Included with these soils in mapping are small areas of Clarno, Ethan, and Trent soils. These included soils make up less than 10 percent of any one mapped area. Clarno and Ethan soils are not so silty as the Egan and Wentworth soils and formed in glacial till. They generally are on the slight rises in areas where slopes are smooth. Trent soils are moderately well drained and are on toe slopes and in swales.

Permeability is moderate in the subsoil of the Egan soil and moderately slow in the underlying material. It is moderate through the Wentworth soil. Available water capacity is high in both soils. Organic-matter content and fertility also are high. Runoff is medium.

Almost all areas are farmed. These soils have good potential for cultivated crops, rangeland, windbreaks and environmental plantings, tame pasture and hay, and openland wildlife habitat. They have fair potential for most building sites and most sanitary facilities.

These soils are well suited to cultivated crops. The main concerns of management are controlling erosion and maintaining fertility. Returning crop residue to the soil improves fertility and tilth, helps to control erosion, and increases the infiltration rate. Because slopes are long and smooth, terraces can be constructed to help control erosion.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

These soils are well suited to rangeland, but very few areas are used as rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, the tall grasses lose vigor and are replaced by less palatable grasses.

Reinforcing the footings and foundations of buildings helps to prevent the structural damage caused by the low strength and shrinking and swelling of these soils. On sites for local roads and streets, the base material should be strengthened or replaced to help prevent the damage caused by frost action and low strength. Enlarging the absorption area of septic tank absorption fields helps overcome the slow absorption rate of these soils.

Sewage lagoons function well on the Egan soil. Sealing the bottom and sides helps control seepage from the lagoons built in areas of the Wentworth soil. Land shaping is needed in the steeper areas. Capability unit IIe-3; Silty range site.

EdA—Egan-Whitewood silty clay loams, 0 to 3 percent slopes. These deep, well drained and somewhat poorly drained, gently undulating soils are on uplands. Slopes are complex and short. Individual areas of this unit range from 15 to 375 acres in size. They are about 50 to 60 percent Egan soil and 25 to 35 percent Whitewood soil. The Egan soil is on the higher parts of the landscape. The Whitewood soil is in swales or on the lower parts of the landscape. It is subject to common, very brief flooding during periods of heavy rain or rapid snowmelt. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Egan soil has a surface layer of dark grayish brown silty clay loam about 7 inches thick. The subsoil is friable silty clay loam about 21 inches thick. The upper part is brown; the middle part is pale brown; the lower part is light yellowish brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places, the soil is wetter.

Typically, the Whitewood soil has a surface layer of dark grayish brown silty clay loam about 19 inches thick. The subsoil is silty clay loam about 23 inches thick. The upper part is dark grayish brown and is friable; the lower part is very dark grayish brown, dark grayish brown, and gray and is firm. The underlying material to a depth of 60 inches is gray and light brownish gray, mottled clay loam. In places, strata of silt and very fine sand are below a depth of 40 inches. In some areas, the subsoil contains more clay.

Included with these soils in mapping are small areas of Tetonka soils. These included soils make up less than 15 percent of any one mapped area. They contain more clay in the subsoil than the Egan and Whitewood soils. They are in small, enclosed depressions and are poorly drained.

Permeability is moderate in the subsoil of the Egan soil and moderately slow in the underlying material. It is moderately slow in the Whitewood soil. Available water capacity is high in both soils. Organic-matter content and fertility also are high. Runoff is slow. The Whitewood soil has a perched water table that fluctuates between the surface and a depth of 2 feet in most years.

Almost all areas are farmed. These soils have good potential for cultivated crops, rangeland, windbreaks and environmental plantings, and openland wildlife habitat. The Egan soil has good potential and the Whitewood soil fair potential for tame pasture and hay and for rangeland wildlife habitat. The Egan soil has fair potential and the Whitewood soil poor potential for most building sites and sanitary facilities.

These soils are suited to cultivated crops. The main concerns of management are the wetness of the Whitewood soil and maintenance of fertility in the Egan soil. Returning crop residue to the soil improves fertility and tilth and increases the infiltration rate. Planting and harvesting may be delayed on the Whitewood soil because of flooding and wetness.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

These soils are well suited to rangeland, but very few areas are used as rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, the tall grasses lose vigor and are replaced by less palatable species.

Buildings should be constructed only on the Egan soil because of flooding in the Whitewood soil. Reinforcing the footings and foundations helps overcome the moderate shrink-swell potential and low strength of the Egan soil. If local roads are constructed across areas of these soils, the base material should be strengthened or replaced. Also, the roads should be graded to shed water and thus prevent the damage caused by frost action and low strength.

Septic tank absorption fields function adequately in the Egan soil if they are enlarged to overcome the slow absorption rate. Sewage lagoons function well on both soils. Those located on the Whitewood soil are protected from flooding by their own embankments. Capability unit I-2; Egan soil in Silty range site, Whitewood soil in Subirrigated range site.

EhA—Enet-Delmont loams, 0 to 2 percent slopes. These nearly level, well drained and somewhat excessively drained soils are on high upland flats and stream terraces. The Enet soil is moderately deep to sand and gravel and the Delmont soil shallow to sand and gravel. Areas of these soils range from 5 to 80 acres in size and are irregular in shape. They are about 45 to 55 percent Enet soil and 30 to 40 percent Delmont soil. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Enet soil has a surface layer of very dark gray loam about 8 inches thick. The subsoil is friable loam about 26 inches thick. The upper part is very dark grayish brown, and the lower part is dark brown. The underlying material to a depth of 60 inches is light brownish gray, calcareous, loose sand and gravel. Coatings of lime are on the gravel in the upper part. In places, the soil has lime closer to the surface and is wetter.

Typically, the Delmont soil has a surface layer of very dark grayish brown loam about 7 inches thick. The subsoil is about 11 inches of very dark grayish brown, very friable loam. The underlying material to a depth of 60 inches is grayish brown and light yellowish brown, calcareous sand and gravel.

Included with these soils in mapping are small areas of Blendon, Clarno, and Thurman soils. These included soils make up less than 20 percent of any one mapped area. They occur in a random pattern throughout the map unit. Their underlying material is not sand and gravel.

Permeability is moderate in the subsoil of the Enet soil and rapid in the underlying material. It is moderately rapid in the subsoil of the Delmont soil and rapid in the underlying material. Available water capacity is moderate in the Enet soil and low in the Delmont soil. Organic-matter content and fertility are high in the Enet soil. Organic-matter content is moderate and fertility medium in the Delmont soil. Runoff is slow on both soils.

Almost all areas are farmed or used as rangeland. These soils have good potential for cultivated crops and fair potential for openland wildlife habitat. The Enet soil has good potential and the Delmont soil poor potential for rangeland and rangeland wildlife habitat. The Enet soil has fair potential and the Delmont soil poor potential for windbreaks and environmental plantings. The Enet soil has good potential and the Delmont soil fair potential for tame pasture and hay. Both soils have good potential for most building sites and poor potential for most sanitary facilities.

These soils are better suited to small grain and tame pasture and hay than to row crops. The main concern of management is conserving moisture. Returning crop residue to the soil helps maintain fertility, increases the rate of water intake, and conserves moisture. Including grasses and legumes in the cropping system helps to maintain fertility.

Tame pasture and hay are suitable alternative uses of these soils. If tame pastures are overstocked, however, the more desirable grasses lose vigor and are replaced by less productive grasses and other plants. Proper stocking rates, rotation grazing, weed control, and timely deferment of grazing help keep the pasture in good condition.

Because these soils are droughty, optimum growth of windbreaks and environmental plantings cannot be expected. Drought-tolerant trees and shrubs can be established, but good survival and growth rates cannot be expected in most years.

The areas of these soils that are used as rangeland have a cover of mid and short grasses. The Delmont soil, which is droughty, has a sparse plant cover. If rangeland is overgrazed, the mid grasses are replaced by short grasses. If overgrazing continues on the Delmont soil, the size of bare areas increases. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

These soils are well suited to building site development, but the sides of shallow excavations can cave in. Septic tank absorption fields function well on these soils, but the effluent from all sanitary facilities can pollute shallow ground water. The Delmont soil is a good source of sand and gravel. Capability unit IIs-3; Enet soil in Silty range site, Delmont soil in Shallow to Gravel range site.

EhB—Enet-Delmont loams, 2 to 6 percent slopes. These well drained and somewhat excessively drained, gently sloping soils are on stream terraces and outwash plains. The Enet soil is moderately deep to sand and gravel and the Delmont soil shallow to sand and gravel. Slopes generally are short and slightly convex. Individual areas range from 5 to 80 acres in size and are irregular in shape. They are about 40 to 50 percent Enet soil and 35 to 45 percent Delmont soil. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Enet soil has a surface layer of very dark gray loam about 8 inches thick. The subsoil is friable loam about 26 inches thick. The upper part is very dark grayish brown, and the lower part is dark brown. The underlying material to a depth of 60 inches is light brownish gray, calcareous, loose sand and gravel. Coatings of lime are on the gravel in the upper part.

Typically, the Delmont soil has a surface layer of very dark grayish brown loam about 7 inches thick. The subsoil is about 11 inches of very dark grayish brown, very friable loam. The underlying material to a depth of 60 inches is grayish brown and light yellowish brown, calcareous sand and gravel.

Included with these soils in mapping are small areas of Blendon, Clarno, Davis, and Thurman soils. These included soils make up less than 20 percent of any one mapped area. They occur in a random pattern throughout the map unit. Their underlying material is not sand and gravel.

Permeability is moderate in the subsoil of the Enet soil and rapid in the underlying material. It is moderately rapid in the subsoil of the Delmont soil and rapid in the underlying material. Available water capacity is moderate in the Enet soil and low in the Delmont soil. Organic-matter content and fertility are high in the Enet soil. Organic-matter content is moderate and fertility medium in the Delmont soil. Runoff is medium on both soils.

These soils are farmed or used as rangeland. They have fair potential for crops. The Enet soil has fair potential and the Delmont soil poor potential for windbreaks and environmental plantings and for openland wildlife habitat. The Enet soil has good potential and the Delmont soil poor potential for rangeland and rangeland wildlife habitat. The Enet soil has good potential and the

Delmont soil fair potential for tame pasture and hay. Both soils have good potential for most building sites and poor potential for most sanitary facilities.

These soils are better suited to small grain and tame pasture and hay than to row crops. The main concerns of management are conserving moisture and controlling erosion. Returning crop residue to the soil helps maintain fertility, improves tilth, conserves moisture, and reduces the runoff rate. Contour farming helps control erosion and conserves moisture.

Using these soils for tame pasture and hay is effective in controlling erosion and conserving moisture. If pasture is overstocked, the more desirable grasses lose vigor and are replaced by less productive grasses and other plants. As a result, the risks of erosion and runoff are increased. Proper stocking rates, rotation grazing, weed control, and timely deferment of grazing help keep the pasture in good condition.

Because these soils are droughty, optimum growth of windbreaks and environmental plantings cannot be expected. Drought-tolerant trees and shrubs can be established, but good survival and growth rates cannot be expected in most years.

The areas of these soils that are used as rangeland have a cover of mid and short grasses. The Delmont soil, which is droughty, has a sparse plant cover. If rangeland is overgrazed, the mid grasses are replaced by short grasses. If overgrazing continues on the Delmont soil, the size of bare areas and the risks of erosion and runoff increase. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

These soils are well suited to building site development, but the sides of shallow excavations can cave in. Septic tank absorption fields function well on these soils. The effluent from all sanitary facilities, however, can pollute shallow ground water. The Delmont soil is a good source of sand and gravel. Capability unit IIIs-2; Enet soil in Silty range site, Delmont soil in Shallow to Gravel range site.

EkD—Ethan stony loam, 3 to 25 percent slopes. This deep, well drained, stony, gently sloping to moderately steep soil is on uplands. Individual areas of this soil range from 5 to 50 acres in size and generally are long and narrow. The stones are as much as 4 feet in diameter and are 1 to 5 feet apart. Slopes generally are short and single but are short and complex in some areas.

Typically, the surface layer is about 4 inches of dark grayish brown, calcareous stony loam. The subsoil is about 12 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam that has spots of lime. In places, the underlying material has strata of very fine sand. In some areas, the surface layer is lighter in color.

Included with this soil in mapping are small areas of Talmo soils. These soils make up less than 10 percent of any one mapped area. They have loose sand and gravel at a depth of 10 inches or less. They occur in a random pattern throughout the map unit.

Permeability is moderate in the subsoil of the Ethan soil and moderately slow in the underlying material. Available water capacity is high. Organic-matter content is low or moderate, and fertility is low or medium. Runoff is medium or rapid.

Almost all areas are rangeland. This soil has good potential for rangeland and for rangeland wildlife habitat. It has poor potential for cultivated crops, windbreaks and environmental plantings, openland wildlife habitat, tame pasture and hay, building sites, and most sanitary facilities.

This soil generally is too steep and too stony for crops, tame pasture and hay, and windbreaks and environmental plantings. It is best suited to rangeland. The native vegetation is mid and tall grasses. The major concern of management is controlling erosion. Maintaining an adequate vegetative cover and ground mulch helps prevent excessive soil loss and improves the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective cover and causes deterioration of the plant community. Under these conditions, bluestems and needlegrasses are replaced by less palatable species. If overuse continues for many years, Kentucky bluegrass and weeds occupy the site. Proper stocking rates, uniform grazing distribution, timely deferment of grazing, and a planned grazing system help keep the range and the soil in good condition.

This soil generally is too steep for buildings. If roads are constructed across areas of this soil, the base material should be strengthened. Ditches and road cuts should be reseeded to prevent excessive roadside erosion. This soil generally is too steep and too stony for sanitary facilities. Capability unit VIIs-1; Silty range site.

EmE—Ethan-Betts loams, 15 to 40 percent slopes. These deep, well drained and excessively drained, moderately steep and steep soils are on breaks adjacent to rivers and creeks. Scattered stones and boulders are common in some areas. Individual areas of this unit range from 15 to several hundred acres in size. They are about 45 to 55 percent Ethan soil and 25 to 35 percent Betts soil. The Ethan soil is at midslope and on the broader ridgetops. The Betts soil is on narrow, convex ridges and the sharper slope breaks. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 4 inches thick. The subsoil is about 12 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam that has spots of lime. In places, the underlying material has strata of sand and small pebbles. In areas that are heavily wooded, the surface layer is thicker and darker. In some areas, the depth to lime is greater.

Typically, the Betts soil has a surface layer of grayish brown, calcareous loam about 3 inches thick. Next is a transitional layer of pale brown, friable, calcareous clay loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray, light gray, and pale yellow, calcareous clay loam. In places, strata of sand and small pebbles are in the lower part of the soil.

Included with these soils in mapping are small areas of Davis, Gavins, Roxbury, and Talmo soils. These included soils make up less than 20 percent of any one mapped area. Davis soils have a thicker surface layer than the Ethan and Betts soils. They are on toe slopes and in the less sloping areas. Gavins soils have soft chalk rock at a depth of 20 inches or less. Roxbury soils are more silty throughout than the Ethan and Betts soils. They are on terraces adjacent to drainageways. Talmo soils have loose sand and gravel at a depth of 10 inches or less. Like the Gavins soils, they occur in a random pattern throughout the map unit. Also included are areas of shale outcrop on some of the steeper breaks and side slopes.

Permeability is moderate in the subsoil of the Ethan and Betts soils and moderately slow in the underlying material. Available water capacity is high in both soils. Organic-matter content is moderate or moderately low in the Ethan soil and low in the Betts soil. Fertility is low or medium in the Ethan soil and low in the Betts soil. Runoff is rapid on both soils.

Most areas support native grass and are used for grazing. A few trees are in some drainageways. These soils have poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and openland wildlife habitat. The Ethan soil has good potential and the Betts soil fair potential for rangeland and rangeland wildlife habitat. Both soils have poor potential for building sites and sanitary facilities.

These soils are best suited to rangeland. The native vegetation is a mixture of mid and short grasses. The major problem of range management is erosion. Management that maintains an adequate vegetative cover and ground mulch helps prevent excessive soil losses and improves the moisture supply by reducing the runoff rate. If rangeland is overgrazed, bluestems and other tall species are replaced by needleandthread and sideoats grama. If overuse continues for many years, Kentucky bluegrass and weeds occupy the site. Proper stocking rates, uniform grazing distribution, timely deferment of grazing, and a planned grazing system help keep the range and the soil in good condition. Some of the deeper draws are good sites for stock water dams.

These soils generally are too steep for crops, tame pasture and hay, and windbreaks and environmental plantings. The native trees on the side slopes and in the draws provide habitat for such woodland wildlife as deer and squirrels.

These soils are too steep for buildings and sanitary facilities. If roads are constructed in areas of these soils, the road cuts should be seeded to prevent excessive roadside erosion. Capability unit VIIe-1; Ethan soil in Silty range site, Betts soil in Thin Upland range site.

EnC—Ethan-Bonilla loams, 3 to 9 percent slopes. These deep, well drained and moderately well drained, gently sloping and gently rolling soils are on uplands. Slopes are single or complex and are short. They generally are along drainageways, or they enclose the shorter drainageways. Individual areas of these soils range from 5 to 80 acres in size and are long and narrow. They are about 50 to 60 percent Ethan soil and 20 to 30 percent Bonilla soil.

The Ethan soil is on the mid and upper side slopes and on the tops of knobs. The Bonilla soil is on the toe slopes and in the broader swales. It is commonly flooded during periods of heavy rain or rapid snowmelt. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 8 inches thick. The subsoil is about 8 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam that has spots of lime. In places, the underlying material has strata of sand and small pebbles. In some areas, the depth to lime is greater.

Typically, the Bonilla soil has a surface layer of dark grayish brown loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown, friable loam; the middle part is grayish brown and brown, firm clay loam; the lower part is pale olive, firm, calcareous clay loam that has spots of lime. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous loam or clay loam that has accumulations of lime.

Included with these soils in mapping are small areas of Crossplain and Thurman soils. These included soils make up less than 15 percent of any one mapped area. Crossplain soils are somewhat poorly drained and are in entrenched swales. Thurman soils contain more sand in the underlying material than the Ethan and Betts soils. They are on knobs and the upper slopes.

Permeability is moderate in the subsoil of the Ethan and Betts soils and moderately slow in the underlying material. Available water capacity is high in both soils. Organic-matter content is moderate or moderately low in the Ethan soil and high in the Bonilla soil. Fertility is low or medium in the Ethan soil and high in the Bonilla soil. The Bonilla soil has a perched water table at a depth of

3 to 6 feet part of the year. Runoff is medium on both soils.

Most areas are farmed. These soils have fair potential for cultivated crops and good potential for rangeland. The Ethan soil has fair potential and the Bonilla soil good potential for tame pasture and hay and for windbreaks and environmental plantings. The Ethan soil has poor potential and the Bonilla soil good potential for openland wildlife habitat. The Ethan soil has good potential and the Bonilla soil fair potential for rangeland wildlife habitat. The Ethan soil has fair potential and the Bonilla soil poor potential for most building sites and sanitary facilities.

These soils are best suited to small grain, alfalfa, and tame grasses. The main concern of management is controlling erosion. Crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help prevent excessive soil losses, conserve moisture, and maintain fertility and tilth. Including tame grasses and legumes in the cropping system helps in controlling erosion.

Using these soils for tame pasture and hay also is effective in controlling erosion. All climatically adapted pasture plants can grow well. Proper stocking rates, pasture rotation, timely deferment of grazing, applications of fertilizer, and weed control help keep the pasture in good condition.

These soils are suited to windbreaks and environmental plantings. Optimum growth, however, cannot be expected on the Ethan soil. A year of fallow prior to planting helps to eliminate undesirable grasses and weeds and stores moisture. Planting trees on the contour helps to control erosion between the rows. Competing vegetation prevents maximum growth. It can be controlled by timely cultivation and by herbicides.

These soils are well suited to rangeland, but very few acres are used for rangeland. The major concern of management is controlling erosion. Maintaining an adequate vegetative cover and ground mulch helps prevent excessive soil loss and reduces the runoff rate. Overgrazing reduces the protective cover and causes deterioration of the plant community. Under these conditions, bluestems and needlegrasses are replaced by less palatable species. If overuse continues for many years, Kentucky bluegrass and weeds occupy the site. Proper stocking rates, uniform grazing distribution, timely deferment of grazing, and a planned grazing system help keep the range and the soil in good condition.

Buildings should be constructed only on the Ethan soil because of flooding on the Bonilla soil. Reinforcing the footings and foundations helps overcome the moderate shrink-swell potential and low strength of the Ethan soil. If local roads are constructed across areas of these soils, the base material should be strengthened. Also, the roads should be graded to shed water.

Septic tank absorption fields function adequately in the Ethan soil if the absorption area is enlarged to overcome the slow absorption rate. The Bonilla soil is flooded too frequently to be used as a septic tank absorption field. Sewage lagoons function well on both soils, but considerable land shaping may be necessary on the Ethan soil. The lagoons in the Bonilla soil are protected from flooding by their own embankments. They should be sealed to prevent seepage. Capability unit IVe-2; Silty range site.

EoD—Ethan-Davis loams, 9 to 15 percent slopes. These deep, well drained, rolling and strongly sloping soils are on uplands. Slopes are short and complex on the higher part of the landscape and short and smooth on the lower part. Individual areas of this unit range from 15 to 500 acres in size. They are about 50 to 60 percent Ethan soil and 35 to 45 percent Davis soil. The Ethan soil is on the higher parts of the landscape. The Davis soil is on side slopes and on foot slopes. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 4 inches thick. The subsoil is about 12 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam that has spots of lime. In places, the underlying material has thin lenses of sand and fine gravel. On some of the ridges, the surface layer is thinner. In some of the less sloping areas, the depth to lime is greater.

Typically, the Davis soil has a surface layer of very dark gray loam about 9 inches thick. The subsoil is about 29 inches thick. It is dark gray, friable loam in the upper part; grayish brown, friable loam in the middle part; and light brownish gray, friable, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray and pale brown, calcareous clay loam.

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 occur in a random pattern throughout the map unit. Talmo soils have loose sand and gravel at a depth of 10 inches or less. Thurman soils contain more sand than the Ethan and Davis 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. Organic-matter content is moderate or moderately low and fertility low or medium in the Ethan soil. Organic-matter content and fertility are high in the Davis soil. Runoff is medium on both soils.

Most areas are rangeland or tame pasture and are used for grazing or hay. These soils have good potential for rangeland and rangeland wildlife habitat. They have poor potential for cultivated crops. The Ethan soil has fair potential for tame pasture and hay and poor potential for windbreaks and environmental plantings. The Davis soil has good potential for tame pasture and hay, for windbreaks and environmental plantings, and for openland wildlife habitat. Both soils have fair potential for most building sites and sanitary facilities.

These soils are well suited to rangeland. The native vegetation is a mixture of tall and mid grasses. The main concerns of management are conserving moisture and controlling erosion. Management that maintains an adequate vegetative cover and ground mulch helps prevent excessive soil losses and improves the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective vegetative cover and causes deterioration of the plant community. Under these conditions, bluestems and needlegrasses decrease in extent and are replaced by less palatable species. If overuse continues for many years, Kentucky bluegrass and weeds occupy the site. Proper stocking rates, uniform grazing distribution, timely deferment of grazing, and a planned grazing system help keep the range in good condition. Some areas are suitable sites for reservoirs.

These soils are suited to tame pasture and hay, but careful management is needed to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pasture in good condition.

The Davis soil can be farmed if it is intensively managed to prevent excessive erosion. It is commonly in areas so small, so extensively dissected by drainageways, or so closely intermingled with areas of the Ethan soil, however, that farming it separately is not feasible. The Ethan soil is too steep to be farmed without excessive soil loss.

Windbreaks can be planted on the Davis soil. A year of fallow prior to planting helps eliminate undesirable grasses and weeds and stores moisture. Planting on the contour helps control erosion and conserves moisture.

Reinforcing the footings and foundations of buildings helps to prevent the structural damage caused by the low strength and shrinking and swelling of these soils. Considerable land leveling and erosion control are needed on most building sites. The base material for local roads and streets should be strengthened or replaced to prevent the damage resulting from low strength. Road cuts should be seeded to prevent excessive roadside erosion. Enlarging the absorption area helps overcome the slow absorption rate in septic tank absorption fields. The strong slopes, however, restrict the possible size and shape of most absorption fields. Also, they limit the soils as sites for other sanitary facilities. Capability unit VIe-3; Silty range site.

EpD—Ethan-Talmo loams, 6 to 15 percent slopes. These well drained and excessively drained, moderately sloping and strongly sloping soils are on ridges and breaks adjacent to the major creeks and tributaries in the uplands. Slopes are short and complex. Individual areas of this unit range from 10 to 50 acres in size and are irregular in shape. They are about 40 to 50 percent Ethan soil and 30 to 40 percent Talmo soil. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 4 inches thick. The subsoil is about 12 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam that has spots of lime. In places, the underlying material has thin strata of sand and small pebbles. On some of the ridges, the surface layer is thinner. In some of the less sloping areas, the depth to lime is greater.

Typically, the surface layer of the Talmo soil is about 9 inches thick. It is very dark grayish brown loam in the upper part and dark grayish brown, very friable, calcareous gravelly loam in the lower part. The underlying material to a depth of 60 inches is brown, calcareous sand and gravel.

Included with these soils in mapping are small areas of Davis, Delmont, and Thurman soils. These included soils make up less than 20 percent of any one mapped area. Davis soils have a thicker and darker surface layer than the Ethan and Talmo soils. They are on toe slopes. Delmont soils have sand and gravel at a depth of 10 to 20 inches. Thurman soils do not have the sand and gravel underlying material characteristic of the Talmo soil and contain more sand than the Ethan soil. Delmont and Thurman soils occur in a random pattern throughout the map unit.

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

Most areas are native rangeland. These soils have poor potential for cultivated crops, windbreaks and environmental plantings, and openland wildlife habitat. The Ethan soil has good potential and the Talmo soil poor potential for rangeland and rangeland wildlife habitat. The Ethan soil has fair potential and the Talmo soil poor potential for tame pasture and hay. Both soils have fair potential for most building sites and poor potential for most sanitary facilities. Some areas of the Talmo soil are used as a source of gravel.

These soils are best suited to native rangeland. The native vegetation is a mixture of tall and mid grasses on the Ethan soil and a mixture of mid and short grasses on the Talmo soil. The Talmo soil is droughty because it has low available water capacity. If rangeland is overgrazed, bluestems and needlegrasses are replaced by less palatable species. If overgrazing is severe, weeds are established or the surface is bare. Establishing vegetation is difficult in overgrazed areas. The bare areas are subject to soil blowing. Proper stocking rates, uniform grazing distribution, timely deferment of grazing, and a planned grazing system help keep the range in good condition.

These soils are poorly suited to cultivated crops and windbreaks and environmental plantings. The Ethan soil is excessively steep, and the Talmo soil is too shallow to sand and gravel.

These soils are not well suited to tame pasture. The Ethan soil is too steep and the Talmo soil too shallow to sand and gravel. The Talmo soil produces very little pasture grass. The Ethan soil is susceptible to erosion because of the strong slopes.

Reinforcing the footings and foundations of buildings helps to prevent the structural damage caused by the low strength and shrinking and swelling of the Ethan soil. Considerable land leveling and erosion control are needed on most building sites. The base material should be strengthened if the Ethan soil is used as a site for local roads and streets. Road cuts should be seeded to prevent excessive roadside erosion.

Enlarging the absorption area helps overcome the slow absorption rate if the Ethan soil is used as a septic tank absorption field. The Talmo soil is well suited to septic tank absorption fields. The strong slopes, however, limit the possible size and shape of the absorption field in both soils. The effluent from any sanitary facility in the Talmo soil can pollute shallow ground water. Seepage occurs if the overlying gravel contacts the underlying glacial till. Capability unit VIe-3; Ethan soil in Silty range site, Talmo soil in Very Shallow range site.

Fa—Forney silty clay loam. This deep, poorly drained, nearly level soil is on the lower parts of the bottom land along the Missouri River. Rare flooding is a hazard, but it occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 10 to several hundred acres in size and are generally irregular in shape.

Typically, the surface layer is grayish brown silty clay loam about 11 inches thick. To a depth of 16 inches, the underlying material is very friable silty clay loam that is dark gray and has many rust-colored spots. Between depths of 16 and 60 inches, it is dark gray, light olive gray, and light gray silty clay and silty clay loam. In places, the underlying material is highly stratified with thin layers that contrast in texture and color.

Included with this soil in mapping are small areas of Haynie, Owego, and Onawa soils. These soils make up less than 15 percent of any one mapped area. They occur in a random pattern throughout the map unit. The Haynie soils are silt loam throughout. The Owego soils have a thick subsurface layer of silt loam. The Onawa soils are sandy in the underlying material.

Permeability is very slow in the Forney soil. Available water capacity is moderate. Organic-matter content also is moderate, and fertility is medium. The shrink-swell potential is high. Runoff is very slow. This soil has a water table at a depth of 1 to 3 feet most of the year.

Almost all areas of this soil are farmed. The soil has good potential for rangeland, tame pasture and hay, windbreaks and environmental plantings, and openland wildlife habitat. It has fair potential for cultivated crops and rangeland wildlife habitat. It has poor potential for building sites and most sanitary facilities.

This soil is suited to cultivated crops. Returning crop residue to the soil improves tilth and fertility and increases the infiltration rate. Avoiding fieldwork when the soil is wet helps to prevent puddling of the soil. Planting and harvesting may be delayed during wet periods.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is poorly suited to building site development because of the wetness, the low strength, and the high shrink-swell potential. If roads are constructed across areas of this soil, the base material should be strengthened or replaced to overcome the low strength and the high shrink-swell potential. Adequate surface drainage is needed. This soil is poorly suited to septic tank absorption fields because of wetness. Sewage lagoons function well on this soil; their embankments provide protection from flooding. Capability unit IIIw-2; Clayey range site.

Ga—Grable silt loam. This deep, well drained, nearly level soil is on the higher parts of the bottom land along the Missouri River, near the present channel and on alluvial fans adjacent to upland escarpments. Very brief flooding is a hazard, but it occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 10 to several hundred acres in size and are irregular in shape.

Typically, the surface layer is grayish brown, calcareous silt loam about 7 inches thick. To a depth of 28 inches, the underlying material is light gray, calcareous, very friable silt loam. Below this to a depth of 60 inches, it is light brownish gray, calcareous fine sand. In places, the surface layer is not so dark.

Included with this soil in mapping are small areas of Blake, Haynie, and Onawa soils. These soils make up less than 15 percent of any one mapped area. Blake soils contain more clay throughout than the Grable soil. Haynie soils are silty throughout. Blake and Haynie soils occur in a random pattern throughout the map unit. Onawa soils are in the lower positions. They contain more clay in the surface layer and subsoil than the Grable soil.

Permeability is moderate in the upper part of the Grable soil and rapid in the underlying material. Available water capacity is moderate. Organic-matter content and fertility are low. Runoff is slow.

Almost all areas are cultivated. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, rangeland wildlife habitat, and openland wildlife habitat. It has fair potential for windbreaks and environmental plantings. It has good potential for truck gardening and nursery stock and poor potential for most building sites and sanitary facilities.

This soil is suited to cultivated crops. The main concerns of management are low fertility and soil blowing. Management practices that maintain adequate cover during dry, windy periods help control soil blowing. Returning crop residue to the soil improves fertility and tilth and increases the infiltration rate. Planting and harvesting may be delayed during wet periods.

This soil is well suited to truck gardening and nursery stock. Irrigation is essential to meet the peak water demands of the crop.

This soil is suited to windbreaks and environmental plantings. It is somewhat droughty, however, because of the underlying sand. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Using the soil for tame pasture and hay is an effective way to control soil blowing. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

Buildings constructed on this soil should be protected from local flooding. Also, the ground water can seep into basements during wet periods. Roads constructed across areas of this soil should be graded to shed water. The effluent from all sanitary facilities can pollute the ground water because of the rapidly permeable underlying material. Capability unit IIs-3; Silty range site.

Gb—Graceville silty clay loam. This deep, well drained, nearly level soil is on terraces on bottom land along the major creeks. It is subject to rare flooding. Areas of this soil range from 15 to 75 acres in size and generally are irregular in shape.

Typically, the surface layer is dark grayish brown silty clay loam about 16 inches thick. The subsoil is about 29 inches of brown, pale brown, and light yellowish brown, friable silty clay loam. The underlying material to a depth of 60 inches is brown gravelly sand. In places, sand and gravel is at a depth of 40 inches or less.

Included with this soil in mapping are small areas of Roxbury and Wentworth soils. These soils make up less than 15 percent of any one mapped area. They do not have sand and gravel in the underlying material. The Roxbury soils have lime at the surface. Their position on the landscape is similar to that of the Graceville soil. The Wentworth soils are on adjacent uplands.

Permeability is moderate in the upper part of the Graceville soil and rapid in the underlying gravelly sand. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow.

Almost all areas are farmed or used as rangeland. This soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and openland wildlife habitat. It has fair potential for rangeland wildlife habitat and poor potential for most building sites and sanitary facilities. Some areas are used as a source of gravel.

This soil is well suited to cultivated crops. It has few limitations. It is subject to rare flooding, but the flooding is brief and fieldwork is delayed for only a short time. Returning crop residue to the soil improves fertility and tilth and increases the infiltration rate.

This soil is well suited to pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to rangeland. The native vegetation is a mixture of tall grasses. Overgrazing reduces the protective cover and causes deterioration of the plant community. Under these conditions, the tall grasses lose vigor and the stand thins out. After many years of overuse, Kentucky bluegrass is the principal grass.

Because of the flood hazard, this soil is poorly suited to building site development. If roads are built across areas of this soil, the base material should be strengthened or replaced in order to prevent the damage caused by frost action and low strength. Also, the roads should be graded to provide adequate drainage. Septic tank absorption fields function well on this soil if they are protected from flooding. The effluent from all sanitary facilities, however, can pollute shallow ground water. Capability unit I-3; Overflow range site.

Ha—Haynie silt loam. This deep, moderately well drained, nearly level soil is on the higher parts of the bottom land near the present channel of the Missouri River. In some areas, it is subject to rare, brief flooding. Areas of this soil range from 10 to several hundred acres in size and are irregular in shape.

Typically, the surface layer is grayish brown and pale brown, calcareous silt loam about 9 inches thick. To a depth of 53 inches, the underlying material is pale brown and very pale brown, calcareous silt loam. Below this to a depth of 60 inches, it is light brownish gray, mottled silty clay. In places, the surface layer is silty clay loam. In some areas, it is not so dark.

Included with this soil in mapping are small areas of Blake, Grable, and Onawa soils. These soils make up less than 15 percent of any one mapped area. They occur in a random pattern throughout the map unit. The Blake soils contain more clay throughout than the Haynie soil. The Grable soils have sand below a depth of 28 inches. The Onawa soils contain more clay in the upper part than the Haynie soil.

Permeability is moderate in the upper part of the Haynie soil and slow in the lower part. Available water capacity is high. Organic-matter content and fertility are low. Runoff is slow. This soil has a perched water table at a depth of 4 to 6 feet most of the year.

Almost all areas are farmed. This soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, tame pasture and hay, and openland wildlife habitat. It has fair potential for rangeland wildlife habitat and for most building sites and most sanitary facilities.

This soil is well suited to cultivated crops. The main concern of management is improving fertility. Returning crop residue to the soil improves fertility and tilth and increases the infiltration rate.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is well suited to building site development, but ground water can seep into basements during wet periods. Roads should be graded to provide drainage and thus prevent the damage caused by frost action. Enlarging the absorption area of septic tank absorption fields helps overcome the slow absorption rate of this soil. Wetness may be a problem during wet periods. Sealing the bottom and sides of sewage lagoons helps prevent seepage. Capability unit I-1; Overflow range site.

Hb—Haynie silty clay loam, overwash. This deep, moderately well drained, nearly level soil is on the lower parts of the bottom land near the present channel of the Missouri River. It is subject to rare, brief flooding. Areas of this soil range from 10 to 300 acres in size and generally are long and narrow.

Typically, the surface layer is light brownish gray, calcareous silty clay loam about 16 inches thick. The underlying material to a depth of 60 inches is pale brown and very pale brown, calcareous silt loam. In places, the surface layer is thicker. In some areas, silty clay is below a depth of 40 inches.

Included with this soil in mapping are small areas of Forney and Onawa soils. These soils make up less than 15 percent of any one mapped area. They occur in a random pattern throughout the map unit. The Forney soils contain more clay than the Haynie soil. The Onawa soils have a clayey surface layer.

Permeability is moderate in the Haynie soil. Available water capacity is high. Organic-matter content and fertility are low. Runoff is slow. This soil has a perched water table at a depth of 4 to 6 feet most of the year.

Almost all areas are farmed. Some support native trees. This soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and openland wildlife habitat. It has fair potential for rangeland wildlife habitat and poor potential for most building sites and sanitary facilities.

This soil is well suited to cultivated crops. The main concerns of management are the low fertility and the rare flooding. Returning crop residue to the soil improves tilth and fertility and increases the infiltration rate. Planting and harvesting may be delayed during periods of heavy rainfall.

The soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is poorly suited to most kinds of building site development. If roads are constructed across areas of this soil, artificial drainage is needed to prevent the damage caused by frost action. Sanitary facilities should be protected from flooding. Wetness is a problem during some periods. Sealing the bottom and sides of sewage lagoons helps prevent seepage. Capability unit IIw-3; Overflow range site.

Ja—James silty clay loam. This deep, poorly drained, nearly level soil is on bottom land. It is frequently flooded for long periods. Individual areas range from 20 to 200 acres in size and are irregular in shape.

Typically, the surface layer is about 18 inches of very dark gray silty clay loam that has many nests of salts. The subsoil is about 10 inches of dark gray, very firm silty clay loam that has nests of salts. To a depth of 40 inches, the underlying material is gray, mottled silty clay loam that has nests of salts and accumulations of lime. Below this to a depth of 60 inches, it is gray, mottled silty clay loam that has many nests of salts. In places, no salts are in the surface layer or subsoil. In some areas, the content of clay is lower throughout.

Included with this soil in mapping are small areas of Clamo and Lamo soils, which are in similar positions on the landscape. These soils make up less than 15 percent of any one mapped area. They do not have salts. In addition, Lamo soils contain less clay than the James soil.

Permeability is slow in the James soil. Available water capacity is moderate. Organic-matter content and fertility are high. The shrink-swell potential also is high. Runoff is very slow. This soil has a water table that is within a depth of 1 foot most of the year.

Most areas are used for tame pasture and hay. This soil has poor potential for windbreaks and environmental plantings, cultivated crops, and openland wildlife habitat. It has fair potential for tame pasture and hay, rangeland, and rangeland wildlife habitat and poor potential for building sites and sanitary facilities.

This soil generally is too wet for most cultivated crops. Surface drainage systems remove excess water in most places. The high content of salts limits the choice of crops.

If this soil is used for tame pasture or hay, the choice of grasses is very limited. Tall wheatgrass and western wheatgrass are the most salt-tolerant grasses. Limiting grazing to periods when the soil is dry prevents puddling of the surface layer. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is not suited to windbreaks and environmental plantings. The water table and the salts content are too high.

In areas that are used as rangeland, the native vegetation is salt-tolerant tall and mid grasses. Overgrazing reduces the protective cover and causes deterioration of the plant community. Under these conditions, the taller, more palatable grasses lose vigor and thin out and are replaced by saltgrass, which is less productive and less palatable. Proper stocking rates, uniform distribution of grazing, and timely deferment of grazing help keep the range and the soil in good condition.

This soil is poorly suited to building site development and sanitary facilities because of the flooding and the high water table. If roads are built across areas of this soil, the base material should be strengthened or replaced. Also, the roads should be graded to prevent the damage caused by frost action. Capability unit IVw-2; Saline Lowland range site.

La—Lakeport silty clay loam. This deep, somewhat poorly drained, nearly level soil is on the higher parts of the bottom land along the Missouri River. Rare flooding is a hazard, but it occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 5 to 500 acres in size and are irregular in shape.

Typically, the surface layer is dark gray silty clay loam about 19 inches thick. The subsoil is about 25 inches of grayish brown and light brownish gray, friable silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silt loam. In places, the underlying material is silty clay loam. In some areas, the content of clay is lower throughout.

Included with this soil in mapping are small areas of Blencoe and Blyburg soils. These soils make up less than 15 percent of any one mapped area. They occur in a random pattern throughout the map unit. The Blencoe soils are shallower to loamy material than the Lakeport soil, and the Blyburg soils contain less clay throughout.

Permeability is moderately slow in the Lakeport soil. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow. This soil has a water table at a depth of 2 to 4 feet most of the year.

Almost all areas are farmed. This soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, tame pasture and hay, openland wildlife habitat, and rangeland wildlife habitat. It has poor potential for building sites and most sanitary facilities.

This soil is suited to cultivated crops. The main concern of management is excess water, which may delay planting and harvesting. Crop residue management helps maintain a high fertility level and good tilth. Surface drainage systems can be used to remove excess water.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Because of wetness, flooding, low strength, and a high shrink-swell potential, this soil is poorly suited to building site development. If roads are constructed across areas of this soil, the base material should be strengthened or replaced to overcome the low strength and high shrink-swell potential. Roads should be graded to provide drainage and thus prevent the damage caused by frost action. The soil is poorly suited to septic tank absorption fields because of wetness. Sewage lagoons function well; their embankments provide protection from flooding. Capability unit IIw-1; Clayey range site.

Lb—Lamo silty clay loam. This deep, somewhat poorly drained, nearly level soil is on bottom land. It is occasionally flooded for brief periods. Individual areas of this soil are 20 to 200 acres in size and generally are long and narrow.

Typically, the surface layer is dark gray, calcareous silty clay loam about 16 inches thick. Next is a transitional layer of grayish brown, very friable, calcareous silt loam about 12 inches thick. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous silt loam and silty clay loam. In places, strata of silt or very fine sand are in the underlying material. In some areas, the soil is better drained.

Included with this soil in mapping are small areas of Clamo, James, amd Salmo soils. These soils make up less than 15 percent of any one mapped area. Clamo soils contain more clay than the Lamo soil. They occur in a random pattern throughout the map unit. James and

Salmo soils contain visible salts. They are on the slightly lower parts of the landscape.

Permeability is moderately slow in the Lamo soil. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow. This soil has a water table at a depth of 2 to 3 feet most of the year.

Most areas are farmed. If drained, this soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, and openland wildlife habitat. It has fair potential for rangeland wildlife habitat and poor potential for building sites and sanitary facilities.

This soil is well suited to cultivated crops. The main concern of management is the seasonal wetness caused by the occasional flooding or the high water table. Returning crop residue to the soil improves tilth, maintains fertility, and improves water infiltration. Planting and harvesting may be delayed during periods of heavy rainfall. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pasture in good condition. Avoiding grazing during wet periods helps prevent puddling of the surface soil.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is poorly suited to most kinds of building site development because of the flooding and the water table. If roads are constructed across areas of this soil, artificial drainage is needed to prevent the damage caused by frost action. The base material should be replaced or strengthened to overcome the low strength of the soil. Sanitary facilities should be constructed on the adjacent well drained soils. Capability IIw-3 drained, IVw-2 undrained; Subirrigated range site.

Lc—Luton silty clay. This deep, poorly drained, nearly level soil is on bottom land along the major rivers. It is subject to common, brief flooding during periods of snowmelt and heavy rain in the spring. Areas are long and broad and range from 10 to several hundred acres in size. Slopes are plane or slightly concave.

Typically, the surface layer is very dark gray silty clay about 16 inches thick. The subsoil is about 34 inches of dark gray and gray, firm and very firm silty clay. It is calcareous in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In places, lime is nearer the surface.

Included with this soil in mapping are small areas of Baltic, Blencoe, and Lakeport soils. These soils make up less than 15 percent of any one mapped area. Baltic soils are wetter than the Luton soil and are in lower lying areas. Blencoe and Lakeport soils are better drained than the Luton soil and contain less clay in the subsoil. They occur in a random pattern throughout the map unit.

Permeability is very slow in the Luton soil. Available water capacity is moderate. This soil is high in fertility and in content of organic matter, but it is difficult to work because tilth is poor. The soil shrinks or swells markedly during dry and wet periods. Runoff is very slow. The water table is within a depth of 1 foot most of the year.

Almost all areas are farmed. This soil has fair potential for cultivated crops, rangeland, and rangeland wildlife habitat. It has good potential for tame pasture, hay, windbreaks and environmental plantings, and openland wildlife habitat. The potential for building sites and most sanitary facilities is poor.

This soil is suited to cultivated crops. The main concern of management is excess water. Planting and harvesting may be delayed during wet periods. Crop residue management improves water intake and tilth.

This soil is suited to rangeland for grazing and hay (fig. 10). The native vegetation is tall, water-tolerant grasses. As a result of overgrazing, cordgrass and reedgrass lose vigor, thin out, and are replaced by sedges, rushes, Kentucky bluegrass, saltgrass, and western wheatgrass. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

Figure 10.—Native hay harvested on Luton silty clay.

If drainage is adequate, all climatically adapted pasture plants grow well on this soil. In undrained areas, Garrison creeping foxtail and reed canarygrass are suited. Proper stocking rates, rotation grazing, deferment of grazing when the soil is wet, applications of fertilizer, and weed control help keep the pasture in good condition.

This soil is well suited to windbreaks and environmental plantings. The trees and shrubs that can tolerate a high water table can grow well. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is poorly suited to building site development. Roads built across areas of this soil should be graded to help prevent the damage caused by flooding and wetness. Also, the base material should be replaced or strengthened to overcome the low strength. Sewage lagoons function well; their embankments provide protection from flooding. The soil is poorly suited to all other sanitary facilities because of flooding. Capability unit IIIw-2; Wetland range site.

Ld—Luton silty clay, depressional. This deep, very poorly drained, nearly level soil is in former backwater areas on bottom land along the Missouri River. It is commonly flooded for long periods. Areas are long and narrow and range from 5 to 80 acres in size.

Typically, the surface layer is very dark gray silty clay about 16 inches thick. The subsoil is about 34 inches of dark gray and gray, firm silty clay. It is calcareous in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. In places, strata of darker material are in the underlying material. In some areas, lime is nearer the surface.

Included with this soil in mapping are small areas of Onawa and Owego soils on the higher parts of the landscape. These soils make up less than 15 percent of any one mapped area. Onawa soils contain more silt in the underlying material than the Luton soil. Owego soils have a silt loam subsurface layer. Also included are some marshy areas.

Permeability is very slow in the Luton soil, and available water capacity is moderate. Fertility is high, and organic-matter content is moderate. The shrink-swell potential is high. The seasonal high water table is within 1 foot of the surface.

Most areas support native vegetation. This soil has poor potential for cultivated crops, windbreaks and environmental plantings, and openland wildlife habitat. It has fair potential for rangeland, rangeland wildlife habitat, and tame pasture and hay. The potential for wetland wildlife habitat is good.

This soil generally is too wet for cultivated crops and for windbreaks and environmental plantings. It is suited to rangeland. The natural plant community is tall, water-tolerant grasses. As a result of overgrazing, cordgrass and reedgrasses lose vigor and are replaced by sedges, rushes, and saltgrass. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

This soil is suited to tame pasture and hay. Water-tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, are best suited. Proper stocking rates, rotation grazing, deferment of grazing when the soil is wet, applications of fertilizer, and weed control help keep the pasture in good condition.

This soil is well suited to wetland wildlife habitat. Management practices that provide food and cover for wildlife are needed.

Because of flooding and wetness, this soil is not suited to building site development. Roads built across areas of this soil should be graded to help prevent the damage caused by flooding and wetness. Also, the base material should be replaced or strengthened to overcome low strength. Sewage lagoons function well on this soil; their embankments provide protection from flooding. The soil is poorly suited to all other sanitary facilities because of flooding. Capability unit Vw-2; Wetland range site.

Oa—Onawa silty clay. This deep, somewhat poorly drained, nearly level soil is in low areas near the present channel of the Missouri River. Common, brief flooding is a hazard, but it occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 10 to 300 acres in size and are generally long and broad.

Typically, the surface layer is grayish brown, calcareous silty clay about 7 inches thick. To a depth of 30 inches, the underlying material is light brownish gray and grayish brown, calcareous, firm silty clay. Below this to a depth of 60 inches, it is light gray and light brownish gray, calcareous silt loam and loamy very fine sand. In places, the upper part of the underlying material is silty.

Included with this soil in mapping are small areas of Forney, Haynie, and Owego soils. These soils make up less than 15 percent of any one mapped area. They occur in a random pattern throughout the map unit. The Forney soils are stratified and clayey throughout. The Haynie soils are silty throughout. The Owego soils have clay in the lower part of the underlying material.

Permeability is slow in the subsoil of the Onawa soil and moderate in the underlying material. Available water capacity is high. The shrink-swell potential is high in the surface layer and moderate in the underlying material. Organic-matter content and fertility are low. This soil has a water table at a depth of 2 to 4 feet part of the year.

Almost all areas are farmed. Some small areas are native woodland. This soil has good potential for cultivated crops if it is drained. It has good potential for rangeland, rangeland wildlife habitat, windbreaks and environmental plantings, openland wildlife habitat, and tame pasture and hay. It has poor potential for building sites and sanitary facilities.

This soil is suited to cultivated crops. The main concern of management is the local flooding. Returning crop residue to the soil improves tilth and fertility and increases the infiltration rate. Avoiding fieldwork when the soil is wet helps maintain good tilth.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

Buildings constructed on this soil should be protected from local flooding. Also, the foundations and footings should be reinforced to prevent the structural damage caused by shrinking and swelling of the soil. Ground water can seep into basements during wet periods. If roads are constructed across areas of this soil, the base material should be strengthened or replaced. Also, the roads should be graded to shed water. The effluent from sewage lagoons and septic tank absorption fields can pollute ground water because of the moderately permeable underlying material. Capability unit IIw-3; Clayey range site.

Ob—Owego silty clay loam. This deep, somewhat poorly drained, nearly level soil is on the lower parts of the bottom land along the Missouri River. It is commonly flooded during periods of heavy rain or rapid snowmelt. The flooding occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 10 to 300 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown silty clay loam about 7 inches thick. The upper part of the underlying material, to a depth of 16 inches, is dark grayish brown and light brownish gray, firm silty clay. The next part, to a depth of 36 inches, is light gray silt loam. The lower part to a depth of 60 inches is light olive gray, calcareous silty clay. In places, the surface layer is silt loam.

Included with this soil in mapping are small areas of Blake, Forney, and Onawa soils. These soils make up less than 15 percent of any one mapped area. They occur in a random pattern throughout the map unit. Blake soils contain less clay throughout than the Owego soil. Forney soils do not have a thick layer of silt loam. Onawa soils have coarser textured underlying material than the Owego soil.

Permeability is very slow in the Owego soil. Available water capacity is moderate. Organic-matter content also is moderate, and fertility is medium. Runoff is slow. The shrink-swell potential is high. This soil has a water table at a depth of 1 to 3 feet part of the year.

Almost all areas are farmed. This soil has fair potential for cultivated crops and rangeland wildlife habitat. It has good potential for rangeland, tame pasture and hay, windbreaks and environmental plantings, and openland wildlife habitat. The potential for building sites and most sanitary facilities is poor.

This soil is suited to cultivated crops. The main concerns of management are the excess water and the high water table. Returning crop residue to the soil improves tilth, maintains fertility, and increases the infiltration rate. Avoiding fieldwork when the soil is wet helps prevent puddling of the soil. Planting and harvesting may be delayed during wet periods. Maintaining adequate cover during dry, windy periods helps control soil blowing.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

Buildings constructed on this soil should be protected from local flooding. Also, the foundations and footings should be reinforced to prevent the structural damage caused by the shrinking and swelling of the soil. Ground water can seep into basements during wet periods. If roads are constructed across areas of this soil, the base material should be strengthened or replaced. Also, the roads should be graded to shed water. The effluent from sewage lagoons and septic tank absorption fields can pollute ground water because of the very slowly permeable underlying material. Capability unit IIIw-3; Subirrigated range site.

Pa—Pits, gravel. This map unit consists of open excavations, 5 to 30 feet deep, from which sand and gravel overburden has been removed. Individual areas are irregular in shape and range from 2 to 50 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottom to almost vertical on the rims. Some of the pit bottoms are covered with water.

The pit bottoms typically are covered with sand and gravel, but they are covered with loam or clay loam glacial till or silty glacial drift where all of the sand and gravel has been removed. Mounds of mixed loamy overburden are on the edges of the areas. The bottom and sides of the pits support little or no vegetation during periods when the pits are operated.

Most gravel pits can be used only as a source of sand and gravel for construction purposes. Some provide limited wildlife habitat. Abandoned gravel pits can be restored to range, tame pasture, or crops if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden material as a topsoil dressing. Applying fertilizer as needed helps to establish the range or pasture. Capability unit VIIs-2; not assigned to a range site.

Ra—Redstoe Variant silt loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping and strongly sloping soil is on uplands. It is on slopes below chalk rock outcrops. Areas of this soil range from 10 to 40 acres in size and are long and narrow.

Typically, the surface layer is brown, calcareous silt loam about 12 inches thick. Next is a transition layer of pale brown, calcareous silty clay loam about 14 inches thick. The underlying material to a depth of 60 inches is silty clay loam. It is light yellowish brown in the upper part and yellow in the lower part. In places, bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Davis soils on foot slopes. These soils make up less than 10 percent of any one mapped area. They formed in alluvium derived from glacial till.

Permeability and available water capacity are moderate in the Redstoe Variant. Organic-matter content also is moderate, and fertility is medium. Runoff is medium.

Almost all areas are tame pasture. Many areas were cropped at one time. This soil has fair potential for tame pasture and hay, cultivated crops, rangeland, rangeland wildlife habitat, and windbreaks and environmental plantings. It has poor potential for openland wildlife habitat and for most building sites and fair potential for most sanitary facilities.

If this soil is cultivated, the main concerns of management are controlling erosion and maintaining fertility. Contour farming and terracing help control erosion. Managing crop residue and including close growing crops and grasses and legumes in the cropping system help control erosion, conserve moisture, and maintain fertility.

This soil is suited to tame pasture and hay. The main concern of management is the hazard of erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition. Keeping the pasture in good condition helps prevent the excessive soil loss resulting from runoff.

This soil is well suited to rangeland. The native vegetation is a mixture of mid and short grasses. The major problem of range management is erosion. If rangeland is overgrazed, bluestems and other tall species are replaced by needleandthread and sideoats grama. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

Though this soil is suited to windbreaks and environmental plantings, optimum growth cannot be expected. Planting trees on the contour helps conserve moisture and control erosion. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Reinforcing the footings and foundations of buildings helps to prevent the structural damage caused by the low strength of this soil. Land leveling may be necessary in the steeper areas. Strengthening the base material helps overcome the low strength on sites for local roads and streets. Seeding road cuts to adapted grasses helps prevent excessive roadside erosion. Enlarging septic tank absorption fields reduces the possibility of lateral seepage to the surface in the strongly sloping areas. Sealing the bottom and sides of lagoons helps prevent seepage. Lagoons should be located in the less sloping areas. Even in these areas, however, considerable land leveling is needed. Capability unit IVe-2; Thin Upland range site.

Rb—Roxbury loam, channeled. This deep, moderately well drained, nearly level soil is on stream terraces along the major creeks. A meandering channel is in the lower part of the mapped areas. The soil is commonly flooded for brief periods. The areas range from 5 to 100 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, calcareous loam about 12 inches thick. The subsoil is about 12 inches of grayish brown, friable silty clay loam. The underlying material to a depth of 60 inches is grayish brown loam. In places, the depth to lime is greater. In some areas, the content of clay and silt is lower throughout.

Included with this soil in mapping are small areas of Lamo and Salmo soils on the lower parts of the landscape. These soils make up less than 15 percent of any one mapped area. They are not so well drained as the Roxbury soil. Also, Salmo soils have visible salts at the surface.

Permeability is moderate in the Roxbury soil. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow.

Nearly all areas are rangeland or support native trees. A few small areas are farmed. This soil has good potential for rangeland and for tame pasture and hay. It has good potential for windbreaks and environmental plantings in the larger unchanneled areas. The potential for cultivated crops is poor because the areas cut by the meandering creek are too small or are inaccessible. The potential is fair for rangeland wildlife habitat and poor for building sites and most sanitary facilities.

This soil is poorly suited to cultivated crops. It is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pasture in good condition.

This soil is suited to windbreaks and environmental plantings. These plantings and the native trees enhance the habitat for woodland wildlife.

This soil is well suited to rangeland. The native vegetation is tall prairie grasses. If rangeland is overgrazed, the tall grasses lose vigor and the stand thins out. After many years of overuse, Kentucky bluegrass is the principal grass. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

Flooding is too frequent for this soil to be used as a building site or a septic tank absorption field. If roads are constructed across areas of this soil, considerable grading is necessary to prevent flood damage. Bridges over the channels are needed. Strengthening or replacing the base material helps overcome low strength. Sealing the bottom and sides of lagoons helps prevent seepage. This soil is an excellent source of fill material for sanitary landfills and for topsoil. Capability unit VIw-1; Overflow range site.

Rc—Roxbury silt loam. This deep, moderately well drained, nearly level soil is on stream terraces and alluvial fans along the major creeks. It is commonly flooded for brief periods. Areas of this soil range from 10 to several hundred acres in size and generally are long and broad.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 12 inches thick. The subsoil is about 12 inches of grayish brown, very friable silty clay loam. The underlying material to a depth of 60 inches is silty clay loam. It is grayish brown and very pale brown in the upper part and dark gray in the lower part. In places, the content of clay and silt is lower throughout. In some areas, the depth to lime is greater.

Included with this soil in mapping are small areas of Baltic, Grable, and Salmo soils. Baltic and Salmo soils are in the lower lying areas, and Grable soils are in a position on the landscape that is similar to that of the Roxbury soil. Baltic soils contain more clay throughout than the Roxbury soil and are not so well drained. Grable soils are underlain by fine sand. Salmo soils have visible salts at the surface and are not so well drained as the Roxbury soil.

Permeability is moderate in the Roxbury soil. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow.

Almost all areas are farmed. This soil has good potential for cultivated crops, rangeland, tame pasture and hay, windbreaks and environmental plantings, openland wildlife habitat, and rangeland wildlife habitat. It has poor potential for building sites and most sanitary facilities.

This soil is well suited to cultivated crops. It has few limitations. The common flooding is a hazard, but it is brief and fieldwork is interrupted for only a short time. Returning crop residue to the soil helps maintain fertility, improves tilth, and increases the infiltration rate.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

The flooding is too frequent for this soil to be used as a building site or a septic tank absorption field. If roads are constructed across areas of this soil, considerable grading is necessary to prevent flood damage. Strengthening or replacing the base material helps overcome low strength. Sealing the bottom and sides of lagoons helps prevent seepage. This soil is an excellent source of fill material for sanitary landfills and for topsoil. Capability unit I-1; Silty range site.

Sa—Salix silty clay loam. This deep, moderately well drained, nearly level soil is on the higher parts of the bottom land along the Missouri River. Rare flooding is a hazard, but it occurs only as local runoff; Gavins Point Dam holds back the potential floodwater in the Missouri River. Areas of this soil range from 20 to 200 acres in size and are irregular in shape.

Typically, the surface layer is dark gray silty clay loam about 16 inches thick. The subsoil is about 18 inches of dark gray, dark grayish brown, and light brownish gray, very friable silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light gray silt loam over light gray very fine sandy loam. In places, the content of clay is higher throughout.

Included with this soil in mapping are small areas of Blencoe and Blyburg soils. These soils make up less than 10 percent of any one mapped area. They occur in a random pattern throughout the map unit. Blencoe soils contain more clay in the upper part than the Salix soil. Blyburg soils contain less clay in the upper part.

Permeability is moderate in the Salix soil. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow. This soil has a seasonal high water table at a depth of 3 to 5 feet.

Almost all areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, windbreaks and environmental plantings, openland wildlife habitat, and rangeland wildlife habitat. It has fair potential for most building sites and poor potential for most sanitary facilities.

This soil is well suited to cultivated crops. It has few limitations. The rare flooding is a hazard, but it is brief and fieldwork is delayed for only a short time. Avoiding fieldwork when the soil is wet helps prevent puddling. Returning crop residue to the soil improves tilth, maintains fertility, and increases the infiltration rate.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep the pasture in good condition.

Buildings constructed on this soil should be protected from local flooding. Also, the foundations and footings should be reinforced to prevent the structural damage caused by low strength and shrinking and swelling. Ground water can seep into basements during wet periods. If roads are constructed across areas of this soil, the base material should be strengthened. Also, the roads should be graded to shed water and thus prevent the damage caused by frost action. As a result of the high water table, this soil generally is unsuitable as a site for sanitary facilities. Capability unit I-1; Silty range site.

Sb—Salmo silty clay loam. This deep, poorly drained, nearly level soil is on bottom land. It is commonly flooded for brief periods. Areas of this soil range from 5 to 200 acres in size and are irregular in shape.

Typically, the surface layer is dark gray, calcareous silty clay loam about 3 inches thick. It has nests of salts. The subsurface layer is about 17 inches of very dark gray, firm, calcareous silty clay loam that has nests of salts. The underlying material to a depth of 60 inches is dark gray and has nests of salts throughout. It is silty clay loam in the upper part and silty clay in the lower part. In places, lime is leached deeper than 24 inches. Some areas have 10 to 20 inches of salt-free silt loam overwash. In some areas, sand and gravel is at a depth of 30 to 60 inches.

Included with this soil in mapping are small areas of Bon and Roxbury soils on the slightly higher parts of the landscape. These soils make up less than 15 percent of any one mapped area. They do not have salts and are better drained than the Salmo soil.

Permeability is moderately slow in the Salmo soil. Available water capacity is high. Organic-matter content also is high, and fertility is medium. Runoff is slow. The seasonal high water table is within a depth of 2.5 feet.

Almost all areas are rangeland. A few areas are farmed. This soil has poor potential for cultivated crops, windbreaks and environmental plantings, and openland wildlife habitat. It has fair potential for tame pasture and hay, rangeland, and rangeland wildlife habitat. The potential is poor for building sites and sanitary facilities.

This soil generally is too wet for most cultivated crops. Surface drainage systems can remove excess water in most areas. The high content of salts limits the choice of crops.

If this soil is used for tame pasture or hay, the choice of grasses is very limited. Tall wheatgrass and western wheatgrass are the most salt-tolerant grasses. Grazing should be limited to periods when the soil is dry to prevent puddling of the surface layer. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is not suited to windbreaks and environmental plantings. The water table and the content of salts are too high.

In areas that are used as rangeland, the native vegetation is salt-tolerant tall and mid grasses. Overgrazing reduces the protective plant cover and causes deterioration of the plant community. Under these conditions, the taller, more palatable grasses lose vigor, thin out, and are replaced by saltgrass, which is less productive. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

This soil is poorly suited to building site development and sanitary facilities because of the flooding and the high water table. If roads are built across areas of this soil, the base material should be strengthened or replaced. Also, the roads should be graded to prevent the damage caused by frost action. Capability unit IVw-2; Saline Lowland range site.

SdA—Sarpy loamy fine sand, 0 to 3 percent slopes. This deep, excessively drained, nearly level and gently undulating soil is on the bottom land adjacent to the Missouri River. Gavins Point Dam prevents major floods, but flooding frequently occurs during periods of high discharge from the dam. Areas of this soil range from 10 to 150 acres in size and generally follow the course of the river channel.

Typically, the surface layer is grayish brown, calcareous loamy fine sand about 9 inches thick. The underlying material to a depth of 60 inches is light brownish gray fine sand. In some places, as much as 25 percent of the surface layer is silty clay. In other places, thin strata of fine material are directly below the surface layer. In some areas, the soil is unstable and lacks a plant cover. In other areas, the seasonal high water table is within 5 feet of the surface.

Included with this soil in mapping are small areas of Blake, Haynie, and Onawa soils. These soils make up less than 15 percent of any one mapped area. Blake soils contain more clay throughout than the Sarpy soil. Their position on the landscape is similar to that of the Sarpy soil. Haynie soils are not so sandy as the Sarpy soil and contain more silt throughout. Their position on the landscape is similar to that of the Sarpy soil. Onawa soils are in the lower positions, such as small meander scars. They contain more clay in the surface layer and subsoil than the Sarpy soil.

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

Most areas are farmed. Some areas near the river support cottonwood and willows. This soil has poor potential for cultivated crops and openland wildlife habitat and good potential for tame pasture and hay and rangeland. It has fair potential for windbreaks and environmental plantings and rangeland wildlife habitat and poor potential for building sites and sanitary facilities.

This soil is poorly suited to cultivated crops. The main concerns of management are controlling soil blowing and improving fertility. Crop residue management, stripcropping, and field windbreaks help control soil blowing. A cropping system in which grasses and legumes are grown in most years also helps control soil blowing and improves fertility.

This soil is suited to tame pasture and hay. Species that are suited to a sandy soil that is low in fertility and droughty should be grown. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the pasture and the soil in good condition.

This soil is suited to windbreaks and environmental plantings. Evergreen trees are better suited than deciduous trees. Keeping cultivation to a minimum helps to control soil blowing. Planting trees directly in sod or stubble also helps to control soil blowing.

Some areas of this soil are suitable as habitat for woodland wildlife. These areas are near the river channel and have an overstory of cottonwood and black willow. Management that maintains an adequate vegetative cover and ground mulch helps prevent excessive soil blowing and provides food and shelter for openland and woodland wildlife.

The flooding generally is too frequent for this soil to be suitable as a site for buildings or sanitary facilities. The effluent from all sanitary facilities can pollute the ground water. Capability unit IVs-1; Sands range site.

SeA—Sarpy-Grable complex, 0 to 4 percent slopes. These deep, nearly level and gently undulating, excessively drained and well drained soils are on bottom land along the Missouri River. They are subject to the flooding that occurs as local runoff. Gavins Point Dam provides protection from the floodwater in the Missouri River during all periods but those of high discharge from the dam. Areas of these soils range from 20 to 200 acres in size. They are about 45 to 55 percent Sarpy soil and about 30 to 40 percent Grable soil. The Sarpy soil is in convex areas, and the Grable soil is in the concave areas. The two soils occur as areas so closely intermingled or small that it is not practical to separate them in mapping.

Typically, the Sarpy soil has a surface layer of grayish brown, calcareous loamy fine sand about 9 inches thick. The underlying material to a depth of 60 inches is light brownish gray fine sand. In places, the surface layer is fine sandy loam or fine sand.

Typically, the Grable soil has a surface layer of grayish brown, calcareous silt loam about 7 inches thick. To a depth of 28 inches, the underlying material is light gray, very friable, calcareous silt loam. Below this to a depth of 60 inches, it is light brownish gray, calcareous fine sand. In places, the surface layer is loamy fine sand, fine sandy loam, or silty clay loam. In some areas, the soil is silty throughout.

Included with these soils in mapping are small areas of Blake and Onawa soils. These included soils make up less than 15 percent of any one mapped area. Blake soils contain more clay throughout than the Sarpy and Grable soils and are in similar positions on the landscape. Onawa soils are in the lower positions. They contain more clay in the upper part than the Sarpy and Grable soils.

Permeability is rapid in the Sarpy soil. It is moderate in the upper part of the Grable soil and rapid in the underlying material. Available water capacity is low in the Sarpy soil and moderate in the Grable soil. Organic-matter content and fertility are low in both soils. Runoff is slow.

Most areas of these soils are farmed. The soils have good potential for rangeland and tame pasture and hay. They have fair potential for windbreaks and environmental plantings and rangeland wildlife habitat. The Sarpy soil has fair potential for cultivated crops and poor potential for openland wildlife habitat. The Grable soil has good potential for cultivated crops and openland wildlife habitat. Both soils have poor potential for building sites and sanitary facilities.

The main concerns in farming these soils are controlling soil blowing and conserving moisture. Crop residue management, stripcrops, and field windbreaks help control soil blowing and conserve moisture. A cropping system in which grasses and legumes are grown during most years also helps to control soil blowing and improves fertility.

These soils are suited to tame pasture and hay. Species that are suited to a sandy soil that is low in fertility and droughty should be grown. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the pasture and the soils in good condition.

These soils are suited to windbreaks and environmental plantings. The Sarpy soil is better suited to evergreen trees than to deciduous trees. Optimum growth should not be expected from trees planted on the Grable soil because of droughtiness. Keeping cultivation to a minimum helps to control soil blowing. Planting trees directly in sod or stubble also helps to control soil blowing.

The flooding is too frequent for these soils to be suitable as sites for buildings or sanitary facilities. The effluent from all sanitary facilities can pollute the ground water. Sarpy soil in capability unit IVs-1, Sands range site; Grable soil in capability unit IIs-3, Silty range site.

TaE—Talmo-Thurman complex, 15 to 40 percent slopes. These excessively drained and somewhat excessively drained, moderately steep and steep soils are on uplands adjacent to the major creeks. The Talmo soil is shallow to sand and gravel, and the Thurman soil is deep. Individual areas of these soils range from 10 to 100 acres in size. They are about 50 to 60 percent Talmo soil and 25 to 35 percent Thurman soil. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the Talmo soil is about 9 inches thick. It is very dark grayish brown loam in the upper part and dark grayish brown gravelly loam in the lower part. The underlying material to a depth of 60 inches is brown, calcareous sand and gravel.

Typically, the Thurman soil has a surface layer of dark grayish brown fine sandy loam about 10 inches thick. Next is a transitional layer about 20 inches thick. The upper part is dark grayish brown, very friable sandy loam; the lower part is brown, loose loamy sand. The underlying material to a depth of 60 inches is very pale brown, calcareous loamy sand. In places, coarse sand and gravel is in the underlying material. In some areas, the surface soil contains less sand. In other areas, the surface layer is thicker and darker.

Included with these soils in mapping are small areas of Betts soils. These included soils make up less than 15 percent of any one mapped area. They formed in glacial till and occur in a random pattern throughout the map unit.

Permeability is rapid in the Talmo and Thurman soils. Available water capacity is low in the Talmo soil and moderate in the Thurman soil. Organic-matter content is moderately low and fertility low in the Talmo soil. Organic-matter content is moderate and fertility medium in the Thurman soil. Runoff is slow on both soils.

Most areas support native grass. These soils have poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and openland wildlife habitat. The Talmo soil has poor potential and the Thurman soil good potential for rangeland and rangeland wildlife habitat. Both soils have poor potential for building sites and sanitary facilities.

These soils are best suited to rangeland. Because the Talmo soil is somewhat droughty, reestablishing vegetation is difficult in overgrazed areas. Management that maintains an adequate vegetative cover and ground mulch helps prevent excessive soil loss. If rangeland is overgrazed, the taller grasses are replaced by less productive, less palatable species. If overgrazing continues, Kentucky bluegrass and weeds dominate. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing help keep the range and the soil in good condition.

These soils are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Evergreen trees are the best suited special plantings.

These soils are too steep for buildings and sanitary facilities. The effluent from sanitary facilities can pollute ground water. If roads are constructed across areas of these soils, the cuts should be seeded to control soil blowing. The Talmo soil is a good source of sand and gravel. Capability unit VIIs-2; Talmo soil in Very Shallow range site, Thurman soil in Sandy range site.

Tb—Tetonka silt loam. This deep, poorly drained, nearly level soil is in enclosed depressions and in low areas in drainageways. It is commonly flooded for very long periods. Individual areas of this soil range from 3 to 15 acres in size and are generally round.

Typically, the surface layer is dark gray silt loam about 10 inches thick. The subsurface layer is about 7 inches of gray and dark gray silt loam. The subsoil is about 31 inches thick. The upper part is dark gray and gray, friable silty clay loam and silt loam; the middle part is dark gray, firm silty clay; the lower part is gray, firm silty clay. The underlying material to a depth of 60 inches is grayish brown, mottled silty clay loam.

Included with this soil in mapping are small areas of Clarno and Salmo soils. These soils make up less than 15 percent of any one mapped area. Clarno soils are on slight rises and formed in glacial till. Salmo soils are near the edges of the depressions. They have visible salts near the surface and contain less clay in the subsoil than the Tetonka soil.

Permeability is very slow in the Tetonka soil. Available water capacity is high. The shrink-swell potential is high in the subsoil and underlying material. Organic-matter content is moderate, and fertility is medium. Runoff is very slow, and the soil is ponded in the spring. The seasonal high water table is perched within a depth of 1 foot.

Most of the less depressional areas are farmed or are used for tame pasture or hay. Some of the more depressional areas support native vegetation. If drained, this soil has good potential for cultivated crops and tame pasture and hay; fair potential for rangeland, rangeland wildlife habitat, and wetland wildlife habitat; and poor potential for windbreaks and environmental plantings and for openland wildlife habitat. If undrained, it has fair potential for crops, rangeland, rangeland wildlife habitat, tame pasture and hay, and wetland wildlife habitat and poor potential for windbreaks and environmental plantings and openland wildlife habitat. The potential for building sites and most sanitary facilities is poor.

This soil is suited to cultivated crops if it is drained. The main concern of management is the wetness caused by flooding after rains. Surface drainage systems help remove excess water. Planting and harvesting usually are delayed during wet periods. Undrained areas are poorly suited to crops.

This soil is well suited to tame pasture and hay if it is drained. Water-tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, are best suited. Grazing should be avoided during wet periods to prevent puddling and compacting. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is suited to rangeland. The natural plant community consists of tall, water-tolerant grasses. If rangeland is overgrazed, cordgrass and reedgrasses lose vigor and are replaced by sedges, rushes, and saltgrass.

The undrained areas are suitable as wetland wildlife habitat. Management practices that provide food and cover are needed to enhance the habitat for wetland wildlife.

This soil generally is unsuitable as a site for most buildings and for septic tank absorption fields because of the wetness and the flooding. Local roads constructed across areas of this soil should be built on well compacted fill material. Also, drainage should be provided through culverts and ditches. Sewage lagoons function well on this soil; their embankments provide protection from flooding. Capability unit IIw-1 drained, IVw-2 undrained; Wetland range site.

TcC—Thurman-Ethan complex, 2 to 9 percent slopes. These somewhat excessively drained and well drained, gently sloping and moderately sloping soils are on uplands. They are on ridges adjacent to drainageways and on undulating knolls on the till plain. Slopes are single or complex. Individual areas of this unit range from 20 to 100 acres in size and are irregular in shape. They are about 40 percent Thurman soil and 35 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that it is not practical to separate them in mapping.

Typically, the Thurman soil has a surface layer of dark grayish brown fine sandy loam about 10 inches thick. Below this is a transitional layer about 20 inches thick. The upper part is dark grayish brown, very friable sandy loam; the lower part is brown, loose loamy sand. The underlying material to a depth of 60 inches is very pale brown, calcareous loamy sand. In places, sand and gravel is within 10 inches of the surface. In some areas, the dark colors extend to a depth of more than 20 inches.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 4 inches thick. The subsoil is about 12 inches of friable, calcareous loam. It is grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown and very pale brown, mottled, calcareous clay loam. In places, the surface layer is lighter colored.

Included with these soils in mapping are small areas of Clarno and Enet soils. These included soils make up less than 25 percent of any one mapped area. They occur in a random pattern throughout the map unit. Clarno soils contain more clay than the Thurman soil and have a thicker subsoil than the Ethan soil. Enet soils have sand and gravel in the underlying material.

Permeability is rapid in the Thurman soil. It is moderate in the upper part of the Ethan soil and moderately slow in the underlying material. Available water capacity is moderate in the Thurman soil and moderate or high in the Ethan soil. In both soils, fertility is low or medium and organic-matter content low or moderate. Runoff is medium on both soils.

Most areas are farmed. These soils have good potential for rangeland and rangeland wildlife habitat. They have fair potential for cultivated crops. The Thurman soil has good potential and the Ethan soil fair potential for windbreaks and environmental plantings and for tame pasture and hay. The Thurman soil has fair potential and the Ethan soil poor potential for openland wildlife habitat. The Thurman soil has good potential for most building sites and poor potential for most sanitary facilities. The Ethan soil has fair potential for most building sites and most sanitary facilities.

These soils are best suited to small grain and tame pasture. They are suited to hay. The main concerns of management are controlling soil blowing and erosion. Returning crop residue to the soil improves fertility and tilth and helps to control soil blowing. Field windbreaks and stripcrops also help to control soil blowing. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are suited to windbreaks and environmental plantings, but optimum growth should not be expected on the Ethan soil. Evergreen trees are well suited to the Thurman soil. Planting trees on the contour helps control erosion on the moderately sloping Ethan soil. A protective plant cover should be maintained until the planting is established on the Thurman soil because of the susceptibility to soil blowing.

These soils are suited to rangeland. The native vegetation is a mixture of tall and mid grasses. Bluestem and prairie sandreed are the main grasses on the Thurman soil. Little bluestem and needlegrasses are on the Ethan soil. If rangeland is overgrazed, the bluestems decrease in extent and are replaced by sideoats grama and needlegrasses. If overgrazing continues for a number of years, Kentucky bluegrass and blue grama dominate. A planned grazing system that includes proper grazing use and deferred grazing maintains or improves the range condition and helps to control erosion.

The Thurman soil has few limitations as a building site. The sides of shallow excavations, however, can cave in. If buildings are constructed on the Ethan soil, reinforcing the footings and foundations helps overcome the moderate shrink-swell potential and low strength. Land shaping may be necessary in the moderately sloping areas. If roads are constructed across areas of the Ethan soil, the base material should be strengthened to overcome the low strength. Seeding the ditches and cuts helps to control soil blowing and erosion.

The Thurman soil is better suited than the Ethan soil as a site for septic tank absorption fields. Enlarging the absorption area helps overcome the slow absorption rate in the Ethan soil. The effluent from all other sanitary facilities in the Thurman soil can pollute shallow ground water because of seepage. Sewage lagoons can be installed only in the Ethan soil. Land shaping is needed in the moderately sloping areas. Capability unit IVe-3; Thurman soil in Sandy range site, Ethan soil in Silty range site.

TdA—Trent silty clay loam, 0 to 2 percent slopes. This deep, moderately well drained, nearly level soil is in upland depressions, in swales, and at the head of drainageways. It is very briefly flooded during periods of heavy rain or rapid snowmelt. Individual areas of this soil range from 5 to 50 acres in size, are generally long and narrrow, and follow the drainage pattern at the head of the drainageways.

Typically, the surface layer is dark grayish brown silty clay loam about 13 inches thick. The subsoil is about 32 inches thick. The upper part is grayish brown, friable silty clay loam; the lower part is light brownish gray, mottled, friable silty clay loam having spots and streaks of soft lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, mottled silty clay loam. In places, the underlying material has strata of silt and very fine sand.

Included with this soil in mapping are small areas of Whitewood and Chancellor soils. These soils make up less than 15 percent of any one mapped area. They are not so well drained as the Trent soil and are lower on the landscape. In addition, Chancellor soils contain more clay in the subsoil.

Permeability is moderate in the Trent soil. Available water capacity is high. Organic-matter content and fertility also are high. Runoff is slow. This soil has a perched water table at a depth of 4 to 6 feet.

Almost all areas of this soil are farmed. The soil has good potential for cultivated crops, tame pasture and hay, openland wildlife habitat, windbreaks and environmental plantings, and rangeland. It has fair potential for rangeland wildlife habitat and poor potential for building sites and most sanitary facilities.

This soil is well suited to cultivated crops. The main concern of management is wetness during rainy periods. Returning crop residue to the soil helps maintain fertility and tilth and increases the infiltration rate. Planting and harvesting may be delayed during wet periods.

This soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition. Grazing should be deferred during wet periods to prevent puddling of the surface soil.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees grow well. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Because of flooding, this soil is poorly suited to building site development. Buildings should be constructed on the adjacent well drained soils. Local roads constructed across areas of this soil should be built on well compacted fill material. Also, drainage should be provided through culverts and ditches. Septic tank absorption fields should not be constructed in this soil because of wetness and flooding. Sealing the bottom and sides of lagoons helps prevent seepage. Capability unit I-3; Overflow range site.

Wa—Waubonsie very fine sandy loam. This deep, moderately well drained, nearly level soil is on bottom land adjacent to the present channel of the Missouri River. In some areas, it is subject to common, brief flooding during periods of high discharge from Gavins Point Dam. The dam prevents major flooding. Areas are irregularly shaped and range from 40 to 400 acres in size.

Typically, the surface layer is grayish brown, calcareous very fine sandy loam about 10 inches thick. The upper part of the underlying material, to a depth of 26 inches, is light brownish gray, very friable, calcareous very fine sandy loam. The lower part to a depth of 60 inches is grayish brown, dark gray, and light brownish gray, mottled silty clay. In places, the soil is not so deep to silty clay. In some areas, the surface layer contains more clay.

Included with this soil in mapping are small areas of Forney, Haynie, Onawa, and Sarpy soils. These soils make up less than 15 percent of any one mapped area. Forney soils contain more clay throughout than the Waubonsie soil. Haynie soils are silty throughout. Onawa soils are clayey in the upper part and silty and sandy in the lower part. Sarpy soils are sandy throughout. Onawa soils are in the lower lying areas. Forney, Haynie, and Sarpy soils occur in a random pattern throughout the map unit.

Permeability is moderately rapid in the upper part of the Waubonsie soil and slow in the lower part. Available water capacity is moderate. Fertility and the content of organic matter are low. Runoff is slow. This soil has a water table at a depth of 1 to 3 feet most of the year.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, rangeland, rangeland wildlife habitat, and openland wildlife habitat. It has poor potential for building sites and sanitary facilities.

This soil is well suited to all of the crops most commonly grown in the county. The main concerns of management are controlling soil blowing and improving fertility. Field windbreaks and stripcrops help control soil blowing. Crop residue management also helps control soil blowing and improves fertility.

This soil is well suited to tame pasture and hay. Species that can withstand low fertility should be favored. Proper stocking rates, uniform grazing distribution, and timely deferment of grazing keep the pasture and the range in good condition.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees grow well. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

The flooding is too frequent for this soil to be suitable as a site for buildings and sanitary facilities. The effluent from all sanitary facilities can pollute the ground water. Capability unit IIs-2; Sandy range site.

WbA—Wentworth silty clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is in smooth areas on uplands. Individual areas of this soil range from 15 to several hundred acres in size. Slopes are plane and long.

Typically, the surface layer is dark grayish brown silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 28 inches thick. The upper part is grayish brown, the middle part is brown, and the lower part is light olive brown and is calcareous. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam. In places, clay loam glacial till is below a depth of 24 inches. In some areas, strata of silt and very fine sand are below 50 inches. In other areas, the darker colors are at a greater depth.

Included with this soil in mapping are small areas of Chancellor and Tetonka soils. These soils make up less than 15 percent of any one mapped area. They are more poorly drained than the Wentworth soil and contain more clay. Chancellor soils are in entrenched swales, and Tetonka soils are in enclosed depressions.

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

Almost all areas are farmed. This soil has good potential for cultivated crops, rangeland, tame pasture and hay, windbreaks and environmental plantings, openland wildlife habitat, and rangeland wildlife habitat. It has fair potential for most building sites and sanitary facilities.

This soil is well suited to cultivated crops. It has few limitations. Returning crop residue to the soil helps maintain fertility, improves tilth, and increases the infiltration rate.

The soil is well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

This soil is well suited to rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, bluestems and needlegrasses are replaced by less palatable species. After continued overuse, Kentucky bluegrass and weeds occupy the site.

If buildings are constructed on this soil, the foundations and footings should be reinforced to prevent the structural damage caused by shrinking and swelling. Also, the base material should be strengthened. The base material should be replaced or strengthened if the soil is used as a site for local roads and streets. Grading the roads to provide drainage helps prevent the damage caused by frost action. Enlarging the absorption area helps overcome the slow absorption rate in septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps to control seepage. Capability unit I-2; Silty range site.

WcB—Wentworth-Trent silty clay loams, 2 to 6 percent slopes. These deep, gently sloping, well drained and moderately well drained soils are on uplands. Individual areas of this unit range from 15 to 300 acres in size. They are about 55 to 65 percent Wentworth soil and 20 to 30 percent Trent soil. The Wentworth soil is on the upper and middle parts of the landscape. The Trent soil is in swales and on toe slopes. It is subject to very brief flooding during periods of heavy rain or rapid snowmelt. The two soils occur as areas so closely intermingled or small that it is not practical to separate them in mapping.

Typically, the Wentworth soil has a surface layer of dark grayish brown silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 28 inches thick. The upper part is grayish brown, the middle part is brown, and the lower part is light olive brown and is calcareous. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam. In places, strata of silt and very fine sand are below a depth of 50 inches. In some areas, clay loam glacial till is at a depth of 24 inches.

Typically, the Trent soil has a surface layer of dark grayish brown silty clay loam about 13 inches thick. The subsoil is about 32 inches thick. The upper part is grayish brown, friable silty clay loam; the lower part is light brownish gray, mottled, friable silty clay loam that has spots and streaks of soft lime extending into the underlying material. The underlying material to a depth of 60 inches is pale yellow, mottled silty clay loam.

Included with these soils in mapping are small areas of Chancellor and Ethan soils. These included soils make up less than 15 percent of any one mapped area. Chancellor soils are somewhat poorly drained and are in the more deeply entrenched swales. Ethan soils have a thinner surface layer than the Wentworth and Trent soils and are not so deep to lime. They are at the crest of slopes or on knobs.

Permeability is moderate in the Wentworth and Trent soils. Available water capacity is high. The shrink-swell potential is moderate. Organic-matter content and fertility are high. The Trent soil has a perched water table at a depth of 4 to 6 feet part of the year. Runoff is medium on both soils.

Almost all areas of these soils are farmed. The soils have good potential for cultivated crops, rangeland, tame pasture and hay, windbreaks and environmental plantings, and openland wildlife habitat. The Wentworth soil has good potential and the Trent soil fair potential for rangeland wildlife habitat. The Wentworth soil has fair potential and the Trent soil poor potential for most building sites and sanitary facilities.

These soils are well suited to cultivated crops. The main concerns of management are erosion on the Wentworth soil and flooding on the Trent soil. Minimum tillage, contour farming, crop residue management, grassed waterways, and grasses and legumes in the cropping system help control erosion. Planting and harvesting may be delayed during periods when the Trent soil is wet.

These soils are well suited to tame pasture and hay. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

These soils are well suited to windbreaks and environmental plantings. Competing vegetation prevents maximum tree growth. It can be controlled by timely cultivation and by herbicides.

Though these soils are well suited to rangeland, very few areas are used as rangeland. The native vegetation is mainly a mixture of mid and tall grasses. If rangeland is overgrazed, the tall grasses lose vigor and are replaced by less palatable species.

Buildings should be constructed only on the Wentworth soil because of flooding on the Trent soil. Foundations and footings should be reinforced to prevent the structural damage caused by shrinking and swelling. Roads constructed on these soils should be shaped to shed water. Low strength and instability limit the ability of these soils to support vehicular traffic. Strengthening the base material helps overcome these limitations. Providing drainage on the Trent soil helps prevent the damage caused by frost action.

Septic tank absorption fields should be installed only in the Wentworth soil because of the flood hazard on the Trent soil. Enlarging the absorption area helps overcome the slow absorption rate in the Wentworth soil. Sealing the bottom and sides of lagoons helps prevent seepage. Runoff should be diverted away from lagoons on the Trent soil. Capability unit IIe-3; Wentworth soil in Silty range site, Trent soil in Overflow range site.

Wd—Worthing silty clay loam. This deep, very poorly drained, nearly level soil is in enclosed depressions. It is commonly flooded for long periods. Individual areas of this soil range from 5 to 80 acres in size and are generally round.

Typically, a 1-inch layer of partly decomposed organic litter is at the surface. The surface layer is about 14 inches of very dark gray silty clay loam. The subsoil is about 38 inches thick. The upper part is very dark gray, mottled, friable silty clay; the middle part is dark gray, mottled, firm silty clay; the lower part is dark gray, mottled, firm silty clay loam. The underlying material to a depth of 60 inches is dark gray, mottled silty clay loam. In places, the underlying material is silty clay or clay loam. In some areas, the surface layer and subsoil contain less clay.

Included with this soil in mapping are small areas of Crossplain and Chancellor soils. These soils make up less than 15 percent of any one mapped area. They are somewhat poorly drained and are in swales.

Permeability is slow in the Worthing soil. Available water capacity is high. The shrink-swell potential is high. Organic-matter content and fertility are high. The soil is ponded, or runoff is very slow. This soil has a perched water table within a depth of 1 foot.

Most areas support native vegetation. If drained, this soil has fair potential for cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat and poor potential for windbreaks and environmental plantings and openland wildlife habitat. If undrained, it has poor potential for cultivated crops, windbreaks and environmental plantings, and openland wildlife habitat and fair potential for tame pasture and hay, rangeland, and rangeland wildlife habitat. The potential is good for wetland wildlife habitat and poor for building sites and most sanitary facilities.

This soil is suited to cultivated crops if it is drained. The main concern of management is the wetness caused by flooding after rains. Surface drainage systems help remove excess water. Planting and harvesting usually are delayed during wet periods. Undrained areas are poorly suited to cultivated crops.

If drained, this soil is well suited to tame pasture and hay. Water-tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, are best suited. Grazing should be avoided during wet periods to prevent pudding and compacting. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help keep pastures in good condition.

This soil is suited to rangeland. The natural plant community is tall, water-tolerant grasses. If rangeland is overgrazed, cordgrass and reedgrasses lose vigor and are replaced by sedges, rushes, and saltgrass.

This soil generally is too wet for windbreaks and environmental plantings. The undrained areas are suitable as wetland wildlife habitat. Management practices that provide food and cover are needed to enhance the habitat for wetland wildlife.

This soil generally is unsuitable as a site for most buildings and for septic tank absorption fields because of wetness and flooding. Local roads constructed across areas of this soil should be built on well compacted fill material. Also, drainage should be provided through culverts and ditches. Sewage lagoons function well on this soil; their embankments provide protection from flooding. Capability unit IIIw-1 drained, Vw-2 undrained; Wetland range site.

We—Worthing silty clay loam, ponded. This deep, very poorly drained, nearly level soil is in enclosed depressions and in low lying areas adjacent to the Missouri River, below Gavins Point Dam. It is frequently flooded for long periods. Individual areas of this soil range from 5 to 50 acres in size and are either circular or long and narrow.

Typically, the surface layer is very dark gray silty clay loam about 14 inches thick. The subsoil is about 38 inches thick. The upper part is very dark gray, mottled, friable silty clay; the middle part is dark gray, mottled, firm silty clay; the lower part is dark gray, mottled, firm silty clay loam. The underlying material to a depth of 60 inches is dark gray, mottled silty clay loam.

Permeability is slow. Available water capacity is high. The shrink-swell potential is high. Organic-matter content and fertility also are high. Except for long droughty periods, the soil is nearly always ponded. The water is 3 or more feet deep during wet periods. The water table is within a depth of 0.5 feet during dry periods.

Most areas are used as wetland wildlife habitat. In most areas, the vegetation is rushes, cattails, and sedges. This soil has good potential for wetland wildlife habitat. It has poor potential for cultivated crops, tame pasture and hay, rangeland, rangeland wildlife habitat, windbreaks and environmental plantings, and openland wildlife habitat and for building sites and sanitary facilities.

This soil is unsuited to cultivated crops, windbreaks and environmental plantings, tame pasture, and rangeland. It is too wet and is flooded too frequently to be used as a site for buildings and septic tank absorption fields. Sewage lagoons can be constructed in areas where the depth of the floodwater does not exceed 5 feet. Capability unit VIIIw-1; not assigned to a range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Ralph W. Stensland, conservation argonomist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 84 percent of the survey area was used for crops, hay, and pasture in 1975 (*13*). Corn, oats, soybeans, and grain sorghum are the main cash crops.

The potential of the soils in Yankton County for increased crop production is good. About 11,000 acres of potentially good cropland is currently used as rangeland, 8,000 acres as pasture, and 5,000 acres as permanent hayland.

In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Soil erosion and *soil blowing* are the major hazards on almost 36 percent of the cropland, hayland, and pasture in Yankton County. If the slope is more than 2 percent, erosion is a hazard on such soils as Blendon, Clarno, Crofton, Davis, Davis Variant, Egan, Ethan, Nora, Redstoe Variant, Thurman, and Wentworth.

Loss of the surface soil through erosion or soil blowing reduces productivity and results in sedimentation in streams and lakes. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a thin or calcareous surface layer, such as the Betts, Crofton, Ethan, and Redstoe Variant. Productivity is reduced on droughty soils, such as Grable, Enet, and Delmont. Controlling erosion minimizes the pollution of streams and lakes by sediment and improves water quality for fish and wildlife, recreation, and municipal use.

A cropping system that keeps vegetative cover on the soil for extended periods holds soil erosion losses to amounts that will not reduce the productive capacity of the soils. During periods when crops do not protect the soil, careful management of crop residue is essential. On livestock farms, legume and grass forage crops in the cropping system not only provide nitrogen and improve tilth for the following crop but also reduce the risk of erosion on sloping soils.

Where slopes are short and irregular, contouring or terracing is not practical. In these areas, cropping systems that provide substantial vegetative cover are needed to control erosion.

Minimizing tillage and leaving crop residue on the surface increase the infiltration rate and reduce the risks of runoff and erosion. Together with grassed waterways, which can be established if needed, these practices can be adapted to most soils in the survey area.

Contour farming, contour stripcropping, terraces, and diversions reduce the risks of runoff and erosion. They are most practical on deep, well drained soils that have long, smooth slopes, such as Clarno, Davis, Davis Variant, and Wentworth soils.

Soil blowing is a slight to severe hazard on some soils in the county. The soil blowing hazard is especially severe on the sandy Sarpy soils and on Thurman and Waubonsie soils. The clayey Blencoe, Boyd, Luton, and Onawa soils and the soils that have a high content of lime, such as Baltic, Betts, Crofton, Gavins, and Redstoe Variant, also are highly susceptible to soil blowing. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining an adequate plant cover or a cover of crop residue and keeping the surface rough minimize soil blowing on these soils. Windbreaks of adapted trees and shrubs also are effective in controlling soil blowing.

Information about the design of erosion-control systems for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on the poorly drained and very poorly drained Baltic, Luton, Tetonka, and Whitewood soils. Unless artificially drained, these soils are so wet that crops frequently are damaged. If a drainage outlet is available, open ditches help to remove excess water. Controlling runoff on adjacent slopes also helps reduce wetness.

The moderately well drained Bon, Bonilla, and Roxbury soils, on stream terraces, flood plains, and flats and in upland swales, receive additional moisture as occasional stream overflow or as runoff from adjacent soils. During wet years, tillage and planting are delayed in spring, but in most years drainage is adequate and the additional moisture is beneficial for crops. Artificial drainage is rarely needed on these soils.

Soil fertility is naturally low in the sandy Sarpy soils, in soils that have a high content of lime, such as Betts, Crofton, and Waubonsie soils, and in Grable and Onawa soils. Grasses and legumes in the cropping system help maintain fertility. On all soils, additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer that are needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Baltic silty clay has a clayey surface layer. Poor tilth is a problem. This soil dries out slowly in the spring and is difficult to till. If it is tilled when wet, it tends to become cloddy when dry and preparing good seedbeds is difficult. Timely tillage, grasses and legumes in the cropping system, crop residue management, and chiseling improve tilth.

Field crops suited to the soils and climate of the survey area include close growing crops and row crops. Oats and alfalfa are the main close growing crops. Spring wheat and barley are also suitable but are grown to a lesser extent. Corn is the main row crop. Soybeans and sorghum are grown less extensively. In the drier years, more corn is harvested for silage.

All commonly grown and climatically suited crops are suited to deep, well drained and moderately well drained soils, such as Blake, Blyburg, Bon, Bonilla, Clarno, Davis, Davis Variant, Egan, Haynie, Nora, Roxbury, Salix, Trent, and Wentworth.

Early maturing, more drought resistant small grain is better suited than deeper rooted corn and alfalfa on such soils as Delmont, Enet, and Grable. The porous underlying material limits rooting depth and water storage capacity. Close sown crops are also better suited to sandy soils, such as Sarpy and Thurman.

Small grain and alfalfa are better suited than row crops on such soils as Stickney. These soils have a clayey subsoil that retards root growth and restricts the amount of water released to plants.

Pasture plants best suited to the climate and most of the soils in the survey area include alfalfa, intermediate wheatgrass, and smooth bromegrass. Crested wheatgrass is well suited to soils that tend to be droughty, such as the Delmont, Enet, and Grable, and to soils that are low in fertility and high content of lime, such as Betts, Crofton, and Ethan. Because of the erosion hazard, a bunch-type species, such as crested wheatgrass, should not be planted alone if the slope is more than 6 percent.

If the poorly drained soils, such as Baltic, Luton, and Tetonka, are used for pasture, the choice of pasture plants is limited to water-tolerant species, such as Garrison creeping foxtail and reed canarygrass. Tall wheatgrass is best suited to saline soils, such as Salmo.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (*11*). These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability unit is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3 or IIIe-2.

Rangeland

About 16 percent of Yankton County is rangeland, which occurs generally as scattered small tracts throughout the county. The larger tracts are on breaks along the James River. Ethan and Betts soils are dominant on these breaks. Many of the soils on these breaks are too steep for cultivation.

Nearly half of the farm income in the county is derived from livestock, principally cattle. Cow-calf-steer operations are predominant throughout the county. The average size of operating units is about 400 acres.

On many farms, the forage produced on rangeland is supplemented by crop stubble and tame pasture. In winter, the native forage often is supplemented with protein concentrate or alfalfa. Creep feeding of calves and yearlings increases market weight on some operating units.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Many of the desirable tall grasses have been replaced by short grasses and weeds. As a result, the amount of forage produced may be less than half of that originally produced. Productivity of the rangeland can be increased by management that is effective on specific kinds of soil and range sites.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing.

The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. If management that is based on soil survey information and rangeland inventories is applied, the potential for increasing the productivity of the rangeland in the county is good. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Native woods and windbreaks and environmental plantings

David L. Hintz, forester, Soil Conservation Service, helped prepare this section.

In Yankton County, approximately 9,250 acres supports native trees and shrubs. The soils supporting trees and shrubs are not classified as woodland soils. Most of the trees and shrubs are deciduous and grow on the flood plains, side slopes, and drainageways near the Missouri River, the James River, and their tributaries.

American elm, American plum, boxelder, common chokecherry, eastern cottonwood, false indigo, golden currant, green ash, common hackberry, peachleaf willow, sandbar willow, smooth sumac, Virginia creeper, riverbank grape, and several species of Symphocarpos and Rosa are common on the flood plains. With the exception of the willows, these species and bur oak, eastern redcedar, honeylocust, and red mulberry are common on the side slopes and along the drainageways.

The trees and shrubs are valued primarily for watershed protection, recreational purposes, and wildlife habitat. Windbreaks have been planted since the days of early settlers. The early plantings were mainly made to protect farmsteads and livestock. Such windbreaks are still needed. In recent years, some field windbreaks have been planted.

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

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

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

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7 based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Wildlife habitat

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

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 8, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, western wheatgrass, and grama grasses.

Hardwood trees in this survey are planted trees and shrubs that provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat (fig. 11). Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native woody plants are bur oak, cottonwood, chokecherry, green ash, boxelder, hawthorn, silver buffaloberry, American plum, hackberry, and currant. Examples of fruit-producing shrubs and small trees that are commercially available and suitable for planting on soils rated *good* are Russian-olive, honeysuckle, and crabapple.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, and prairie cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting

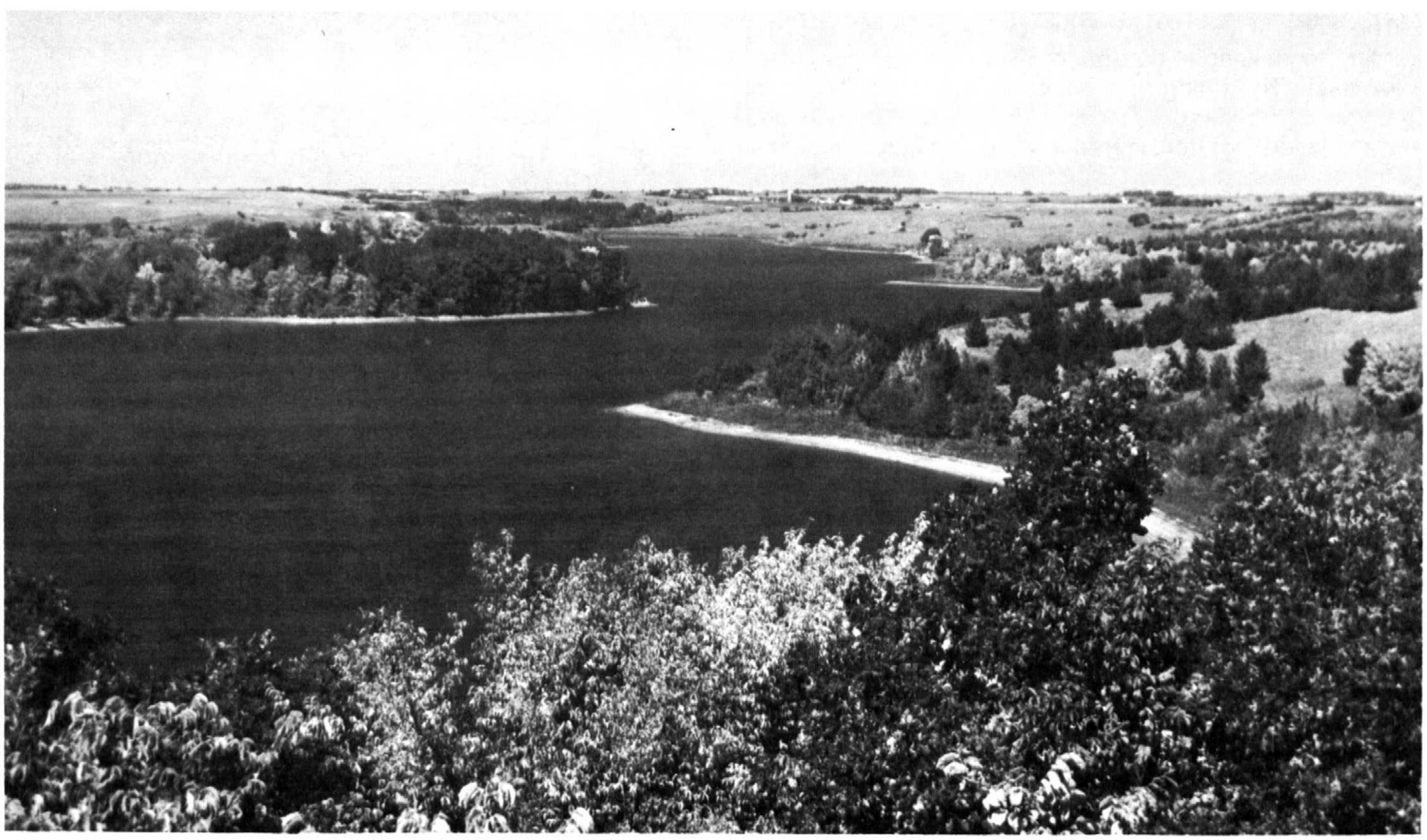


Figure 11.—A wooded area around Marindahl Lake. The trees and shrubs provide excellent wildlife habitat.

shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, shallow dugouts, ditches, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, trees, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous and woody plants. The kinds of wildlife attracted to these areas include bobwhite, ring-necked pheasant, gray partridge, mourning dove, meadowlark, cottontail, raccoon, and red fox.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include whitetail deer, jackrabbit, coyote, meadowlark, and lark bunting.

Recreation

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

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 11, and interpretations for dwellings without basements and for local roads and streets, given in table 10.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 10 shows, for each kind of soil, the degree and kind of limitations for building site development; table 11, for sanitary facilities; and table 13, shows the kind of limitations for water management. Table 12 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 10. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 5 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 10 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the compressibility and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 10 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 11 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments. These limitations do not apply to anaerobic lagoons.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 11 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 12 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 5 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 5 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 13, the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 15. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values in this survey area range from 0.15 to 0.43. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

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

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

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

Flooding is the temporary covering of soil with water from overflowing streams or with runoff from adjacent slopes. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated 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. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*10*). Unless otherwise noted, matrix colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Baltic series

The Baltic series consists of deep, poorly drained and very poorly drained, slowly permeable soils that formed in clayey alluvium. These soils are on bottom land. Slopes are 0 to 1 percent.

Baltic soils are similar to Luton soils and commonly are adjacent to Blyburg, Roxbury, and Salix soils. Blyburg, Roxbury, and Salix soils are fine-silty. Luton soils have free carbonates below a depth of 36 inches.

Typical pedon of Baltic silty clay, 110 feet south and 452 feet west of the northeast corner of sec. 21, T. 94 N., R. 54 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, friable, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

A12—6 to 13 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak medium and fine granular; slightly hard, friable, sticky and plastic; few accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

A13—13 to 24 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to moderate fine and very fine blocky; slightly hard, friable, sticky and plastic; thin shiny films on faces of peds; few medium accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

B21g—24 to 29 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; weak medium prismatic structure parting to moderate fine and medium blocky; hard, firm, sticky and plastic; thin films on faces of peds; common medium accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

B22g—29 to 36 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; weak medium prismatic structure parting to moderate medium blocky; hard, firm, sticky and plastic; thin shiny films on faces of peds; few medium accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

C1g—36 to 46 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; very thin shiny films on faces of peds; few fine accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

C2g—46 to 60 inches; light gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; common medium distinct mottles, light olive brown (2.5Y 5/4) and very dark gray (5YR 3/1) moist; massive; hard, firm, sticky and plastic; few medium accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum and of the mollic epipedon ranges from 24 to 45 inches. Free carbonates are at the surface in most pedons but may be leached as deep as 6 inches.

The A horizon typically is silty clay, but in some pedons it is clay loam. The B horizon has hue of 10YR or 5Y. Few or common distinct mottles are in some pedons. Accumulations of carbonate are lacking in some pedons. Few to many fine gypsum crystals are in the C horizon of some pedons.

Betts series

The Betts series consists of deep, excessively drained soils that formed in calcareous clay loam glacial till. Permeability is moderate in the upper part of the soils and moderately slow in the lower part. These soils are on uplands. Slopes range from 15 to 40 percent.

Betts soils commonly are adjacent to Ethan and Talmo soils on the landscape. Ethan and Talmo soils have a mollic epipedon. In addition, Talmo soils have sand and gravel within a depth of 10 inches.

Typical pedon of Betts loam, in an area of Ethan-Betts loams, 15 to 40 percent slopes, 2,280 feet west and 700 feet south of the northeast corner of sec. 24, T. 94 N., R. 54 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish (10YR 3/2) moist; weak fine and medium granular structure; soft, friable; violent effervescence; mildly alkaline; clear smooth boundary.

AC—3 to 8 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, sticky and plastic; few fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual smooth boundary.

C1ca—8 to 18 inches; light brownish gray (2.5Y 6/2) clay loam, light olive brown (2.5Y 5/4) moist; very weak very fine and fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine accumulations of carbonate; few fragments of chalk rock; violent effervescence; mildly alkaline; gradual smooth boundary.

C2—18 to 32 inches; light gray (2.5Y 7/2) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct mottles, strong brown (7.5YR 5/8) moist; massive; hard, firm, sticky and plastic; few fragments of chalk rock; common medium accumulations of carbonate; violent effervescence; mildly alkaline; gradual smooth boundary.

C3—32 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; many medium distinct mottles, strong brown (7.5YR 5/8) and yellowish red (5YR 4/8) moist; massive; hard, firm, sticky and plastic; few fragments of chalk rock; common medium accumulations of carbonate; violent effervescence; mildly alkaline.

The solum is 6 to 10 inches thick. Free carbonates are within a depth of 3 inches.

The A horizon has value of 4 or 5 (2 or 3 moist). The AC horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. Accumulations of carbonate are lacking in some pedons.

Blake series

The Blake series consists of deep, somewhat poorly drained soils that formed in recent silty alluvium. Permeability is moderate in the upper part of the soils and moderately rapid in the lower part. These soils are on bottom land. Slopes range from 0 to 2 percent.

The Blake soils in Yankton County have a thicker mollic epipedon and are leached of carbonates to a greater depth than is defined as the range for the series. These differences, however, do not alter the use or behavior of the soils.

Blake soils are similar to Lakeport and Salix soils and commony are adjacent to Forney, Haynie, and Owego soils. Forney and Owego soils are fine textured. Haynie soils are coarse-silty. Lakeport and Salix soils have a thicker mollic epipedon than Blake soils. In addition, Lakeport soils are fine textured.

Typical pedon of Blake silty clay loam, 650 feet south and 1,300 feet east of the northwest corner of sec. 6, T. 93 N., R. 54 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

A12—8 to 17 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; thin light gray (10YR 7/2) strata; common fine distinct mottles, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure; slighty hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

C1—17 to 23 inches; pale yellow (2.5Y 7/4) and light brownish gray (2.5Y 6/2) silt loam, light olive brown (2.5Y 5/4) and dark grayish brown (2.5Y 4/2) moist; many fine prominent mottles, yellowish brown (10YR 5/6) moist; very weak medium prismatic structure; soft, very friable, slightly plastic; strong effervescence; mildly alkaline; clear wavy boundary.

C2—23 to 31 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; common fine distinct mottles, yellowish brown (10YR 5/6) moist; weak medium prismatic structure parting to moderate fine blocky; hard, firm, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

C3—31 to 53 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; many fine distinct mottles, yellowish brown (10YR 5/6) moist; massive; soft, friable, slightly sticky and slightly plastic; common fine streaks of carbonate; strong effervescence; mildly alkaline; abrupt smooth boundary.

IIC4—53 to 60 inches; light yellowish brown (2.5Y 6/4) loamy very fine sand, olive brown (2.5Y 4/4) moist; single grained; loose; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 8 to 18 inches. In some pedons free carbonates are at the surface.

The A horizon typically is silty clay loam but is silt loam in some pedons. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. Some pedons lack a IIC horizon.

Blencoe series

The Blencoe series consists of deep, somewhat poorly drained soils that formed in clayey alluvium over loamy alluvium. Permeability is very slow in the upper part of the soils and moderate in the lower part. These soils are on bottom land. Slopes range from 0 to 2 percent.

The Blencoe soils in Yankton County have a thinner solum and have carbonates closer to the surface than is defined as the range for the series. These differences, however, do not alter the use or behavior of the soils.

Blencoe soils are similar to Onawa soils and commonly are adjacent to Blyburg, Lakeport, Luton, and Salix soils. Blyburg soils are coarse-silty. Lakeport and Luton soils are fine textured and lack very fine sandy loam in the lower part. Onawa soils lack a mollic epipedon. Salix soils are fine-silty.

Typical pedon of Blencoe silty clay, 188 feet north and 115 feet east of the southwest corner of sec. 36, T. 94 N., R. 54 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak coarse and medium subangular blocky structure; hard, firm, slightly sticky and plastic; neutral; abrupt smooth boundary.

A12—8 to 14 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, firm, slightly sticky and plastic; neutral; clear wavy boundary.

B2—14 to 21 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; few fine faint mottles, yellowish brown (10YR 5/6) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; thin shiny films on faces of peds; neutral; clear wavy boundary.

B3ca—21 to 27 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct mottles, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

IIC—27 to 60 inches; pale yellow (2.5Y 7/4) very fine sandy loam, light olive brown (2.5Y 5/4) moist; common fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 32 inches. The depth to free carbonate ranges from 20 to 30 inches. The thickness of the mollic epipedon ranges from 20 to 24 inches.

The A horizon typically is silty clay, but silty clay loam is within the range. The thickness of the clayey material ranges from 20 to 36 inches.

Blendon series

The Blendon series consists of deep, well drained soils that formed in glacial melt water deposits. Permeability is moderately rapid. These soils are on uplands. Slopes range from 0 to 6 percent.

Blendon soils are adjacent to Ethan and Thurman soils. Ethan soils are fine-loamy. Thurman soils have a mollic epipedon less than 20 inches thick.

Typical pedon of Blendon loam, in an area of Blendon-Thurman complex, 0 to 6 percent slopes, 1,800 feet north and 120 feet west of the southeast corner of sec. 36, T. 96 N., R. 57 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine and medium granular structure; soft, friable; neutral; abrupt smooth boundary.

B21—8 to 18 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; slightly acid; clear smooth boundary.

B22—18 to 26 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; very weak medium prismatic structure; soft, very friable; neutral; clear smooth boundary.

B3—26 to 33 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; very weak coarse prismatic structure; loose, very friable; neutral; gradual smooth boundary.

C1—33 to 50 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grained; loose; neutral; gradual smooth boundary.

C2ca—50 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grained; loose; strong effervescence; neutral.

The thickness of the solum ranges from 28 to 40 inches. The depth to free carbonates is 45 to 55 inches. The thickness of the mollic epipedon ranges from 24 to 38 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is loam but is fine sandy loam in some pedons. The B2 horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B3 horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is sandy loam in some pedons. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 3 or 4. It typically is loamy fine sand, but loamy sand and fine sandy loam are within the range. Thin strata of silt loam or sandy loam are in some pedons.

Blyburg series

The Blyburg series consists of deep, well drained, moderately permeable soils that formed in silty alluvium. These soils are on bottom land. Slopes range from 0 to 2 percent.

Blyburg soils are similar to the Haynie soils and commonly are adjacent to Blencoe, Lakeport, and Salix soils. Blencoe soils are clayey in the upper part and loamy in the lower part. Haynie soils lack a mollic epipedon. Lakeport soils are fine textured. Salix soils are fine-silty.

Typical pedon of Blyburg silt loam, 1,600 feet south and 110 feet east of the northwest corner of sec. 36, T. 94 N., R. 54 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A12—8 to 15 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

A13—15 to 19 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; abrupt wavy boundary.

C1—19 to 27 inches; grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—27 to 45 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C3—45 to 60 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; common medium distinct mottles, yellowish brown (10YR 5/6) moist; massive; soft, very friable; strong effervescence; mildly alkaline.

The thickness of the solum and of the mollic epipedon ranges from 12 to 19 inches. The depth to free carbonates ranges from 8 to 19 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It typically is silt loam, but silty clay loam is within the range. The C horizon has chroma of 2 or 3.

Bon series

The Bon series consists of deep, moderately well drained, moderately permeable soils that formed in loamy alluvium. These soils are on stream terraces and bottom land. Slopes range from 0 to 2 percent.

Bon soils are similar to Davis soils and commonly are adjacent to Clarno and Roxbury soils on the landscape.

Roxbury soils are fine-silty. Clarno soils have a mollic epipedon less than 20 inches thick. Davis soils have free carbonates below a depth of 20 inches. They are in concave areas on foot slopes.

Typical pedon of Bon loam, 2,590 feet west and 340 feet north of the southeast corner of sec. 7, T. 94 N., R. 54 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak fine and very fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A12—5 to 19 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; moderate fine and very fine subangular blocky structure; soft, very friable; moderately alkaline; abrupt wavy boundary.

A13—19 to 36 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak very fine and fine subangular blocky; soft, very friable; slight effervescence; moderately alkaline; gradual smooth boundary.

C1—36 to 50 inches; very dark grayish brown (2.5Y 3/2) loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

C2—50 to 60 inches; very dark grayish brown (2.5Y 3/2) and grayish brown (2.5Y 5/2) stratified loam and loamy sand, very dark brown (10YR 2/2) and dark grayish brown (2.5Y 4/2) moist; massive and single grained; slightly hard and loose, very friable; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 22 to 50 inches. The depth to free carbonates ranges from 6 to 20 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. Typically, it is loam, but silt loam is within the range. The C horizon has value of 3 to 6 (2 to 5 moist) and chroma of 2 or 3. It is dominantly loam, but strata of clay loam, fine sandy loam, and loamy sand are within the range.

Bonilla series

The Bonilla series consists of deep, moderately well drained soils formed in loamy glacial till. Permeability is moderate in the upper part of the soils and moderately slow in the lower part. These soils are in swales on uplands. Slopes range from 0 to 6 percent.

Bonilla soils are similar to Trent soils and commonly are adjacent to Clarno and Ethan soils. Clarno and Ethan soils have a mollic epipedon less than 20 inches thick. They are on the higher parts of the landscape. Trent soils are fine-silty.

Typical pedon of Bonilla loam, in an area of Clarno-Bonilla loams, 1 to 6 percent slopes, 2,574 feet west and 175 feet south of the northeast corner of sec. 5, T. 94 N., R. 54 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; soft, friable; slightly acid; abrupt smooth boundary.

B21—7 to 15 inches; dark grayish brown (10YR 4/2) 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.

B22—15 to 26 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and plastic; slightly acid; clear smooth boundary.

B23—26 to 30 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) crushing to brown (10YR 4/3) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and plastic; slightly acid; abrupt smooth boundary.

B3ca—30 to 40 inches; pale olive (5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, slightly sticky and plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C1—40 to 48 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; common medium distinct mottles, gray (5Y 6/1) and yellowish brown (10YR 5/8) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C2—48 to 60 inches; pale yellow (2.5Y 7/4) clay loam, olive brown (2.5Y 4/4) moist; common medium distinct mottles, gray (5Y 6/1) and brownish yellow (10YR 6/8) moist; massive; hard, firm, slightly sticky and plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 32 to 40 inches. The depth to free carbonates and the thickness of the mollic epipedon are 26 to 32 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is loam, but silt loam is within the range. The B2 horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. It is dominantly clay loam, but stratified loam, clay loam, and fine sandy loam are within the range. This horizon has common or many distinct mottles. Gypsum crystals are in some pedons.

Boyd series

The Boyd series consists of moderately deep, well drained soils that formed in material weathered from the underlying shale. Permeability is slow or very slow. These soils are on uplands. Slopes range from 15 to 40 percent.

Boyd soils are adjacent to Crofton, Ethan, and Betts soils. These adjacent soils contain less clay than Boyd soils and are higher on the landscape. Betts and Ethan soils formed in glacial till. Crofton soils formed in loess.

Typical pedon of Boyd silty clay, in an area of Boyd-Ethan association, 15 to 40 percent slopes, 2,700 feet west and 1,200 feet north of the southeast corner of sec. 16, T. 93 N., R. 57 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; very hard, very firm, sticky and plastic; neutral; clear wavy boundary.

B21—3 to 8 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium blocky structure; extremely hard, firm, sticky and plastic; slight effervescence; neutral; clear wavy boundary.

B22—8 to 13 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; slight effervescence; neutral; clear wavy boundary.

B23—13 to 23 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse blocky structure; extremely hard, very firm, sticky and plastic; common medium accumulations of carbonate; strong effervescence; neutral; clear wavy boundary.

C1—23 to 30 inches; light olive gray (5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct stains along bedding planes, brownish yellow (10YR 6/6) moist; massive; extremely hard, very firm, sticky and plastic; strong effervescence; common crystals of gypsum; common shale fragments; neutral; gradual wavy boundary.

Cr—30 to 60 inches; light olive gray (5Y 6/2) shale, olive (5Y 5/2) moist; common medium distinct stains along bedding planes, brownish yellow (10YR 6/6) moist; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 18 to 28 inches. The depth to free carbonate ranges from 0 to 5 inches. The thickness of the mollic epipedon ranges from 9 to 15 inches.

The A horizon has hue of 10YR or 2.5Y and value of 4 or 5 (2 or 3 moist). It is clay in some pedons. The B horizon is clay in some pedons. Tongues of A1 material are common in the B2 horizon, and some extend into the C horizon. The C1 horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The Cr horizon has hue of 2.5Y or 5Y, value of 4 to 6 (4 or 5 moist), and chroma of 2 or 3.

Chancellor series

The Chancellor series consists of deep, somewhat poorly drained, slowly permeable soils that formed in silty alluvium. These soils are in swales and in drainageways on uplands. Slopes are 0 to 1 percent.

Chancellor soils are similar to Crossplain soils and commonly are adjacent to Egan, Wentworth, and Whitewood soils on the landscape. Crossplain soils contain more sand than Chancellor soils. Egan, Wentworth, and Whitewood soils are fine-silty.

Typical pedon of Chancellor silty clay loam, 2,514 feet west and 473 feet south of the northeast corner of sec. 3, T. 94 N., R. 54 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A12—8 to 12 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak thin and medium platy; slightly hard, very friable, slightly sticky and plastic; neutral; clear wavy boundary.

A13—12 to 19 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; common medium distinct mottles, dark brown (7.5YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and plastic; thin shiny films on faces of peds; neutral; gradual wavy boundary.

B21tg—19 to 30 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; common medium distinct mottles, dark brown (7.5YR 3/2) moist; weak medium prismatic structure parting to moderate fine blocky; slightly hard, firm, slightly sticky and plastic; thin shiny films on faces of peds; neutral; clear wavy boundary.

B22tg—30 to 37 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct mottles, dark brown (7.5YR 3/2) and reddish yellow (7.5YR 6/8) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and plastic; thin films on faces of peds; few fine concretions of iron and manganese oxide; neutral; clear wavy boundary.

C1gca—37 to 44 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common medium distinct mottles, reddish yellow (7.5YR 6/8) moist; very weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and plastic; few fine concretions of iron and manganese oxide; few medium accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C2g—44 to 56 inches; light gray (5Y 7/2) silty clay loam, light olive gray (5Y 6/2) moist; common medium distinct mottles, reddish yellow (7.5YR 6/8) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine concretions of iron and manganese oxide; few medium accumulations of carbonate; violent effervescence; mildly alkaline; clear wavy boundary.

C3g—56 to 60 inches; light gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; common medium distinct mottles, reddish yellow (7.5YR 6/8) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine concretions of iron and manganese oxide; few medium accumulations of carbonate; violent effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 36 to 50 inches. The thickness of the mollic epipedon ranges from 26 to 48 inches.

The A horizon is typically silty clay loam but is silty clay in some pedons. It is slightly acid or neutral. The B horizon has value of 4 to 6 (2 to 4 moist) and chroma of 1 or 2. It typically is silty clay but is silty clay loam in some pedons. It is neutral or slightly acid. The C horizon has value of 5 to 7 (5 or 6 moist) and chroma of 2. It is mildly alkaline or moderately alkaline. Accumulations of carbonate are few or common. Nests of gypsum are below a depth of 40 inches in some pedons.

Clamo series

The Clamo series consists of deep, poorly drained, slowly permeable soils formed in silty alluvium. These soils are on bottom land. Slopes range from 0 to 2 percent.

Clamo soils are similar to Lamo soils and commonly are adjacent to James and Lamo soils. James soils have visible salts in the solum. Lamo soils are fine-silty.

Typical pedon of Clamo silty clay loam, 1,100 feet east and 250 feet north of the southwest corner of sec. 35, T. 96 N., R. 56 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

B2g—7 to 14 inches; dark gray (2.5Y 4/1) silty clay loam, black (2.5Y 2/1) moist; weak coarse subangular blocky structure parting to moderate fine and very fine subangular blocky; hard, firm, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B3gca—14 to 26 inches; dark gray (2.5Y 4/1) silty clay loam, black (2.5Y 2/1) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1g—26 to 32 inches; gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; few fine distinct mottles, strong brown (7.5YR 5/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; very thin strata; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C2g—32 to 60 inches; dark gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) moist; massive; hard, firm, slightly sticky and slightly plastic; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 36 inches. The depth to free carbonates ranges from 14 to 24 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1. It typically is silty clay loam, but silty clay is within the range. The B horizon has hue of 2.5Y or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1. Few or common accumulations of carbonate are in the lower part of the B horizon of some pedons. The C horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1. It typically is silty clay loam, but thin strata of silt loam or fine sandy loam are in some pedons. Accumulations of carbonate and nests of gypsum are few or common in some pedons.

Clamo Variant

The Clamo Variant consists of deep, poorly drained soils that are slowly permeable in the upper part and moderately permeable in the lower part. These soils formed in silty alluvium on bottom land. Slopes range from 0 to 2 percent.

These soils are adjacent to other Clamo soils and to James and Lamo soils. The other Clamo soils are clayey throughout. The James soils have visible salts in the solum. The Lamo soils contain less clay in the solum than the Clamo Variant.

Typical pedon of Clamo Variant silty clay loam, 1,700 feet east and 350 feet north of the southwest corner of sec. 28, T. 96 N., R. 56 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate fine and medium granular structure; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—9 to 16 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

B2—16 to 26 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; many fine distinct mottles, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

C1—26 to 38 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; many fine distinct mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; clear smooth boundary.

C2—38 to 60 inches; gray (5Y 5/1) silt loam, very dark gray (5Y 3/1) moist; many fine and medium distinct mottles, yellowish brown (10YR 5/6) and dark gray (5Y 4/1) moist; massive; soft, very friable, slightly plastic; strong effervescence; mildly alkaline.

The thickness of the solum and of the mollic epipedon ranges from 18 to 30 inches and corresponds to the depth to contrasting underlying material. The depth to free carbonates ranges from 0 to 30 inches.

The A horizon has hue of 10YR or 2.5Y and value of 3 or 4 (2 or 3 moist). It typically is silt loam, but silty clay is within the range. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. The C horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. It typically is silt loam, but in some pedons it is stratified silt loam, very fine sandy loam, loamy very fine sand, and loam.

Clarno series

The Clarno series consists of deep, well drained soils that formed in clay loam glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are on uplands. Slopes range from 0 to 6 percent.

Clarno soils commonly are adjacent to Bonilla, Crossplain, Davis, Ethan, Stickney, and Tetonka soils. Bonilla and Davis soils have a mollic epipedon more than 20 inches thick. Crossplain soils are somewhat poorly drained. Ethan soils are not so deep to free carbonates as Clarno soils. Stickney soils have a natric horizon. Tetonka soils are poorly drained and are in depressions. Bonilla, Crossplain, Davis, and Stickney soils are in intermediate positions between the Clarno and Tetonka soils. Ethan soils are on the higher parts of the landscape.

Typical pedon of Clarno loam (fig. 12), in an area of Clarno-Bonilla loams, 1 to 6 percent slopes, 1,840 feet west and 114 feet south of the northeast corner of sec. 5, T. 94 N., R. 54 W.

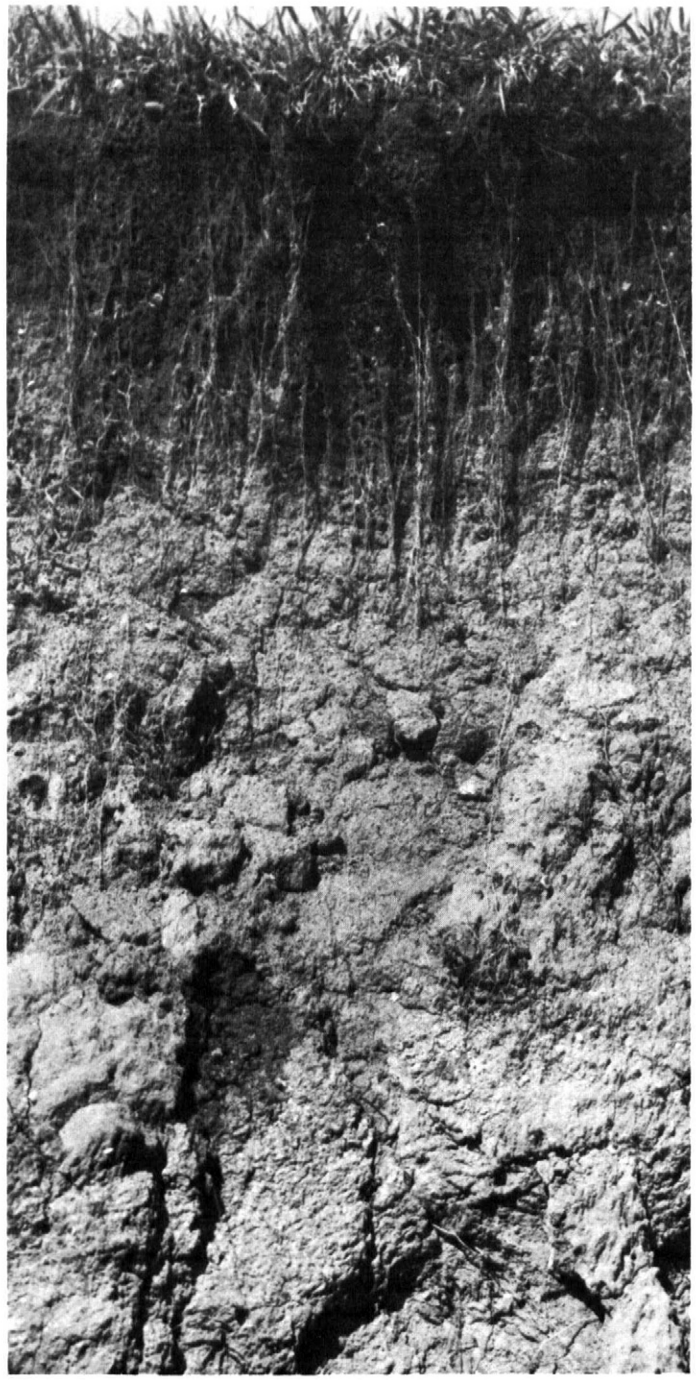


Figure 12.—Typical profile of Clarno loam, in an area of Clarno-Bonilla loams, 1 to 6 percent slopes. The dark surface layer is about 11 inches thick.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; soft, friable; slightly acid; abrupt smooth boundary.

A12—7 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

B21—11 to 16 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

B22—16 to 23 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; neutral; abrupt smooth boundary.

B3ca—23 to 33 inches; pale brown (10YR 6/3) clay loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C1ca—33 to 43 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct mottles, gray (5Y 6/1) and brownish yellow (10YR 6/8) moist; massive; hard, friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—43 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct mottles, gray (5Y 6/1) and brownish yellow (10YR 6/8) moist; massive; hard, friable; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 35 inches. The depth to free carbonates ranges from 15 to 24 inches. The thickness of the mollic epipedon ranges from 12 to 20 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is loam, but silt loam is within the range. The B2 horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. It is loam or clay loam and is neutral or mildly alkaline. The C horizon has value of 5 to 7 (5 or 6 moist) and chroma of 3 or 4. It typically is clay loam, but loam is within the range. Mottles and accumulations of carbonate range from few to many. Gypsum crystals are below a depth of 40 inches in some pedons.

Crofton series

The Crofton series consists of deep, well drained, moderately permeable soils that formed in loess. These soils are on uplands. Slopes range from 9 to 40 percent.

Crofton soils commonly are adjacent to Boyd, Gavins, Nora, and Talmo soils on the landscape. Boyd soils contain more clay than Crofton soils and formed in clayey shale. Gavins soils are shallow to chalk rock. Nora soils have a mollic epipedon. Talmo soils have a mollic epipedon and are shallow to sand and gravel.

Typical pedon of Crofton silt loam, in an area of Crofton-Nora silt loams, 9 to 25 percent slopes, 330 feet south and 90 feet east of the northwest corner of sec. 18, T. 93 N., R. 56 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

A12—4 to 6 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine and very fine subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

AC—6 to 12 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; many fine faint mottles, brownish yellow (10YR 6/6) moist; weak coarse prismatic structure; slightly hard, friable; common fine accumulations and streaks of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C1—12 to 26 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; many fine distinct mottles, brownish yellow (10YR 6/6) moist; weak coarse prismatic structure; slightly hard, friable; common fine accumulations and streaks of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—26 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; common fine distinct mottles, brownish yellow (10YR 6/6) moist; massive; slightly hard, very friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 8 to 14 inches. Free carbonates are within 6 inches of the surface.

The A horizon is 3 to 6 inches thick. It has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is typically silt loam but is silty clay loam in some pedons. The AC horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 3 or 4. Some pedons lack an AC horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4.

Crossplain series

The Crossplain series consists of deep, somewhat poorly drained, slowly permeable soils that formed in clay loam glacial till. These soils are on uplands. Slopes range from 0 to 2 percent.

Crossplain soils are similar to Chancellor soils and commonly are adjacent to Bonilla, Clarno, Stickney, and Tetonka soils. Bonilla soils are moderately well drained. Chancellor soils contain less sand than Crossplain soils. Clarno soils are on the higher parts of the landscape and are well drained. They lack an argillic horizon. Stickney soils have a natric horizon. Tetonka soils are poorly drained and are in depressions. Bonilla and Stickney soils and the Crossplain soils are in similar positions on the landscape.

Typical pedon of Crossplain clay loam, in an area of Clarno-Crossplain-Tetonka complex, 0 to 3 percent slopes, 2,110 feet north and 336 feet west of the southeast corner of sec. 17, T. 96 N., R. 56 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A12—8 to 14 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; slightly acid; clear smooth boundary.

B21—14 to 25 inches; gray (2.5Y 5/1) clay, very dark gray (2.5Y 3/1) moist; common fine faint mottles, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm, sticky and plastic; shiny films on faces of peds; few fine concretions of iron and manganese oxide; neutral; clear wavy boundary.

B22tg—25 to 32 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; common fine distinct mottles, yellowish brown (10YR 5/6) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm, sticky and plastic; few fine concretions of iron and manganese oxide; neutral; clear wavy boundary.

B3g—32 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; many fine distinct mottles, yellowish brown (10YR 5/6) and very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine concretions of iron and manganese oxide; few fine nests of salts; neutral; abrupt wavy boundary.

C1ca—42 to 60 inches; pale olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; many fine and medium distinct mottles, light olive brown (2.5Y 5/6) and gray (5Y 5/1) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine concretions of iron and manganese oxide; common fine accumulations of carbonate; strong effervescence; common fine nests of gypsum; mildly alkaline.

The thickness of the solum ranges from 36 to 50 inches. The depth to free carbonates ranges from 32 to 44 inches. The thickness of the mollic epipedon ranges from 20 to 32 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1. It typically is clay loam, but loam and silty clay loam are within the range. The B2 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The clay content ranges from 35 to 45 percent. Mottles range from faint in the upper part to prominent in the lower part. The B3 horizon is calcareous in some pedons. The B3 and C horizons have hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3.

Davis series

The Davis series consists of deep, well drained, moderately permeable soils that formed in loamy alluvium. These soils are in concave areas on foot slopes in the uplands. Slopes range from 2 to 15 percent.

Davis soils are similar to Bon soils and commonly are adjacent to Clamo, Clarno, and Ethan soils on the landscape. Bon soils are calcareous near the surface. Clamo soils are fine textured. Clarno and Ethan soils are not pachic and are fine-loamy.

Typical pedon of Davis silt loam, 2 to 9 percent slopes, 600 feet south and 300 feet west of the northeast corner of sec. 32, T. 95 N., R. 55 W.

A1—0 to 9 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, very friable; slightly acid; clear wavy boundary.

B1—9 to 19 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; gradual wavy boundary.

B2—19 to 30 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

B3ca—30 to 38 inches; light grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C1ca—38 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; very weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—42 to 60 inches; pale brown (10YR 6/3) clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, sticky and plastic; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 32 to 60 or more inches thick. The depth to free carbonates ranges from 24 to 48 inches. The mollic epipedon is 24 to 60 or more inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is silt loam but is loam in some pedons. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 to 3. The C horizon typically is clay loam, but loam and stratified silt loam, sandy loam, silty clay loam, and clay loam are within the range. Accumulations of carbonates are few or common in the lower part of the B horizon or in the C horizon.

Davis Variant

The Davis Variant consists of deep, well drained soils that formed in loamy and sandy alluvium. Permeability is moderately rapid. These soils are on convex outwash fans adjacent to the uplands. Slopes range from 0 to 6 percent.

These soils are adjacent to other Davis soils and to Ethan and Clamo soils on the landscape. The other Davis soils contain more clay and less sand and are leached of carbonates to a greater depth. Ethan soils are fine-loamy and formed in glacial till. Clamo soils are fine textured.

Typical pedon of Davis Variant loam, 0 to 6 percent slopes, 1,250 feet north and 700 feet east of the southwest corner of sec. 29, T. 96 N., R. 56 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A12—7 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; thin strata of light brownish gray (10YR 6/2) very fine sand; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—12 to 22 inches; light gray (10YR 7/2) sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; 10 percent gravel; violent effervescence; mildly alkaline; clear wavy boundary.

C2—22 to 30 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; mildly alkaline; clear wavy boundary.

C3—30 to 38 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; massive; soft, very friable; 10 percent gravel; violent effervescence; mildly alkaline; clear wavy boundary.

C4—38 to 60 inches; very pale brown (10YR 7/4) loamy fine sand, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 10 to 18 inches. Free carbonates are within 24 inches of the surface. The mollic epipedon is less than 20 inches thick. Some pedons have a buried A horizon.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It typically is loam, but sandy loam, fine sandy loam, and gravelly or cobbly loam are within the range. The C horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It is sandy loam, very fine sandy loam, loamy fine sand, loam, or silt loam.

Delmont series

The Delmont series consists of somewhat excessively drained soils that are shallow to sand and gravel. These soils formed in loamy glacial outwash on uplands. Permeability is moderately rapid in the solum and rapid in the underlying sand and gravel. Slopes range from 0 to 6 percent.

Delmont soils are similar to Enet soils and commonly are adjacent to Clarno, Enet, and Talmo soils. Clarno soils formed in clay loam glacial till. Enet soils have sand and gravel within a depth of 20 to 40 inches. Talmo soils have sand and gravel within a depth of 10 inches.

Typical pedon of Delmont loam, in an area of Enet-Delmont loams, 0 to 2 percent slopes, 1,106 feet north and 27 feet east of the southwest corner of sec. 7, T. 95 N., R. 56 W.

Ap—0 to 7 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.

B2—7 to 18 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; soft, very friable; neutral; gradual wavy boundary.

IIC1ca—18 to 32 inches; grayish brown (10YR 5/2) sand and gravel, dark grayish brown (10YR 4/2) moist; single grained; loose; gravel coated with calcium carbonate; strong effervescence; mildly alkaline; abrupt smooth boundary.

IIC2—32 to 60 inches; light yellowish brown (10YR 6/4) sand and gravel, yellowish brown (10YR 5/4) moist; single grained; loose; strong effervescence; mildly alkaline.

The thickness of the solum, the depth to carbonates, and the thickness of the mollic epipedon range from 10 to 20 inches and correspond to the depth to underlying sand and gravel.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is loam, but fine sandy loam is within the range. The B horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2.

Egan series

The Egan series consists of deep, well drained soils that formed in silty drift and the underlying glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are on uplands. Slopes range from 0 to 9 percent.

Egan soils are similar to Wentworth soils and commonly are adjacent to Ethan, Trent, and Wentworth soils. Ethan soils are fine-loamy. Trent and Wentworth soils do not have glacial till within a depth of 20 to 40 inches.

Typical pedon of Egan silty clay loam, in an area of Egan-Ethan-Trent complex, 1 to 6 percent slopes, 2,240 feet west and 110 feet north of the southeast corner of sec. 3, T. 94 N., R. 54 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B21—7 to 14 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B22—14 to 19 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B3ca—19 to 28 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to moderate fine and medium blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; abrupt smooth boundary.

IIC1—28 to 38 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct mottles, gray (5Y 6/1) and brownish yellow (10YR 6/6) moist; massive; hard, firm, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

IIC2—38 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; many medium distinct mottles, gray (5Y 6/1) and brownish yellow (10YR 6/8) moist; massive; hard, firm, sticky and plastic; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 30 inches. The depth to free carbonates ranges from 15 to 24 inches. The thickness of the mollic epipedon ranges from 12 to 19 inches. The depth to glacial till ranges from 24 to 36 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is silty clay loam, but silt loam is within the range. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. The IIC horizon has value of 5 to 7 (5 or 6 moist) and chroma of 3 or 4. It typically is clay loam, but it is loam in some pedons. Mottles and accumulations of carbonate range from few to many.

Enet series

The Enet series consists of well drained soils that are moderately deep to sand and gravel. Permeability is moderate in the solum and rapid in the underlying sand and gravel. These soils are on uplands. They formed in glacial outwash. Slopes range from 0 to 9 percent.

Enet soils are similar to Delmont soils and commonly are adjacent to Clarno, Delmont, and Talmo soils. Clarno soils formed in clay loam glacial till. Delmont and Talmo soils have sand and gravel within a depth of 20 inches.

Typical pedon of Enet loam, in an area of Enet-Delmont loams, 0 to 2 percent slopes, 1,195 feet north and 122 feet west of the southeast corner of sec. 12, T. 95 N., R. 57 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; neutral; abrupt smooth boundary.

B2—8 to 25 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

B3—25 to 34 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

IIC1ca—34 to 42 inches; light brownish gray (10YR 6/2) sand and gravel, grayish brown (10YR 5/2) moist; single grained; loose; underside of pebbles coated with calcium carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

IIC2—42 to 60 inches; light brownish gray (10YR 6/2) sand and gravel, grayish brown (10YR 5/2) moist; single grained; loose; strong effervescence; mildly alkaline.

The thickness of the solum typically is 34 inches but ranges from 20 to 40 inches. It corresponds to the depth to free carbonates and the thickness of the mollic epipedon.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is loam, but fine sandy loam is within the range. The B horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. The IIC horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. Few or common fine accumulations of carbonate are in some pedons.

Ethan series

The Ethan series consists of deep, well drained soils that formed in glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are on uplands. Slopes range from 2 to 25 percent.

Ethan soils are adjacent to Betts, Clarno, Davis, and Egan soils on the landscape. Betts soils lack a mollic epipedon. Clarno and Davis soils are leached of carbonates to a greater depth than Ethan soils. Egan soils are fine-silty.

Typical pedon of Ethan loam, in an area of Ethan-Betts loams, 15 to 40 percent slopes, 2,340 feet west and 750 feet south of the northeast corner of sec. 24, T. 94 N., R. 54 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; clear smooth boundary.

B2—4 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; gradual smooth boundary.

B3ca—8 to 16 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, sticky and plastic; few medium accumulations of carbonate; violent effervescence; mildly alkaline; gradual smooth boundary.

C1ca—16 to 27 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (2.5Y 4/3) moist; few medium distinct mottles, brownish yellow (10YR 6/8) moist; massive; hard, firm, sticky and plastic; few medium accumulations of carbonate; violent effervescence; mildly alkaline; gradual smooth boundary.

C2—27 to 60 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; many fine and medium distinct mottles, brownish yellow (10YR 6/8) and dark reddish brown (5YR 3/4) moist; hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 12 to 24 inches. Free carbonates are within 5 inches of the surface. The mollic epipedon is 7 to 10 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It typically is loam but in some pedons is stony loam or clay loam. It is neutral in some pedons. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3. It is loam or clay loam. Accumulations of carbonate do not occur in some pedons. In cultivated areas, the soil typically lacks a B2 horizon and has an AC horizon. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 6 moist), and chroma of 3 or 4. It is loam, clay loam, or stratified clay loam, silt loam, and fine sandy loam. Reaction is moderately alkaline in some pedons.

Forney series

The Forney series consists of deep, poorly drained soils formed in clayey alluvium. Permeability is very slow. These soils are on bottom land. Slopes are 0 to 2 percent.

The Forney soils in Yankton County have a mollic epipedon and are shallower to a buried surface layer and brighter colored in the underlying material than is defined as the range for the Forney series. These differences, however, do not alter the use or behavior of the soils.

Forney soils are similar to Luton soils and are commonly adjacent to Blake, Owego, and Onawa soils. Blake soils are fine-silty. Luton soils are deeper to carbonates than Forney soils and are not so stratified. Owego soils are coarse-silty. Onawa soils have coarse-silty underlying material.

Typical pedon of Forney silty clay loam, 1,325 feet south and 110 feet east of the northwest corner of sec. 23, T. 93 N., R. 54 W.

Ap—0 to 4 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak fine and very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—4 to 11 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium and fine angular blocky structure; hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—11 to 16 inches; dark gray (5Y 4/1) silty clay loam, dark grayish brown (2.5Y 4/2) moist; 1-inch light gray (2.5Y 7/2) strata in upper part; common medium distinct mottles, brownish yellow (10YR 6/6) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; slight effervescence; neutral; clear smooth boundary.

IIA1b—16 to 32 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; common fine faint mottles, brownish yellow (10YR 6/6) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable, sticky and plastic; neutral; clear smooth boundary.

IIC1—32 to 40 inches; dark gray (5Y 4/1) and light olive gray (5Y 6/2) silty clay, olive gray (5Y 5/2) and very dark gray (5Y 3/1) moist; common medium distinct mottles, yellowish brown (10YR 5/6) moist; massive; hard, friable, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

IIC2—40 to 44 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; common medium distinct mottles, yellowish brown (10YR 6/8) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; clear smooth boundary.

IIC3—44 to 60 inches; light gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; common coarse distinct mottles, yellowish brown (10YR 5/4) moist; massive; hard, firm, sticky and plastic; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 6 to 11 inches. The depth to carbonates ranges from 0 to 36 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It typically is silty clay loam but in some pedons is silty clay. The C horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 or 2.

Gavins series

The Gavins series consists of shallow, excessively drained, moderately permeable soils that formed in residuum weathered from chalk. These soils are on uplands. Slopes range from 15 to 40 percent.

Gavins soils commonly are adjacent to Betts, Boyd, and Redstoe Variant soils. Betts soils formed in glacial till. Boyd soils formed in clayey shale. Redstoe Variant soils are deeper to chalk than Gavins soils.

Typical pedon of Gavins silt loam, in an area of Betts-Gavins complex, 15 to 40 percent slopes, 2,240 feet west and 2,400 feet north of the southeast corner of sec. 35, T. 95 N., R. 54 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable; common fine fragments of chalk rock; strong effervescence; mildly alkaline; clear smooth boundary.

AC—4 to 11 inches; light gray (2.5Y 7/2) and grayish brown (10YR 5/2) silt loam, light brownish gray (2.5Y 6/2) and dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; many fine fragments of chalk rock; violent effervescence; mildly alkaline; gradual wavy boundary.

C1—11 to 16 inches; white (2.5Y 8/2) silt loam, pale yellow (2.5Y 7/4) moist; massive; many fragments of chalk rock and evidence of rock structure; violent effervescence; mildly alkaline; gradual wavy boundary.

Cr—16 to 60 inches; white (2.5Y 8/2) soft chalk rock, pale yellow (2.5Y 7/4) moist; violent effervescence; mildly alkaline.

The depth to chalk ranges from 12 to 18 inches. The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The AC horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. The fracture seams in the Cr horizon are filled with gypsum in some pedons.

Gayville series

The Gayville series consists of deep, somewhat poorly drained soils. Permeability is very slow in the solum and moderate below. These soils formed in clayey alluvium that overlies silty alluvium on bottom land. Slopes range from 0 to 2 percent.

Gayville soils commonly are adjacent to Blencoe and Blyburg soils. Blencoe and Blyburg soils lack a natric horizon. In addition, Blyburg soils are coarse-silty.

Typical pedon of Gayville silty clay loam, in an area of Blencoe-Gayville complex, 1,200 feet east and 240 feet north of the southwest corner of sec. 36, T. 94 N., R. 54 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; massive; very hard, firm, sticky and plastic; slight effervescence; neutral; abrupt smooth boundary.

B21t—6 to 14 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; strong medium prismatic structure parting to moderate fine and medium blocky; hard, firm, sticky and plastic; gray (10YR 6/1) coatings on top of prisms; slight effervescence; moderately alkaline; clear wavy boundary.

B22t—14 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to moderate fine blocky; hard, firm, sticky and plastic; few fine nests of salt crystals; strong effervescence; moderately alkaline; clear wavy boundary.

C1—22 to 36 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; common medium distinct mottles, yellow (10YR 7/6) moist; massive; slightly hard, friable; common fine nests of salt crystals; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C2—36 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; common fine faint mottles, yellow (10YR 7/6) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 24 inches. Free carbonates are within 15 inches of the surface. The depth to silty material ranges from 20 to 30 inches.

The Ap horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B horizon has value of 4 or 5 (2 or 3 moist). It typically is silty clay loam but is silty clay in some pedons. The C horizon has few to many mottles.

Grable series

The Grable series consists of deep, well drained soils that formed in silty alluvium overlying sandy alluvium. Permeability is moderate in the upper part of the soils and rapid in the lower part. These soils are on bottom land. Slopes range from 0 to 4 percent.

Grable soils are adjacent to Haynie, Onawa, and Sarpy soils. Haynie soils are coarse-silty. Onawa soils are clayey in the upper part and loamy in the lower part. Sarpy soils are sandy.

Typical pedon of Grable silt loam, 2,600 feet south and 150 feet east of the northwest corner of sec. 15, T. 93 N., R. 55 W.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—7 to 28 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; 1-inch layer of grayish brown (10YR 5/2) silty clay in upper part and very thinly stratified below; massive; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

IIC2—28 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; soft, very friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 6 to 10 inches and corresponds to the thickness of the A horizon. This horizon has hue of 10YR or 2.5Y and chroma of 1 or 2. It typically is silt loam, but in some pedons it is silty clay loam or loam. The C horizon is dominantly silt loam, but it has thin strata of silty clay loam or silty clay. The IIC horizon typically is fine sand, but sand and loamy sand are within the range.

Graceville series

The Graceville series consists of deep, well drained soils that are moderately permeable in the upper part and rapidly permeable in the underlying material. These soils formed in silty glacial drift over outwash gravel. They are on stream terraces. Slopes range from 0 to 2 percent.

Graceville soils are adjacent to Davis, Roxbury, and Wentworth soils. Davis soils are fine-loamy. Roxbury soils are calcareous to the surface. Wentworth soils do not have gravel in the underlying material.

Typical pedon of Graceville silty clay loam, 1,100 feet east and 132 feet south of the northwest corner of sec. 12, T. 94 N., R. 54 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A12—8 to 16 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; soft, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B21—16 to 26 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B22—26 to 38 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine blocky; hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B3ca—38 to 45 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common medium accumulations of carbonate; strong effervescence; mildly alkaline; abrupt smooth boundary.

IIC—45 to 60 inches; brown (10YR 4/3) gravelly sand, dark brown (10YR 3/3) moist; single grained; loose; strong effervescence; mildly alkaline.

The thickness of the solum, or the depth to sand and gravel, ranges from 40 to 50 inches. The depth to carbonates ranges from 36 to 46 inches. The mollic epipedon ranges from 24 to 36 inches in thickness.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is silty clay loam but in some pedons is silt loam. The B2 horizon has value of 4 to 6 (2 to 4 moist) and chroma of 2 to 4. Some pedons lack a B3 horizon, and some have a B3 horizon that is not calcareous.

Haynie series

The Haynie series consists of deep, moderately well drained soils that formed in silty alluvium. Permeability is moderate in the upper part of the soils and slow in the lower part. These soils are on bottom land. Slopes range from 0 to 4 percent.

Haynie soils are similar to Blyburg soils and commonly are adjacent to Blake, Forney, Onawa, and Owego soils. Blake soils are fine-silty. Blyburg soils have a mollic epipedon. Forney, Onawa, and Owego soils are clayey at or near the surface.

Typical pedon of Haynie silt loam, 1,550 feet south and 150 feet east of the northwest corner of sec. 8, T. 93 N., R. 54 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; slight effervescence; neutral; abrupt smooth boundary.

A12—7 to 9 inches; grayish brown (10YR 5/2) and pale brown (10YR 6/3) silt loam, very dark grayish brown (10YR 3/2) and brown (10YR 4/3) moist; common fine distinct mottles, strong brown (7.5YR 5/8) moist; weak medium and coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable; strong effervescence; neutral; abrupt wavy boundary.

C1—9 to 34 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; common fine distinct mottles, strong brown (7.5YR 5/8) moist; weak coarse prismatic structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C2—34 to 53 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; common fine and medium distinct mottles, yellowish red (5YR 4/6) moist; massive; soft, friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

IIC3—53 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles, yellowish red (5YR 5/8) moist; strong fine blocky structure; slightly hard, firm, sticky and plastic; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 6 to 10 inches. The A horizon typically is silt loam but is very fine sandy loam in some pedons. The lower part of the A horizon is not mottled in some pedons. The C horizon is very fine sandy loam, silt loam, or silty clay.

James series

The James series consists of deep, poorly drained, slowly permeable soils that formed in silty alluvium. These soils are on bottom land. Slopes range from 0 to 2 percent.

James soils commonly are near Clamo and Lamo soils. Clamo soils have no carbonates and salts in the upper part of the solum. Lamo soils are fine-silty and do not have salts.

Typical pedon of James silty clay loam, 2,800 feet north and 1,800 feet west of the southeast corner of sec. 32, T. 95 N., R. 55 W.

A1sa—0 to 4 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; hard, firm, slightly sticky and slightly plastic; common roots; slight effervescence; few fine nests of gypsum; moderately alkaline; abrupt smooth boundary.

A12sa—4 to 18 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; very weak medium subangular blocky structure parting to moderate fine granular; very hard, firm, slightly sticky and slightly plastic; common roots; strong effervescence; common fine nests of gypsum; moderately alkaline; clear smooth boundary.

B2g—18 to 28 inches; dark gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) moist; weak medium subangular blocky structure parting to moderate medium granular; very hard, very firm, slightly sticky and slightly plastic; few roots; slight effervescence; few fine nests of gypsum; moderately alkaline; clear wavy boundary.

C1gcacs—28 to 40 inches; gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; tongues of very dark gray (5Y 3/1) moist; few fine distinct mottles, brownish yellow (10YR 6/6) moist; moderate medium prismatic structure parting to moderate fine blocky; very hard, very firm, slightly sticky and slightly plastic; few roots; common medium accumulations of carbonate; strong effervescence; common medium nests of gypsum; moderately alkaline; clear wavy boundary.

C2gcs—40 to 60 inches; gray (5Y 6/1) silty clay loam, gray (5Y 5/1) moist; common fine distinct mottles, brownish yellow (10YR 6/6) moist; massive; very hard, very firm, slightly sticky and slightly plastic; strong effervescence; many medium nests of gypsum; moderately alkaline.

The thickness of the solum ranges from 24 to 60 inches. Free carbonates are within 10 inches of the surface. The depth to gypsum ranges from 0 to 10 inches. The mollic epipedon is 24 to 48 inches thick.

The A horizon has hue of 10YR or 2.5Y. It is 8 to 20 inches thick. The C horizon has hue of 2.5Y or 5Y. It is moderately alkaline or strongly alkaline. Typically, all horizons are silty clay loam, but silty clay is within the range. A buried A horizon is below a depth of 20 inches in some pedons.

Lakeport series

The Lakeport series consists of deep, somewhat poorly drained soils that formed in silty alluvium. Permeability is moderately slow. These soils are on bottom land. Slopes range from 0 to 2 percent.

The Lakeport soils in Yankton County have a thicker mollic epipedon than is defined as the range for the series. This difference, however, does not alter the use or behavior of the soils.

Lakeport soils are similar to Blake and Salix soils and commonly are adjacent to Blencoe, Blyburg, and Luton soils. Blencoe soils have very fine sandy loam within a depth of 40 inches. Blyburg soils are coarse-silty. Luton soils range from 50 to 60 percent clay in the control section. Blake and Salix soils are fine-silty.

Typical pedon of Lakeport silty clay loam, 1,400 feet north and 1,900 feet west of the southeast corner of sec. 34, T. 94 N., R. 54 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate fine and medium granular structure; hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

A12—6 to 19 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate fine and medium granular; hard, friable, sticky and plastic; neutral; clear smooth boundary.

B21—19 to 25 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 2/1) moist; moderate medium prismatic structure parting to moderate fine and medium blocky; hard, friable, sticky and plastic; neutral; clear smooth boundary.

B22—25 to 37 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common medium tongues, very dark grayish brown (2.5Y 3/2) moist; few fine distinct mottles, yellow (2.5Y 7/6) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium blocky; hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

B3—37 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct mottles, yellow (2.5Y 7/6) moist; weak coarse prismatic structure; hard, friable, sticky and plastic; common medium accumulations of carbonate; strong effervescence; mildly alkaline; abrupt smooth boundary.

C—44 to 60 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; many fine mottles, dark brown (7.5YR 3/2), strong brown (7.5YR 5/6), and gray (5Y 5/1) moist; slightly hard, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. Free carbonates are at a depth of 24 to 48 inches. The thickness of the mollic epipedon ranges from 20 to 30 inches.

The A horizon has chroma of 1 or 2. It typically is silty clay loam but is silty clay in some pedons. The B horizon has value of 4 to 6 (2 to 4 moist) and chroma of 1 or 2. It typically is silty clay loam but is silty clay in some pedons. The clay content averages as low as 35 percent in some pedons and as high as 42 percent in others. The C horizon typically is silt loam but is very fine sandy loam in some pedons.

Lamo series

The Lamo series consists of deep, somewhat poorly drained soils that formed in silty alluvium. Permeability is moderately slow. These soils are on bottom land. Slopes range from 0 to 2 percent.

Lamo soils are similar to Clamo soils and commonly are adjacent to Clamo, Davis, and Salmo soils. Clamo soils are fine textured. Davis soils are fine-loamy and are well drained. Salmo soils contain salts throughout the solum.

Typical pedon of Lamo silty clay loam, 2,800 feet north and 50 feet west of the southeast corner of sec. 9, T. 96 N., R. 57 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—7 to 16 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate medium granular; hard, very friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; clear smooth boundary.

AC—16 to 28 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; many fine distinct mottles, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; hard, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—28 to 55 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; many medium distinct mottles, light olive brown (2.5Y 5/6) moist; massive; hard, very friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—55 to 60 inches; light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) moist; massive; very hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline.

The thickness of the solum and of the mollic epipedon ranges from 24 to 35 inches. The depth to free carbonates is 10 inches or less.

The A horizon has value of 3 to 5 (2 or 3 moist). Typically, it is silty clay loam, but it is silt loam in some pedons. The AC horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7 (3 to 5 moist); and chroma of 1 or 2. Typically, it is silty clay loam and silt loam, but silty clay is within the range.

Luton series

The Luton series consists of deep, poorly drained and very poorly drained soils formed in clayey alluvium. Permeability is very slow. These soils are on bottom land. Slopes range from 0 to 2 percent.

Luton soils are similar to and commonly are near Baltic, Blencoe, and Salix soils. Baltic soils have free carbonates at or near the surface. Blencoe soils contain less clay than Luton soils. Salix soils are fine-silty.

Typical pedon of Luton silty clay, 1,320 feet east and 75 feet south of the northwest corner of sec. 29, T. 94 N., R. 54 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak fine granular structure; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

A12—7 to 16 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium and fine granular; hard, firm, sticky and plastic; thin shiny films on faces of peds; neutral; clear wavy boundary.

B21—16 to 24 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to strong medium and fine blocky; hard, firm, sticky and plastic; thin shiny films on faces of peds; mildly alkaline; clear wavy boundary.

B22g—24 to 42 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; common fine distinct mottles, olive (5Y 5/6) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very firm, sticky and plastic; thin shiny films on faces of peds; matrix is noncalcareous and has few very fine accumulations of carbonate; mildly alkaline; clear wavy boundary.

B3cag—42 to 50 inches; gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; common fine distinct mottles, olive (5Y 5/6) moist; massive; hard, very firm, sticky and plastic; thin shiny films on faces of peds; slight effervescence; few fine accumulations of carbonate; mildly alkaline; clear wavy boundary.

Cg—50 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles, olive (5Y 5/6) moist, and few fine distinct mottles, dark olive gray (5Y 3/2) moist; massive; hard, very firm, sticky and plastic; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 60 inches. The mollic epipedon is 24 to 45 inches thick.

The A horizon has value of 2 or 3 when moist and is silty clay loam in some pedons. The B2 horizon has hue of 10YR, 2.5Y, or 5Y and value of 4 or 5 (3 to 5 moist). It typically is silty clay, but clay is within the range. The clay content averages as low as 50 percent in some pedons and as high as 60 percent in others. The C horizon has hue of 2.5Y or 5Y.

Nora series

The Nora series consists of deep, well drained, moderately permeable soils that formed in silty loess. These soils are on uplands. Slopes range from 9 to 25 percent.

Nora soils commonly are adjacent to Boyd, Crofton, Gavins, and Talmo soils on the landscape. Boyd soils are fine textured and formed in clayey shale. Crofton soils lack a mollic epipedon. Gavins soils are shallow to Niobrara chalk rock. Talmo soils are shallow to gravel.

Typical pedon of Nora silt loam, in an area of Crofton-Nora silt loams, 9 to 25 percent slopes, 210 feet west and 60 feet south of the northeast corner of sec. 13, T. 93 N., R. 57 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable; neutral; gradual wavy boundary.

B21—7 to 15 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; mildly alkaline; clear wavy boundary.

B22—15 to 24 inches; light olive brown (2.5Y 5/4) silt loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; mildly alkaline; abrupt wavy boundary.

B3ca—24 to 30 inches; light olive brown (2.5Y 5/4) silt loam, olive brown (2.5Y 4/4) moist; very weak coarse prismatic structure; slightly hard, friable; few accumulations of carbonate occurring as threads; strong effervescence; mildly alkaline; clear smooth boundary.

C—30 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable; common fine streaks and accumulations of carbonate in the upper part; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 32 inches. The depth to free carbonates ranges from 12 to 30 inches. The mollic epipedon is 12 to 20 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist). It typically is silt loam but is silty clay loam in some pedons. The B horizon has value of 5 or 6 (3 or 4 moist). It is silt loam or silty clay loam. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 3 or 4.

Onawa series

The Onawa series consists of deep, somewhat poorly drained soils that formed in clayey over silty alluvium. These soils are slowly permeable in the upper part and moderately permeable in the lower part. They are on bottom land. Slopes are 0 to 2 percent.

Onawa soils are similar to Blencoe soils and commonly are adjacent to Blake, Forney, and Owego soils. Blake soils are fine-silty. Blencoe soils have a mollic epipedon. Forney and Owego soils are fine textured.

Typical pedon of Onawa silty clay, 1,600 feet west and 1,410 feet north of the southeast corner of sec. 12, T. 93 N., R. 55 W.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine and medium granular structure; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—7 to 30 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; few fine distinct mottles, yellowish brown (10YR 5/6) moist; massive; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

IIC2—30 to 48 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; common fine distinct mottles, yellowish brown (10YR 5/6) and gray (5Y 5/1) moist; massive; soft, friable; strong effervescence; mildly alkaline; clear smooth boundary.

IIC3—48 to 60 inches; light brownish gray (2.5Y 6/2) loamy very fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 4 to 10 inches and corresponds to the thickness of the A horizon. This horizon has hue of 2.5Y or 10YR and chroma of 1 or 2. It typically is silty clay but is silty clay loam or silt loam in some pedons. The C horizon has hue of 2.5Y or 5Y and chroma of 1 or 2. It typically is silty clay but is clay in some pedons. The IIC horizon has hue of 2.5Y or 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2.

Owego series

The Owego series consists of deep, somewhat poorly drained, very slowly permeable soils formed in clayey and silty alluvium. These soils are on bottom land. Slopes range from 0 to 2 percent.

The Owego soils in this county have a thicker silt loam subhorizon than is defined as the range for the series. This difference, however, does not alter the use or behavior of the soils.

Owego soils are adjacent to Blake, Forney, and Haynie soils on the landscape. Blake soils are fine-silty. Forney soils lack a thick silty layer. Haynie soils are coarse-silty.

Typical pedon of Owego silty clay loam, 740 feet east and 75 feet north of the southwest corner of sec. 5, T. 93 N., R. 54 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure parting to moderate medium granular; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

C1—7 to 16 inches; dark grayish brown (10YR 4/2) and light brownish gray (2.5Y 6/2) silty clay, very dark grayish brown (10YR 3/2) and dark grayish brown (2.5Y 4/2) moist; few fine distinct mottles, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, firm, sticky and plastic; neutral; clear smooth boundary.

C2g—16 to 36 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; many fine distinct mottles, brownish yellow (10YR 6/6) moist; massive; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C3g—36 to 60 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 4/2) moist; common fine distinct mottles, yellowish brown (10YR 6/6) moist; massive; very hard, very firm, sticky and plastic; very few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 6 to 18 inches and corresponds to thickness of the A horizon. This horizon has hue of 10YR or 2.5Y. It typically is silty clay loam but is silty clay in some pedons. The C2 horizon typically is silt loam but is very fine sandy loam or loamy very fine sand in some pedons. The C3 horizon is silty clay loam or silty clay.

Redstoe Variant

The Redstoe Variant consists of deep, well drained, moderately permeable soils that formed in silty alluvium and colluvium. These soils are on uplands. Slopes range from 6 to 15 percent.

Redstoe Variant soils are adjacent to Betts, Ethan, Gavins, and Roxbury soils. Betts and Ethan soils are fine-loamy and formed in glacial drift. Gavins soils have chalk rock within 20 inches of the surface. Roxbury soils are in drainageways and are moderately well drained.

Typical pedon of Redstoe Variant silt loam, 6 to 15 percent slopes, 2,400 feet west and 1,400 feet south of the northeast corner of sec. 17, T. 93 N., R. 56 W.

Ap—0 to 5 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A12—5 to 12 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

AC—12 to 26 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; very weak fine and medium subangular blocky structure; slightly hard, friable; violent effervescence; mildly alkaline; clear smooth boundary.

C1—26 to 36 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, sticky and plastic; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—36 to 60 inches; yellow (10YR 7/6) silty clay loam, yellowish brown (10YR 5/6) moist; massive; soft, friable, sticky and plastic; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 30 inches. The mollic epipedon is 6 to 18 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 typically is silt loam but is silty clay loam in some pedons. The AC horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It typically is silty clay loam but is silt loam in some pedons. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 6 moist), and chroma of 4 to 6. It is silty clay loam or silt loam. Chips of unweathered chalk rock are in some pedons.

Roxbury series

The Roxbury series consists of deep, moderately well drained, moderately permeable soils that formed in recent silty alluvium. These soils are on bottom land. Slopes range from 0 to 2 percent.

Roxbury soils are adjacent to Baltic and Bon soils. Bon soils are fine-loamy. Baltic soils are fine textured.

Typical pedon of Roxbury silt loam, 2,490 feet south and 210 feet east of the northwest corner of sec. 15, T. 94 N., R. 54 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; strong effervescence; neutral; abrupt smooth boundary.

A12—8 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, very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

B2—12 to 24 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

C—24 to 42 inches; grayish brown (10YR 5/2) and very pale brown (10YR 7/3) silty clay loam, dark grayish brown (10YR 4/2) and brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; thin strata of contrasting color and texture; strong effervescence; mildly alkaline; abrupt smooth boundary.

A1b—42 to 60 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 22 to 48 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to free carbonates ranges from 0 to 12 inches.

The A horizon has chroma of 1 or 2. It typically is silt loam, but it is loam or silty clay loam in some pedons. The B horizon has chroma of 1 or 2. It is silty clay loam or silt loam. The C horizon has hue of 10YR or 2.5Y. It is loam, silt loam, or silty clay loam. Some pedons have thin strata of sandy material below a depth of 40 inches. The buried A horizon does not occur in some pedons.

Salix series

The Salix series consists of deep, moderately well drained, moderately permeable soils that formed in silty alluvium. These soils are on bottom land. Slopes range from 0 to 2 percent.

The Salix soils in Yankton County have a thicker mollic epipedon than is defined as the range for the series. This difference, however, does not alter the use or behavior of the soils.

Salix soils are similar to Blake and Lakeport soils and commonly are adjacent to Baltic, Blencoe, Blyburg, and

Luton soils. Blake soils have a thinner mollic epipedon than Salix soils. Blencoe soils are clayey in the upper part and loamy in the lower part. Blyburg soils are coarse-silty. Baltic, Lakeport, and Luton soils are fine textured.

Typical pedon of Salix silty clay loam, 2,240 feet east and 1,700 feet north of the southwest corner of sec. 28, T. 94 N., R. 54 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and plastic; neutral; abrupt smooth boundary.

A3—7 to 16 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and plastic; neutral; clear smooth boundary.

B21—16 to 21 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, very friable, slightly sticky and plastic; neutral; clear smooth boundary.

B22—21 to 28 inches; dark grayish brown (2.5Y 4/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and plastic; neutral; abrupt smooth boundary.

B3—28 to 34 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C1—34 to 55 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; few fine distinct mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C2—55 to 60 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; common medium distinct mottles, yellowish brown (10YR 5/6) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. The thickness of the mollic epipedon and the depth to carbonates are 20 to 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It typically is silty clay loam but is silt loam in some pedons. The B horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 or 2. The C horizon is very fine sand, loam, very fine sandy loam, or silt loam.

Salmo series

The Salmo series consists of deep, poorly drained soils that formed in silty and clayey alluvium. Permeability is moderately slow. These soils are on bottom land. Slopes range from 0 to 2 percent.

Salmo soils are similar to James soils and are adjacent to Clamo, Clarno, and Egan soils. Clamo and James soils are fine textured. Their position on the landscape is similar to that of Salmo soils. Clarno and Egan soils are well drained and are on adjacent uplands.

Typical pedon of Salmo silty clay loam, 2,000 feet west and 150 feet north of the southeast corner of sec. 15, T. 96 N., R. 54 W.

A11sa—0 to 3 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine and medium granular structure; hard, firm, slightly sticky and plastic; strong effervescence; few fine salt nests; moderately alkaline; abrupt smooth boundary.

A12sa—3 to 20 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; slight effervescence; common fine salt nests; moderately alkaline; clear smooth boundary.

C1gsacs—20 to 28 inches; dark gray (2.5Y 4/1) silty clay loam, black (2.5Y 2/1) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; strong effervescence; common fine salt and gypsum nests; moderately alkaline; gradual smooth boundary.

C2gsacs—28 to 34 inches; dark gray (5Y 4/1) silty clay loam, black (5Y 2/1) moist; common medium faint mottles, yellowish brown (10YR 5/8) moist; massive; hard, firm, sticky and plastic; strong effervescence; common fine salt and gypsum nests; moderately alkaline; gradual smooth boundary.

C3g—34 to 60 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; common medium faint mottles, yellowish brown (10YR 5/8) moist; massive; hard, very firm, sticky and plastic; slight effervescence; common medium salt nests; mildly alkaline.

The thickness of the solum ranges from 14 to 24 inches. The mollic epipedon ranges from 24 to 40 inches in thickness.

The A horizon has hue of 10YR or 2.5Y. It is silt loam in some pedons. The C horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or less. It is silty clay loam, silty clay, or silt loam. Sand and gravel is below a depth of 40 inches in some pedons.

Sarpy series

The Sarpy series consists of deep, excessively drained, rapidly permeable soils that formed in sandy alluvium. These soils are on bottom land. Slopes range from 0 to 4 percent.

Sarpy soils commonly are near Grable and Haynie soils. Grable soils are coarse-silty in the upper part and sandy-skeletal in the lower part. Haynie soils are coarse-silty.

Typical pedon of Sarpy loamy fine sand, in an area of Sarpy-Grable complex, 0 to 4 percent slopes, 1,200 feet north and 1,300 feet east of the southwest corner of sec. 2, T. 93 N., R. 55 W.

A1—0 to 9 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; very weak fine granular structure; loose, very friable; many roots; slight effervescence; moderately alkaline; clear smooth boundary.

C—9 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, grayish brown (2.5Y 5/2) moist; single grained; loose; slight effervescence; moderately alkaline.

The thickness of the solum, which corresponds to the thickness of the A horizon, ranges from 4 to 10 inches. The A horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3.

Stickney series

The Stickney series consists of deep, moderately well drained, slowly permeable soils that formed in glacial till on uplands. Slopes range from 0 to 3 percent.

The Stickney soils in this county lack the glossic properties that are definitive for the Stickney series. This difference, however, does not alter the use or behavior of the soils.

Stickney soils commonly are near Clarno, Crossplain, and Tetonka soils. Clarno soils are fine-loamy and lack a natric horizon. They are higher on the landscape than Stickney soils. Crossplain and Tetonka soils are not so well drained as Stickney soils and lack a natric horizon.

Typical pedon of Stickney silt loam, in an area of Clarno-Crossplain-Stickney complex, 0 to 3 percent slopes, 345 feet west and 75 feet north of the southeast corner of sec. 32, T. 96 N., R. 57 W.

Ap—0 to 8 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; slightly acid; abrupt smooth boundary.

A12—8 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine prismatic structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slighty acid; abrupt smooth boundary.

B21t—10 to 18 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium prismatic structure parting to strong fine blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; neutral; clear smooth boundary.

B22t—18 to 22 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate fine blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; mildly alkaline; abrupt wavy boundary.

B3ca—22 to 26 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; hard, friable, sticky and plastic; few fine nests of gypsum crystals; common medium accumulations of carbonate; slight effervescence; mildly alkaline; clear smooth boundary.

C1cs—26 to 40 inches; pale yellow (5Y 7/3) silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; common fine nests of gypsum crystals; strong effervescence; moderately alkaline; clear smooth boundary.

C2—40 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; many fine and medium distinct mottles, light gray (5Y 7/1) and brownish yellow (10YR 6/6) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 38 inches. The thickness of the mollic epipedon and the depth to free carbonates range from 20 to 32 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. Some pedons have an A2 horizon. The B2t horizon is clay loam, silty clay loam, or silty clay. The clay content averages as low as 35 percent in some pedons and as high as 45 percent in others. In some pedons the B3 horizon lacks carbonates. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. It is moderately alkaline or strongly alkaline.

Talmo series

The Talmo series consists of excessively drained, rapidly permeable soils that formed in sandy and gravelly glacial outwash. These soils are very shallow to sand and gravel. They are on uplands. Slopes range from 6 to 40 percent.

Talmo soils commonly are near Betts, Enet, Ethan, and Delmont soils. Betts and Ethan soils are fine-loamy and are not underlain by sand and gravel. Enet and Delmont soils are fine-loamy in the upper part and sandy or sandy-skeletal in the lower part.

Typical pedon of Talmo loam, in an area of Ethan-Talmo loams, 6 to 15 percent slopes, 1,450 feet east and 1,000 feet north of the southwest corner of sec. 1, T. 94 N., R. 54 W.

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, friable; many roots; mildly alkaline; clear wavy boundary.

A12—5 to 9 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; single grained; loose, very friable; many roots; violent effervescence; mildly alkaline; clear wavy boundary.

IIC—9 to 60 inches; brown (10YR 5/3) sand and gravel, dark yellowish brown (10YR 4/4) moist; single grained; loose; violent effervescence; moderately alkaline.

The solum and the mollic epipedon are 7 to 10 inches thick. The depth to free carbonates ranges from 0 to 7 inches.

The A horizon has value of 3 to 5 (2 or 3 moist). It is 7 to 10 inches thick. The IIC horizon has hue of 10YR or 2.5Y and value of 5 or 6 (4 or 5 moist). It is mildly alkaline or moderately alkaline.

Tetonka series

The Tetonka series consists of deep, poorly drained soils that formed in local alluvial deposits over glacial till. Permeability is very slow. These soils are in closed depressions in the uplands. Slopes range from 0 to 2 percent.

Tetonka soils are near Chancellor, Clarno, Egan, Trent, and Worthing soils. Chancellor soils lack an A2 horizon and have a thicker mollic epipedon than Tetonka soils. Clarno soils are fine-loamy and are on adjacent uplands. Egan and Trent soils are fine-silty and are on adjacent uplands. Worthing soils lack an A2 horizon and are very poorly drained.

Typical pedon of Tetonka silt loam, 483 feet east and 218 feet south of the northwest corner of sec. 26, T. 95 N., R. 55 W.

Ap—0 to 10 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine and very fine granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A2—10 to 17 inches; gray (10YR 6/1) and dark gray (10YR 4/1) silt loam, dark gray (10YR 4/1) and very dark gray (10YR 3/1) moist; common fine mottles, brownish yellow (10YR 6/6) moist; weak and moderate thin platy structure; hard, very friable; slightly acid; clear smooth boundary.

B&A—17 to 21 inches; dark gray (10YR 4/1) silty clay loam (B), very dark gray (10YR 3/1) moist, and gray (10YR 5/1) silt loam (A), very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium platy; hard, friable, slightly sticky and plastic; common fine iron concretions; slightly acid; clear smooth boundary.

B21t—21 to 33 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to weak medium blocky; very hard, firm, sticky and plastic; neutral; gradual smooth boundary.

B22t—33 to 48 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium blocky; hard, firm, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

C—48 to 60 inches; grayish brown (10YR 5/2) silty clay loam, very dark gray (10YR 3/1) moist; common medium distinct mottles, light yellowish brown (2.5Y 6/4) moist; massive; hard, firm, slightly sticky and slightly plastic; mildly alkaline.

The thickness of the solum ranges from 36 to 60 inches. The depth to carbonates ranges from 48 to 60 inches or more.

The Ap horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It ranges from 8 to 12 inches in thickness. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It ranges from 4 to 12 inches in thickness. The B&A horizon has colors similar to those of the A2 and B21t horizons. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5 (2 to 4 moist); and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y. It is neutral or mildly alkaline.

Thurman series

The Thurman series consists of deep, somewhat excessively drained, rapidly permeable soils that formed in sandy and loamy glacial outwash. These soils are on uplands. Slopes range from 2 to 30 percent.

The Thurman soils in this county have a finer textured mollic epipedon than is defined as the range for the series. This difference, however, does not alter the use or behavior of the soils.

Thurman soils are adjacent to Blendon, Ethan, and Talmo soils. Blendon soils have a mollic epipedon that is more than 20 inches thick. Ethan soils are fine-loamy. Talmo soils are shallow to sand and gravel.

Typical pedon of Thurman fine sandy loam, in an area of Blendon-Thurman complex, 0 to 6 percent slopes, 1,910 feet north and 300 feet west of the southeast corner of sec. 36, T. 96 N., R. 57 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, friable; slightly acid; abrupt smooth boundary.

AC1—10 to 18 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

AC2—18 to 30 inches; brown (10YR 5/3) loamy sand, brown (10YR 4/3) moist; very weak medium and coarse prismatic structure; loose; neutral; gradual smooth boundary.

Cca—30 to 60 inches; very pale brown (10YR 7/4) loamy sand, yellowish brown (10YR 5/4) moist; single grained; loose; slight effervescence; neutral.

The thickness of the solum ranges from 24 to 36 inches. The depth to free carbonates ranges from 20 to 60 inches or more. The mollic epipedon is 14 to 20 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is fine sandy loam but is loamy fine sand in some pedons. The AC horizon does not occur in some pedons. The C horizon has hue of 10YR or 2.5Y. Some pedons have sand and gravel below a depth of 50 inches. A IIC horizon of clay loam or loam is below a depth of 40 inches in some pedons.

Trent series

The Trent series consists of deep, moderately well drained soils that formed in silty material over glacial till. Permeability is moderate in the solum and moderately slow in the underlying glacial till. These soils are in swales and on uplands. Slopes range from 0 to 6 percent.

Trent soils commonly are near Chancellor, Egan, Wentworth, Whitewood, and Worthing soils. Chancellor and Whitewood soils are somewhat poorly drained and Worthing soils poorly drained. They are in the deeper swales and depressions. Egan and Wentworth soils are well drained and are on uplands.

Typical pedon of Trent silty clay loam, in an area of Egan-Ethan-Trent complex, 1 to 6 percent slopes, 525 feet north and 120 feet west of the center of sec. 10, T. 94 N., R. 54 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure parting to moderate fine and medium granular; soft, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A12—7 to 13 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B21—13 to 24 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; thin shiny films on faces of peds; mildly alkaline; clear wavy boundary.

B22—24 to 34 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, friable, slightly sticky and slightly plastic; thin shiny films on faces of peds; mildly alkaline; abrupt wavy boundary.

B3ca—34 to 45 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/3) moist; common fine distinct mottles, gray (5Y 6/1) and brownish yellow (10YR 6/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

IIC—45 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct mottles, gray (5Y 6/1) and brownish yellow (10YR 6/8) moist; massive; hard, firm, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 36 to 48 inches, and the depth to free carbonates ranges from 30 to 40 inches. The mollic epipedon is 20 to 30 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is silty clay loam but in some pedons is silt loam. The B2 horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. The IIC horizon has value of 6 or 7 (5 or 6 moist) and chroma of 3 or 4. It does not occur in some pedons. It has strata of silt and very fine sand in some pedons.

Waubonsie series

The Waubonsie series consists of deep, moderately well drained soils that formed in loamy alluvium over clayey alluvium on bottom land. Permeability is moderately rapid in the upper part of the soils and slow in the lower part. Slopes range from 0 to 2 percent.

Waubonsie soils are adjacent to Forney, Grable, and Haynie soils on the landscape. Forney soils are fine textured. Grable soils are coarse-silty in the upper part and sandy or sandy-skeletal in the lower part. Haynie soils are coarse-silty.

Typical pedon of Waubonsie very fine sandy loam, 2,500 feet south and 600 feet west of the northeast corner of sec. 9, T. 93 N., R. 55 W.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) very fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak fine granular structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

A12—7 to 10 inches; grayish brown (2.5Y 5/2) very fine sandy loam, dark grayish brown (2.5Y 4/2) moist;

weak medium subangular blocky structure; soft, very friable; slight effervescence; mildly alkaline; clear wavy boundary.

C1—10 to 26 inches; light brownish gray (2.5Y 6/2) very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles, brownish yellow (10YR 6/6) moist; single grained; loose; strong effervescence; mildly alkaline; abrupt smooth boundary.

IIC2—26 to 38 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; many fine distinct mottles, brownish yellow (10YR 6/6) moist; massive; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

IIC3—38 to 42 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; few fine distinct mottles, brownish yellow (10YR 6/6) moist; massive; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

IIC4—42 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles, brownish yellow (10YR 6/6) moist; massive; hard, firm, sticky and plastic; mildly alkaline.

The solum is 6 to 10 inches thick. The depth to a clayey horizon ranges from 22 to 30 inches.

The A horizon has hue of 10YR or 2.5Y and value of 4 or 5 (3 or 4 moist). It typically is very fine sandy loam but is silt loam in some pedons. The C1 horizon has value of 6 or 7 (4 or 5 moist). It has thin strata of loamy fine sand in some pedons.

Wentworth series

The Wentworth series consists of deep, well drained, moderately permeable soils formed in silty glacial drift. These soils are on uplands. Slopes range from 0 to 6 percent.

Wentworth soils are similar to Egan soils and commonly are near Egan, Ethan, Trent, and Whitewood soils. Egan soils are in areas where silty deposits are less than 40 inches deep over clay loam glacial till. Ethan soils are fine-loamy and are on uplands. Trent soils are moderately well drained and Whitewood soils somewhat poorly drained. Both are in swales.

Typical pedon of Wentworth silty clay loam, 0 to 2 percent slopes, 1,150 feet east and 1,400 feet north of the southwest corner of sec. 5, T. 93 N., R. 55 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A12—6 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B21—10 to 18 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B22—18 to 26 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear smooth boundary.

B23—26 to 32 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

B3ca—32 to 38 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

Cca—38 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 32 to 42 inches, and the depth to carbonates ranges from 24 to 36 inches. The mollic epipedon is 10 to 19 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is silty clay loam but is silt loam in some pedons. The B2 horizon has value of 4 to 6. The clay content ranges from 25 to 34 percent. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 3 or 4. Clay loam glacial till is below a depth of 40 inches in some pedons.

Whitewood series

The Whitewood series consists of deep, somewhat poorly drained soils that formed in silty glacial drift. Permeability is moderately slow. These soils are on uplands. Slopes range from 0 to 2 percent.

The Whitewood soils in this county are leached of free carbonates to a greater depth and have a thicker mollic epipedon than is defined as the range for the Whitewood series. These differences, however, do not alter the use or behavior of the soils.

Whitewood soils are adjacent to Chancellor, Egan, Tetonka, and Wentworth soils. Chancellor and Tetonka soils have an argillic horizon. Egan and Wentworth soils are well drained.

Typical pedon of Whitewood silty clay loam, in an area of Egan-Whitewood silty clay loams, 0 to 3 percent slopes, 2,000 feet west and 225 feet north of the southeast corner of sec. 23, T. 94 N., R. 55 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A12—9 to 19 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

B21—19 to 30 inches; dark grayish brown (10YR 4/2) 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; mildly alkaline; clear smooth boundary.

B22—30 to 38 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; very hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

B3g—38 to 42 inches; gray (5Y 6/1) and dark grayish brown (10YR 4/2) silty clay loam, dark gray (5Y 4/1) and very dark brown (10YR 2/2) moist; common fine distinct mottles, yellowish brown (10YR 5/6) moist; weak coarse prismatic structure; very hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

IIC1—42 to 48 inches; gray (5Y 6/1) clay loam, dark gray (5Y 4/1) moist; common fine prominent mottles, brownish yellow (10YR 6/6) moist; massive; hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

IIC2—48 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; many fine and medium prominent mottles, brownish yellow (10YR 6/6) and dark yellowish brown (10YR 4/6) moist; massive; hard, friable, sticky and plastic; mildly alkaline.

The thickness of the solum ranges from 36 to 50 inches. The depth to carbonates ranges from 36 to more than 60 inches. The mollic epipedon ranges from 24 to 48 inches in thickness.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It typically is silty clay loam but is silt loam in some pedons. The B2 horizon has hue of 10YR or 2.5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. The B3 and IIC horizons have hue of 10YR, 2.5Y, or 5Y; value of 6 or 7 (4 or 5 moist); and chroma of 1 or 2.

Worthing series

The Worthing series consists of deep, very poorly drained, slowly permeable soils formed in silty and clayey alluvial sediments. These soils are in enclosed depressions in the uplands. Slopes range from 0 to 2 percent.

Worthing soils commonly are near Clarno, Crossplain, Egan, Ethan, and Trent soils. Clarno and Ethan soils are fine-loamy, are well drained, and are higher on the landscape than Worthing soils. Egan and Trent soils are fine-silty and are better drained than Worthing soils. Crossplain soils are somewhat poorly drained and are in swales.

Typical pedon of Worthing silty clay loam, 195 feet west and 150 feet south of the northeast corner of sec. 32, T. 96 N., R. 54 W.

O—1 inch to 0; partly decomposed organic litter.

A1—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine and very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

A12—6 to 14 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; few fine distinct mottles, light olive brown (2.5Y 5/6) moist; weak medium subangular blocky structure parting to weak fine granular; hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B21t—14 to 22 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; common fine distinct mottles, yellowish brown (10YR 5/6) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; neutral; clear smooth boundary.

B22t—22 to 44 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; common fine distinct mottles, yellowish brown (10YR 5/6) moist; weak medium and coarse prismatic structure parting to moderate fine and medium angular blocky; very hard, firm, slightly sticky and plastic; neutral; clear smooth boundary.

B3g—44 to 52 inches; dark gray (5Y 4/1) silty clay loam, black (5Y 2/1) moist; common medium faint mottles, dark yellowish brown (10YR 4/6) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, firm, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

C—52 to 60 inches; dark gray (5Y 4/1) silty clay loam, black (5Y 2/1) moist; common medium distinct mottles, dark yellowish brown (10YR 4/6) moist; massive; very hard, firm, slightly sticky and slightly plastic; mildly alkaline.

The thickness of the solum ranges from 38 to 60 inches, and the depth to free carbonates ranges from 40 to 60 inches. The mollic epipedon is 36 to 60 inches thick.

The A horizon has hue of 10YR to 5Y and value of 3 or 4. It is 10 to 18 inches thick. It is neutral or mildly alkaline. The B2 horizon has hue of 10YR to 5Y. It is silty clay or clay, and it ranges from 38 to 55 percent clay. It is neutral or mildly alkaline. Some pedons lack a B3g horizon. The C horizon is mildly alkaline or moderately alkaline.

Formation of the soils

In this section, five factors of soil formation are related to the soils in Yankton County. These factors determine the characteristics of the soil at any given point. They are (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, and (5) 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 that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also 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 required for the differentiation of soil horizons. Usually, a long time is required 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.

Parent material

Parent material is the unconsolidated mass of material in which soils form. Glacial deposits of late Wisconsin age cover most of Yankton County. Recent alluvium deposited by the Missouri River covers the southeastern corner.

During the Pleistocene epoch of geologic history, the glacial ice moving into the county from the north carried large amounts of soil and rock material that ranged in size from clay to large boulders. Evidence of this deposition is throughout most parts of the county, especially in the area north and east of Clay Creek, where red Sioux quartzite rocks are on the surface. When the climate warmed, the ice receded, leaving several types of deposits, including till, outwash, loess, and silty drift.

Glacial till is a mixture of silt, clay, sand, and gravel in proportions that differ from one place to another. Scattered cobblestones and stones, including some of boulder size, commonly are throughout the till. The glacial till was deposited in place as the ice receded. Clarno and Ethan soils formed in glacial till.

Glacial stagnation results in landforms having a poorly defined surface drainage pattern. An example is a dead-ice moraine having numerous potholes or enclosed depressions and circular disintegration ridges, or "doughnuts"(*3*).

In some parts of the county, the glacier melted rapidly and a large volume of water spread over the landscape. This water carried and deposited large amounts of sand and gravel. These deposits of stratified sand and gravel are called glacial outwash. Delmont, Enet, and Talmo soils formed in glacial outwash deposits.

During dry periods, southeasterly winds picked up silt from the flood plain along the Missouri River and deposited it on the adjacent landscape. This material mantled the surface with several feet of loess. Crofton and Nora soils formed in this loess. In several areas of the county, soils formed in silty drift. Egan and Wentworth soils are examples.

The alluvium along the Missouri River is highly stratified material nearest the present river channel and nonstratified material away from the present channel. Generally, the nonstratified material is at a higher elevation than the stratified sediments. Baltic, Blyburg, Lakeport, and Luton soils formed in the nonstratified alluvium. Blake, Forney, Haynie, and Sarpy soils formed in the stratified alluvium.

Climate

Climate is one of the most important factors of soil formation. It influences the rate of chemical and physical weathering. Yankton County has a continental climate characterized by cold winters and hot summers. The average annual air temperature is about 47 degrees F. The average annual precipitation is about 24 inches, about 80 percent of which falls during the period April through September. It is sufficient to leach carbonates in most soils to a depth of about 24 inches.

The climate favors a grassland ecology. It is generally uniform throughout the county. Therefore, climate alone does not account for soil differences within the county.

Plant and animal life

Living organisms play an important part in soil formation. These include plants, animals, insects, earthworms, bacteria, and fungi. In Yankton County, the tall and mid prairie grasses have had more influence than other living organisms on soil formation. The organic matter produced by grasses accumulates at the surface, as is evident in the dark surface layers of such soils as Bonilla, Clarno, Crossplain, and Wentworth. Micro-organisms help decompose the plant residue, thus releasing nutrients for plant food. Earthworms, burrowing insects, moles, and other animals that live in the soil mix the soil materials.

Relief

Relief influences soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On Betts and Gavins soils, for example, much of the rainfall is lost because of excessive runoff. As a result, less moisture enters the soil and more soil is lost through erosion. These soils have thin layers in which organic matter accumulates and are calcareous at or near the surface.

More moisture enters Clarno, Lakeport, and Wentworth soils because runoff is less rapid. The horizons in which organic matter accumulates are thicker, and the soils are calcareous below a depth of 20 inches.

Chancellor and Crossplain soils are in swales that receive extra moisture in the form of runoff from adjacent soils. The horizons in which organic matter accumulates are thicker than those in Clarno, Lakeport, and Wentworth soils, and the depth to carbonates is greater. Tetonka and Worthing soils formed in low areas where surface drainage is impeded.

Time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that have formed. All of the soils in Yankton County are on somewhat young landscapes that date back to the Late Wisconsin glacial period. The youngest soils are those on the small active flood plains. Bon and Roxbury soils are examples. Other young soils are the Forney, Haynie, and Sarpy soils on the large, stable flood plain along the Missouri River. Examples of the older soils on the glacial till plain are Clarno and Wentworth.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*12*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is 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 expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplustolls (*Hapl*, meaning simple horizons, plus *ustolls*, the suborder of Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, mesic Typic Haplustolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

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 vol., 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) Clayton, L. and T. Treers. 1967. Glacial geology of the Missouri Coteau and adjacent areas. North Dakota geological Survey, Misc. Ser. 30, 170 pp., illus.

(4) Flint, Richard Foster. 1955. Pleistocene geology of eastern South Dakota. U.S. Geol. Surv., Prof. Pap. 262, 173 pp., illus.

(5) Milton, John R. 1977. South Dakota: a bicentennial history. 200 pp., illus.

(6) Simpson, Howard E. 1960. Geology of the Yankton area, South Dakota and Nebraska. U.S. Geol. Surv. Prof. Pap. 328, 124 pp., illus.

(7) South Dakota Association of Soil and Water Conservation Districts. 1969. History of South Dakota Conservation Districts. 283 pp., illus.

(8) South Dakota Crop and Livestock Reporting Service. 1964. Yankton County agriculture. 62 pp.

(9) South Dakota Crop and Livestock Reporting Service. 1975. South Dakota agriculture: 1975. 94 pp.

(10) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962.]

(11) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(12) United States Department of Agriculture. 1975. Soil taxonomy: a basic system of soil classification for making and interpreting soil surveys. U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(13) United States Department of Agriculture. 1976. South Dakota land use—1975 estimates. 65 pp.

Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

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 stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Crop residue management. Use of that part of plants or crops left in the field after harvest for protection or improvement of the soil.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Erosion. The wearing away of the land surface by running 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 a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Foot slope. The inclined surface at the base of a hill.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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.

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. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

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. Inadequate strength for supporting loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Piping. Moving water forms subsurface tunnels or pipelike cavities in 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.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Managing the intensity of grazing on range and pasture so that an adequate protective plant cover is maintained and the quality and quantity of desirable vegetation is maintained, improved, or increased.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Subsurface layer. Any surface soil horizon (A1, A2, A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently referred to as the "plow layer," or the "Ap horizon."

Surface soil. All of the A 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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature*						Precipitation*				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days**	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	26.6	4.7	15.6	56	-24	0	.32	.07	.51	1	5.0
February---	32.6	10.6	21.6	64	-18	0	.69	.17	1.10	2	6.1
March------	41.7	19.9	30.8	77	-7	28	1.26	.38	1.95	4	7.6
April------	59.0	34.2	46.6	88	16	53	2.16	1.24	2.91	5	1.0
May--------	71.7	46.6	59.2	93	28	298	3.63	1.50	5.35	7	.0
June-------	81.1	56.8	69.0	102	41	570	4.13	2.20	5.69	7	.0
July-------	87.1	61.7	74.4	103	45	756	3.14	1.52	4.45	6	.0
August-----	85.4	59.3	72.4	102	45	694	3.06	1.15	4.59	6	.0
September--	74.6	48.3	61.5	98	30	350	2.50	1.25	3.50	5	.0
October----	64.8	37.5	51.2	89	19	136	1.31	.36	2.07	3	.0
November---	46.5	23.4	35.0	76	-2	0	.94	.11	1.56	2	2.0
December---	32.4	11.9	22.2	61	-18	0	.55	.21	.81	2	4.9
Year-----	58.6	34.6	46.6	105	-24	2,885	23.69	18.44	28.61	50	26.6

* Recorded in the period 1951-75 at Yankton, S. Dak.

** 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

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 2	May 19
2 years in 10 later than--	April 19	April 28	May 14
5 years in 10 later than--	April 12	April 19	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 15	October 4	September 18
2 years in 10 earlier than--	October 20	October 9	September 23
5 years in 10 earlier than--	October 28	October 18	October 4

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season*		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	183	158	130
8 years in 10	189	166	138
5 years in 10	199	181	152
2 years in 10	209	196	166
1 year in 10	214	204	173

* Recorded in the period 1951-75 at Yankton, S. Dak.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ba	Baltic clay loam	945	0.3
Bb	Baltic silty clay	3,625	1.1
Bc	Baltic silty clay, depressional	1,015	0.3
BdE	Betts-Gavins complex, 15 to 40 percent slopes	875	0.3
Be	Blake silty clay loam	3,155	0.9
Bf	Blencoe silty clay	420	0.1
Bg	Blencoe-Gayville complex	415	0.1
BhB	Blendon-Thurman complex, 0 to 6 percent slopes	1,185	0.4
Bk	Blyburg silt loam	2,245	0.7
Bm	Bon loam	2,805	0.8
BnA	Bonilla-Crossplain complex, 0 to 2 percent slopes	1,050	0.3
BoE	Boyd-Ethan association, 15 to 40 percent slopes	1,425	0.4
Ca	Chancellor silty clay loam	3,230	1.0
Cb	Clamo silty clay loam	5,600	1.7
Cc	Clamo Variant silty clay loam	1,030	0.3
CdA	Clarno loam, 0 to 2 percent slopes	13,550	4.1
CeB	Clarno-Bonilla loams, 1 to 6 percent slopes	47,230	14.2
ChA	Clarno-Crossplain-Stickney complex, 0 to 3 percent slopes	2,880	0.9
CkA	Clarno-Crossplain-Tetonka complex, 0 to 3 percent slopes	49,692	15.0
CoE	Crofton-Boyd association, 15 to 40 percent slopes	1,655	0.5
CmE	Crofton-Nora silt loams, 9 to 25 percent slopes	1,270	0.4
DaB	Davis silt loam, 2 to 9 percent slopes	5,055	1.5
DbB	Davis Variant loam, 0 to 6 percent slopes	855	0.3
EaB	Egan-Chancellor silty clay loams, 1 to 6 percent slopes	4,340	1.3
EbB	Egan-Ethan-Trent complex, 1 to 6 percent slopes	29,075	8.8
EbC	Egan-Ethan-Trent complex, 2 to 9 percent slopes	12,870	3.9
EcA	Egan-Wentworth silty clay loams, 0 to 2 percent slopes	6,040	1.8
EcB	Egan-Wentworth silty clay loams, 2 to 6 percent slopes	8,415	2.5
EdA	Egan-Whitewood silty clay loams, 0 to 3 percent slopes	6,055	1.8
EhA	Enet-Delmont loams, 0 to 2 percent slopes	1,145	0.3
EhB	Enet-Delmont loams, 2 to 6 percent slopes	880	0.3
EkD	Ethan stony loam, 3 to 25 percent slopes	810	0.2
EmE	Ethan-Betts loams, 15 to 40 percent slopes	22,890	6.9
EnC	Ethan-Bonilla loams, 3 to 9 percent slopes	13,080	3.9
EoD	Ethan-Davis loams, 9 to 15 percent slopes	10,890	3.3
EpD	Ethan-Talmo loams, 6 to 15 percent slopes	740	0.2
Fa	Forney silty clay loam	7,565	2.3
Ga	Grable silt loam	1,250	0.4
Gb	Graceville silty clay loam	460	0.1
Ha	Haynie silt loam	6,080	1.8
Hb	Haynie silty clay loam, overwash	2,365	0.7
Ja	James silty clay loam	1,305	0.4
La	Lakeport silty clay loam	1,915	0.6
Lb	Lamo silty clay loam	2,015	0.6
Lc	Luton silty clay	2,750	0.8
Ld	Luton silty clay, depressional	945	0.3
Oa	Onawa silty clay	1,525	0.4
Ob	Owego silty clay loam	2,025	0.6
Pa	Pits, gravel	345	0.1
Ra	Redstoe Variant silt loam, 6 to 15 percent slopes	485	0.1
Rb	Roxbury loam, channeled	1,910	0.6
Rc	Roxbury silt loam	4,195	1.3
Sa	Salix silty clay loam	500	0.2
Sb	Salmo silty clay loam	2,115	0.6
SdA	Sarpy loamy fine sand, 0 to 3 percent slopes	1,710	0.5
SeA	Sarpy-Grable complex, 0 to 4 percent slopes	2,955	0.9
TaE	Talmo-Thurman complex, 15 to 40 percent slopes	1,865	0.6
Tb	Tetonka silt loam	4,925	1.5
TcC	Thurman-Ethan complex, 2 to 9 percent slopes	1,250	0.4
TdA	Trent silty clay loam, 0 to 2 percent slopes	975	0.3
Wa	Waubonsie very fine sandy loam	1,090	0.3
WbA	Wentworth silty clay loam, 0 to 2 percent slopes	3,065	0.9
WcB	Wentworth-Trent silty clay loams, 2 to 6 percent slopes	2,515	0.8
Wd	Worthing silty clay loam	2,270	0.7
We	Worthing silty clay loam, ponded	1,225	0.4
	Total land area	332,032	100.0
	Open water greater than 40 acres	7,808	
	Total area	339,840	

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Only arable soils are listed. Absence of a yield figure 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	Grain sorghum	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Ton	AUM*
Ba------------------------ Baltic	70	70	29	56	3.4	5.7
Bb------------------------ Baltic	61	65	23	47	3.0	5.0
Be------------------------ Blake	84	90	40	82	3.8	6.1
Bf------------------------ Blencoe	77	74	27	79	3.6	5.7
Bg------------------------ Blencoe-Gayville	62	59	21	60	2.8	4.5
BhB----------------------- Blendon-Thurman	55	55	18	63	2.1	3.6
Bk------------------------ Blyburg	88	80	38	79	4.2	6.9
Bm------------------------ Bon	90	82	39	73	4.1	6.7
BnA----------------------- Bonilla-Crossplain	80	79	31	74	3.4	5.7
Ca------------------------ Chancellor	77	74	29	70	3.4	5.7
Cb------------------------ Clamo	70	56	29	60	3.7	6.2
Cc------------------------ Clamo Variant	73	60	31	62	3.7	6.2
CdA----------------------- Clarno	78	78	30	70	3.5	5.8
CeB----------------------- Clarno-Bonilla	76	77	28	64	3.4	5.7
ChA----------------------- Clarno-Crossplain-Stickney	73	74	29	60	3.2	5.4
CkA----------------------- Clarno-Crossplain-Tetonka	75	74	28	59	3.3	5.5
DaB----------------------- Davis	82	83	30	75	3.5	5.8
DbB----------------------- Davis Variant	60	64	22	55	3.0	4.3
EaB----------------------- Egan-Chancellor	79	78	29	70	3.6	6.0
EbB----------------------- Egan-Ethan-Trent	78	79	29	67	3.5	5.8
EbC----------------------- Egan-Ethan-Trent	66	68	26	60	3.2	5.3

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Soybeans	Grain sorghum	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Ton	AUM*
EcA: Egan-Wentworth	85	83	32	75	3.8	6.3
EcB: Egan-Wentworth	81	81	30	72	3.6	6.0
EdA: Egan-Whitewood	83	80	31	70	3.6	6.0
EhA: Enet-Delmont	47	54	22	37	2.1	3.6
EhB: Enet-Delmont	43	50	19	28	2.0	3.4
EnC: Ethan-Bonilla	60	61	22	48	2.8	4.7
Fa: Forney	73	64	28	70	3.2	5.3
Ga: Grable	70	60	25	65	2.8	4.7
Gb: Graceville	82	77	31	80	3.5	5.8
Ha: Haynie	82	84	31	85	4.0	6.7
Hb: Haynie	78	74	28	80	3.8	6.1
Ja: James	30	35	---	30	2.6	4.0
La: Lakeport	86	74	29	77	4.0	6.7
Lb: Lamo	80	72	28	70	4.0	6.7
Lc: Luton	63	60	24	58	3.3	5.5
Oa: Onawa	75	63	27	70	3.6	6.0
Ob: Owego	80	74	28	78	3.8	6.3
Ro: Roxbury	88	82	37	82	4.1	7.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Soybeans	Grain sorghum	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Ton	AUM*
Sa** Salix	92	80	36	84	4.3	7.2
Sb Salmo	37	45	---	35	2.6	4.3
SdA Sarpy	45	35	17	37	2.5	4.2
SeA Sarpy-Grable	65	46	21	55	2.8	4.7
Tb Tetonka	61	62	24	47	3.3	5.5
TcC Thurman-Ethan	48	48	18	40	2.0	3.3
TdA Trent	88	91	38	76	4.0	6.7
Wa** Waubonsie	76	70	28	75	3.7	6.1
WbA Wentworth	86	83	33	75	3.8	6.3
WcB Wentworth-Trent	83	83	32	72	3.8	6.3

* 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.

** Yields are for drained areas.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that commonly are used 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
BdE*:					
Betts	Thin Upland	Favorable	3,120	Little bluestem	45
		Normal	2,600	Sideoats grama	10
		Unfavorable	1,820	Needleandthread	10
				Prairie dropseed	10
				Big bluestem	5
				Western wheatgrass	5
				Sedge	5
				Leadplant	5
Gavins	Thin Upland	Favorable	3,600	Little bluestem	40
		Normal	3,000	Sideoats grama	15
		Unfavorable	2,100	Prairie dropseed	10
				Big bluestem	5
				Needleandthread	5
				Western wheatgrass	5
				Blue grama	5
				Sedge	5
BhB*:					
Blendon	Sandy	Favorable	3,960	Little bluestem	25
		Normal	3,300	Big bluestem	20
		Unfavorable	2,310	Prairie sandreed	15
				Needleandthread	10
				Porcupinegrass	10
				Blue grama	5
				Leadplant	5
				Sedge	5
Thurman	Sandy	Favorable	3,960	Little bluestem	25
		Normal	3,300	Sand bluestem	20
		Unfavorable	2,310	Prairie sandreed	20
				Needlegrass	15
				Switchgrass	5
				Sedge	5
BcE*:					
Boyd	Clayey	Favorable	3,600	Green needlegrass	25
		Normal	3,000	Little bluestem	25
		Unfavorable	2,100	Western wheatgrass	15
				Big bluestem	15
				Sideoats grama	10
				Blue grama	5
Ethan	Silty	Favorable	3,600	Little bluestem	30
		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Western wheatgrass	15
				Green needlegrass	10
				Needleandthread	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
CcE*:					
Crofton	Thin Upland	Favorable	3,360	Little bluestem	45
		Normal	2,800	Big bluestem	10
		Unfavorable	1,960	Sideoats grama	10
				Western wheatgrass	10
				Needleandthread	10
				Blue grama	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
CoE*:					
Boyd	Clayey	Favorable	3,600	Green needlegrass	25
		Normal	3,000	Little bluestem	25
		Unfavorable	2,100	Western wheatgrass	15
				Big bluestem	15
				Sideoats grama	10
				Blue grama	5
CmE*:					
Crofton	Thin Upland	Favorable	3,600	Little bluestem	40
		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Sideoats grama	10
				Western wheatgrass	10
				Needleandthread	10
				Blue grama	5
				Sedge	5
Nora	Silty	Favorable	3,840	Little bluestem	45
		Normal	3,200	Needlegrass	25
		Unfavorable	2,240	Big bluestem	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
EhA*, EhB*:					
Enet	Silty	Favorable	4,560	Big bluestem	30
		Normal	3,800	Little bluestem	15
		Unfavorable	2,660	Western wheatgrass	15
				Green needlegrass	10
				Needleandthread	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Delmont	Shallow To Gravel	Favorable	3,360	Needleandthread	50
		Normal	2,800	Little bluestem	10
		Unfavorable	1,680	Sedge	10
				Sideoats grama	5
				Prairie dropseed	5
				Blue grama	5
				Plains muhly	5
EkD Ethan	Silty	Favorable	3,720	Little bluestem	25
		Normal	3,100	Big bluestem	20
		Unfavorable	2,170	Western wheatgrass	15
				Green needlegrass	10
				Needleandthread	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
EmE*:					
Ethan	Silty	Favorable	3,600	Little bluestem	30
		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Western wheatgrass	15
				Green needlegrass	10
				Needleandthread	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight (Lb/acre)	Characteristic vegetation	Composition (Pct)
EmE*:					
Betts	Thin Upland	Favorable	3,120	Little bluestem	45
		Normal	2,600	Sideoats grama	10
		Unfavorable	1,820	Needleandthread	10
				Prairie dropseed	10
				Big bluestem	5
				Western wheatgrass	5
				Sedge	5
				Leadplant	5
EoD*:					
Ethan	Silty	Favorable	3,710	Little bluestem	25
		Normal	3,100	Big bluestem	20
		Unfavorable	2,170	Western wheatgrass	15
				Green needlegrass	10
				Needleandthread	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Davis	Silty	Favorable	4,560	Little bluestem	35
		Normal	3,800	Big bluestem	30
		Unfavorable	2,660	Green needlegrass	15
				Sideoats grama	5
				Leadplant	5
				Sedge	5
EpD*:					
Ethan	Silty	Favorable	3,720	Little bluestem	25
		Normal	3,100	Big bluestem	20
		Unfavorable	2,170	Western wheatgrass	15
				Green needlegrass	10
				Needleandthread	10
				Sideoats grama	5
				Blue grama	5
				Sedge	5
Talmo	Very Shallow	Favorable	2,520	Blue grama	35
		Normal	2,100	Needleandthread	30
		Unfavorable	1,260	Sideoats grama	15
				Sedge	10
Ja: James	Saline Lowland	Favorable	4,180	Cordgrass	55
		Normal	3,800	Big bluestem	10
		Unfavorable	3,040	Sedge	10
				Inland saltgrass	10
				Western wheatgrass	5
				Switchgrass	5
Ra: Redstoe Variant	Thin Upland	Favorable	3,960	Little bluestem	35
		Normal	3,300	Sideoats grama	15
		Unfavorable	2,310	Big bluestem	10
				Prairie dropseed	10
				Needleandthread	5
				Western wheatgrass	5
				Blue grama	5
				Sedge	5
Rb: Roxbury	Overflow	Favorable	6,000	Big bluestem	60
		Normal	5,000	Switchgrass	10
		Unfavorable	3,500	Canada wildrye	5
				Little bluestem	5
				Bluegrass	5
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Sb: Salmo	Saline Lowland	Favorable	4,180	Cordgrass	55
		Normal	3,800	Big bluestem	10
		Unfavorable	3,040	Inland saltgrass	10
				Sedge	10
				Switchgrass	5
				Western wheatgrass	5
TaE*:					
Talmo	Very Shallow	Favorable	2,400	Blue grama	40
		Normal	2,000	Needleandthread	20
		Unfavorable	1,200	Sideoats grama	15
				Sedge	15
Thurman	Sandy	Favorable	3,960	Little bluestem	25
		Normal	3,300	Sand bluestem	20
		Unfavorable	2,310	Prairie sandreed	20
				Needlegrass	15
				Switchgrass	5
				Sedge	5
TcC*:					
Thurman	Sandy	Favorable	3,960	Little bluestem	25
		Normal	3,300	Sand bluestem	20
		Unfavorable	2,310	Prairie sandreed	20
				Needlegrass	15
				Switchgrass	5
				Sedge	5
Ethan	Silty	Favorable	3,960	Big bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	2,310	Green needlegrass	10
				Needleandthread	10
				Western wheatgrass	5
				Sideoats grama	5
				Blue grama	5
				Sedge	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--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
Ba, Bb: Baltic	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Bc. Baltic					
BdE*: Betts.					
Gavins.					
Be: Blake	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood.
Bf: Blencoe	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Bg*: Blencoe	Lilac, silver buffaloberry.	Tatarian honeysuckle, Siberian peashrub.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Green ash, golden willow.	Eastern cottonwood.
Gayville.					
BhB*: Blendon	---	Eastern redcedar, Tatarian honeysuckle, Siberian peashrub, lilac, American plum.	Green ash, common hackberry, ponderosa pine, Russian-olive, Siberian crabapple.	Siberian elm, honeylocust.	---
Thurman	---	Eastern redcedar, Tatarian honeysuckle, Siberian peashrub, lilac, American plum.	Green ash, ponderosa pine, Siberian crabapple, Russian-olive, common hackberry.	Siberian elm, honeylocust.	---
Bk: Blyburg	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Bm: Bon	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
BnA*:					
Bonilla	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
Crossplain	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
BoE*:					
Boyd.					
Ethan.					
Ca Chancellor	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Cb Clamo	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Cc Clamo Variant	Lilac, silver buffaloberry.	Tatarian honeysuckle, Siberian peashrub.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple.	Golden willow, green ash, honeylocust.	Eastern cottonwood.
CdA Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
CeB*:					
Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common 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, common hackberry.	Eastern cottonwood, Siberian elm.
ChA*:					
Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
ChA*:					
Crossplain	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Stickney	Lilac	Siberian crabapple, Tatarian honeysuckle, American plum, Siberian peashrub.	Honeylocust, ponderosa pine, common hackberry, Russian-olive, eastern redcedar.	Siberian elm, green ash.	---
CkA*:					
Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Crossplain	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Tetonka.					
CoE*:					
Crofton.					
Boyd.					
CmE*:					
Crofton.					
Nora.					
DaB Davis	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
DbB Davis Variant	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
EaB*:					
Egan	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
EaB*:					
Chancellor	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
EbB*, EbC*:					
Egan	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Ethan	American plum, silver buffaloberry.	Russian-olive, common hackberry, eastern redcedar, Rocky Mt. juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Trent	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood.
EcA*, EcB*:					
Egan	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Wentworth	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
EdA*:					
Egan	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Whitewood	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
EhA*, EhB*:					
Enet	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mt. juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine.	Siberian elm	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
EhA*, EhB*:					
Delmont	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mt. juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine.	Siberian elm	---
EkD. Ethan					
EmE*: Ethan.					
Betts.					
EnC*:					
Ethan	American plum, silver buffaloberry.	Russian-olive, common hackberry, eastern redcedar, Rocky Mt. 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, common 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, common hackberry.	Eastern cottonwood, Siberian elm.
EpD*: Ethan.					
Talmo.					
Fa Forney	Lilac, silver buffaloberry.	Tatarian honeysuckle, Siberian peashrub.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Ga Grable	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian peashrub, eastern redcedar, Rocky Mt. juniper, Siberian crabapple.	Honeylocust, green ash, Russian-olive, ponderosa pine.	Siberian elm	---
Gb Graceville	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
Ha, Hb Haynie	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Ponderosa pine, Siberian, crabapple, eastern redcedar, blue spruce.	Golden willow, common hackberry, green ash.	Eastern cottonwood.
Ja. James					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
La. Lakeport	Lilac, silver buffaloberry.	Tatarian honeysuckle, Siberian peashrub.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Lb. Lamo	Lilac, silver buffaloberry.	Siberian peashrub, Tatarian honeysuckle.	Eastern redcedar, common hackberry, blue spruce, ponderosa pine, Siberian crabapple.	Green ash, golden willow.	Eastern cottonwood.
Lc, Ld. Luton	Lilac, silver buffaloberry.	Siberian peashrub, Tatarian honeysuckle.	Eastern redcedar, common hackberry, blue spruce, ponderosa pine, Siberian crabapple.	Green ash, golden willow.	Eastern cottonwood.
Oa. Onawa	Lilac, silver buffaloberry.	Tatarian honeysuckle, Siberian peashrub.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Ob. Owego	Lilac, silver buffaloberry.	Tatarian honeysuckle, Siberian peashrub.	Common hackberry, blue spruce, eastern redcedar, ponderosa pine, Siberian crabapple.	Golden willow, green ash.	Eastern cottonwood.
Pa. Pits, gravel					
Ra. Redstoe Variant	Silver buffaloberry, American plum.	Tatarian honeysuckle, Russian-olive, common hackberry, Rocky Mt. juniper, eastern redcedar, Siberian peashrub.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Rb. Roxbury					
Rc. Roxbury	---	Eastern redcedar, Siberian peashrub, lilac, American plum.	Ponderosa pine, common hackberry, Russian-olive, Siberian crabapple, blue spruce.	Honeylocust, green ash.	Siberian elm.
Sa. Salix	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Ponderosa pine, common hackberry, Russian-olive, Siberian crabapple, blue spruce.	Honeylocust, green ash.	Siberian elm.
Sb. Salmo					
SdA. Sarpy	---	Ponderosa pine, eastern redcedar, Rocky Mt. juniper.	---	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
SeA*:					
Sarpy	---	Ponderosa pine, eastern redcedar, Rocky Mt. juniper.	---	---	---
Grable	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mt. juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine.	Siberian elm	---
TaE*: Talmo.					
Thurman	---	Eastern redcedar, Tatarian honeysuckle, Siberian peashrub, lilac, American plum.	Green ash, ponderosa pine, Siberian crabapple, Russian-olive, common hackberry.	Siberian elm, honeylocust.	---
Tb. Tetonka					
TcC*:					
Thurman	---	Eastern redcedar, Tatarian honeysuckle, Siberian peashrub, lilac, American plum.	Green ash, ponderosa pine, Siberian crabapple, Russian-olive, common hackberry.	Siberian elm, honeylocust.	---
Ethan	American plum, silver buffaloberry.	Russian-olive, common hackberry, eastern redcedar, Rocky Mt. juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
TdA Trent	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood.
Wa Waubonsie	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood.
WbA Wentworth	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
WcB*:					
Wentworth	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
WcB*: Trent	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood.
Wd, We. Worthing					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--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	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Ba----------------- Baltic	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Bb----------------- Baltic	Fair	Good	Fair	Poor	Fair	Fair	Fair	Fair	Fair.
Bc----------------- Baltic	Very poor	Poor	Fair	Poor	Good	Good	Very poor	Good	Fair.
BdE*:									
Betts-------------	Very poor	Very poor	Fair	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	Fair.
Be----------------- Blake	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Bf----------------- Blencoe	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Bg*:									
Blencoe-----------	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Gayville----------	Very poor	Very poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
BhB*:									
Blendon-----------	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Thurman-----------	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Bk----------------- Blyburg	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bm----------------- Bon	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
BnA*:									
Bonilla-----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Crossplain--------	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
BoE*:									
Boyd--------------	Very poor	Poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Ethan-------------	Very poor	Poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Ca----------------- Chancellor	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Cb----------------- Clamo	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Cc----------------- Clamo Variant	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
CdA---------------- Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
CeB*:									
Clarno------------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bonilla-----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
ChA*:									
Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Crossplain	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Stickney	Good	Fair	Good	Fair	Very poor	Very poor	Good	Very poor	Good.
CkA*:									
Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Crossplain	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Tetonka	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Fair	Fair.
CoE*:									
Crofton	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Boyd	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
CmE*:									
Crofton	Very Poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Nora	Very poor	Good	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
DaB Davis	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
DbB Davis Variant	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
EaB*:									
Egan	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Chancellor	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
EbB*:									
Egan	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Trent	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
EbC*:									
Egan	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
Trent	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
EcA*, EcB*:									
Egan	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Wentworth	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
EdA*:									
Egan	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Whitewood	Good	Fair	Fair	Good	Poor	Poor	Good	Poor	Fair.
EhA*:									
Enet	Good	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Delmont	Fair	Fair	Poor	Poor	Very poor	Very poor	Fair	Very poor	Poor.
EhB*:									
Enet	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
EhB*:									
Delmont	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
EkD Ethan	Very poor	Very poor	Good	Very poor	Very poor	Very poor	Very poor	Very poor	Good.
EmE*:									
Ethan	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Betts	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
EnC*:									
Ethan	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
Bonilla	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
EoD*:									
Ethan	Very poor	Fair	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Davis	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
EpD*:									
Ethan	Very poor	Fair	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Talmo	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Fa Forney	Fair	Good	Good	Good	Fair	Fair	Good	Fair	Fair.
Ga Grable	Good	Fair	Good	Poor	Very poor	Very poor	Good	Very poor	Good.
Gb Graceville	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Ha, Hb Haynie	Good	Good	Fair	Good	Very poor	Very poor	Good	Poor	Fair.
Ja James	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Fair	Fair.
La Lakeport	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Lb Lamo	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Lc Luton	Fair	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Ld Luton	Very poor	Poor	Fair	Poor	Good	Good	Very poor	Good	Fair.
Oa Onawa	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Ob Owego	Fair	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Pa. Pits, gravel									
Ra Redstoe Variant	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Rb Roxbury	Very poor	Good	Fair	Poor	Poor	Very poor	Poor	Very poor	Fair.
Rc Roxbury	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Sa------------------ Salix	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Sb------------------ Salmo	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Fair	Fair.
SdA----------------- Sarpy	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
SeA*:									
Sarpy---------------	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Grable--------------	Good	Fair	Good	Poor	Very poor	Very poor	Good	Very poor	Good.
TaE*:									
Talmo---------------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Thurman-------------	Poor	Poor	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Tb------------------ Tetonka	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Fair	Fair.
TcC*:									
Thurman-------------	Poor	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Ethan---------------	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
TdA----------------- Trent	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Wa------------------ Waubonsie	Good	Good	Good	Good	Very poor	Poor	Good	Very poor	Good.
WbA----------------- Wentworth	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
WcB*:									
Wentworth-----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Trent---------------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Wd------------------ Worthing	Poor	Poor	Fair	Poor	Good	Good	Poor	Good	Fair.
We------------------ Worthing	Very poor	Very poor	Very poor	Very poor	Good	Good	Very poor	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ba: Baltic	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Bb, Bc: Baltic	Severe: too clayey, floods, wetness.	Severe: too clayey, wetness.	Severe: too clayey, wetness, floods.	Severe: too clayey, wetness.
BdE*:				
Betts	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gavins	Severe: slope, dusty.	Severe: slope, dusty.	Severe: slope, dusty.	Severe: slope, dusty.
Be: Blake	Severe: floods.	Moderate: wetness, too clayey.	Moderate: too clayey, wetness.	Moderate: too clayey.
Bf: Blencoe	Severe: floods, wetness, percs slowly.	Severe: too clayey.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey.
Bg*:				
Blencoe	Severe: floods, wetness, percs slowly.	Severe: too clayey.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey.
Gayville	Severe: floods, percs slowly.	Moderate: wetness.	Moderate: wetness, floods.	Slight.
BhB*:				
Blendon	Slight	Slight	Moderate: slope.	Slight.
Thurman	Slight	Slight	Moderate: slope.	Slight.
Bk: Blyburg	Severe: floods.	Slight	Slight	Slight.
Bm: Bon	Severe: floods.	Slight	Moderate: floods.	Slight.
BnA*:				
Bonilla	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Crossplain	Severe: wetness, floods.	Moderate: floods, wetness, too clayey.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.
BoE*:				
Boyd	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Moderate: too clayey, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BoE*:				
Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ca Chancellor	Severe: floods, wetness.	Moderate: floods, wetness, too clayey.	Severe: wetness.	Moderate: wetness, too clayey.
Cb Clamo	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Cc Clamo Variant	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
CdA Clarno	Slight	Slight	Slight	Slight.
CeB*:				
Clarno	Slight	Slight	Moderate: slope.	Slight.
Bonilla	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
ChA*:				
Clarno	Slight	Slight	Slight	Slight.
Crossplain	Severe: wetness, floods.	Moderate: floods, wetness, too clayey.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.
Stickney	Slight	Slight	Slight	Slight.
CkA*:				
Clarno	Slight	Slight	Slight	Slight.
Crossplain	Severe: wetness, floods.	Moderate: floods, wetness, too clayey.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.
Tetonka	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, floods, percs slowly.	Severe: wetness.
CoE*:				
Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Boyd	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Moderate: too clayey, slope.
CmE*:				
Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Nora	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
DaB Davis	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
DbB: Davis Variant	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
EaB*:				
Egan	Slight	Slight	Moderate: slope, too clayey.	Slight.
Chancellor	Severe: floods, wetness.	Moderate: floods, wetness, too clayey.	Severe: wetness.	Moderate: wetness, too clayey.
EbB*:				
Egan	Slight	Slight	Moderate: slope, too clayey.	Slight.
Ethan	Slight	Slight	Moderate: slope.	Slight.
Trent	Severe: floods.	Slight	Moderate: floods.	Slight.
EbC*:				
Egan	Slight	Slight	Severe: slope.	Slight.
Ethan	Slight	Slight	Severe: slope.	Slight.
Trent	Severe: floods.	Slight	Moderate: floods.	Slight.
EcA*:				
Egan	Slight	Slight	Moderate: too clayey.	Slight.
Wentworth	Slight	Slight	Moderate: too clayey.	Slight.
EcB*:				
Egan	Slight	Slight	Moderate: slope, too clayey.	Slight.
Wentworth	Slight	Slight	Moderate: slope, too clayey.	Slight.
EdA*:				
Egan	Slight	Slight	Moderate: too clayey.	Slight.
Whitewood	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
EhA*:				
Enet	Slight	Slight	Slight	Slight.
Delmont	Slight	Slight	Slight	Slight.
EhB*:				
Enet	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
EhB*:				
Delmont	Slight	Slight	Moderate: slope.	Slight.
EkD Ethan	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Moderate: slope, large stones.
EmE*:				
Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Betts	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
EnC*:				
Ethan	Slight	Slight	Severe: slope.	Slight.
Bonilla	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
EoD*:				
Ethan	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Davis	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
EpD*:				
Ethan	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Talmo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Fa Forney	Severe: floods, wetness, percs slowly.	Moderate: wetness, too clayey.	Severe: wetness, percs slowly.	Moderate: wetness, too clayey.
Ga Grable	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Gb Graceville	Slight	Slight	Moderate: too clayey.	Slight.
Ha Haynie	Slight	Slight	Slight	Slight.
Hb Haynie	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Ja James	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
La Lakeport	Severe: floods.	Moderate: too clayey.	Moderate: too clayey, wetness, percs slowly.	Moderate: too clayey.
Lb Lamo	Severe: floods.	Moderate: too clayey, wetness.	Moderate: too clayey, wetness, floods.	Moderate: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lc, Ld: Luton	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, floods, too clayey.	Severe: wetness, too clayey.
Oa: Onawa	Severe: floods, too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Ob: Owego	Severe: wetness, too clayey, percs slowly.	Severe: wetness, too clayey, floods.	Severe: wetness, too clayey, percs slowly.	Severe: wetness, too clayey.
Pa. Pits, gravel				
Ra: Redstoe Variant	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Rb: Roxbury	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Rc: Roxbury	Severe: floods.	Slight	Moderate: floods.	Slight.
Sa: Salix	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Sb: Salmo	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
SdA: Sarpy	Severe: floods.	Moderate: too sandy.	Severe: floods.	Moderate: too sandy.
SeA*:				
Sarpy	Severe: floods.	Moderate: too sandy.	Severe: floods.	Moderate: too sandy.
Grable	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
TaE*:				
Talmo	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Thurman	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tb: Tetonka	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
TcC*:				
Thurman	Slight	Slight	Moderate: slope.	Slight.
Ethan	Slight	Slight	Moderate: slope.	Slight.
TdA: Trent	Severe: floods.	Slight	Moderate: floods.	Slight.
Wa: Waubonsie	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
WbA-------------------- Wentworth	Slight---------------	Slight---------------	Moderate: too clayey.	Slight.
WcB*:				
Wentworth------------	Slight---------------	Slight---------------	Moderate: slope, too clayey.	Slight.
Trent----------------	Severe: floods.	Slight---------------	Moderate: floods.	Slight.
Wd-------------------- Worthing	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
We-------------------- Worthing	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.

* 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
Ba, Bb, Bc: Baltic	Severe: floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: wetness, low strength, floods.
BdE*:					
Betts	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Gavins	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, low strength.
Be: Blake	Severe: cutbanks cave, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action, low strength.
Bf: Blencoe	Severe: wetness.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
Bg*:					
Blencoe	Severe: wetness.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
Gayville	Severe: wetness, floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods.
BhB*:					
Blendon	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
Thurman	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Bk: Blyburg	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.
Bm: Bon	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
BnA*:					
Bonilla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Crossplain	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: frost action, shrink-swell, low strength.
BoE*:					
Boyd	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, 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
BoE*:					
Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Ca Chancellor	Severe: wetness, floods.	Severe: shrink-swell, floods, low strength.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, low strength.	Severe: floods, shrink-swell, low strength.
Cb Clamo	Severe: floods, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: low strength, wetness, floods.
Cc Clamo Variant	Severe: floods, wetness.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, frost action, low strength.
CdA Clarno	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
CeB*:					
Clarno	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
Bonilla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
ChA*:					
Clarno	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Crossplain	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: frost action, shrink-swell, low strength.
Stickney	Slight	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
CkA*:					
Clarno	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Crossplain	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: frost action, shrink-swell, low strength.
Tetonka	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, wetness.
CoE*:					
Crofton	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
CoE*:					
Boyd	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
CmE*:					
Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Nora	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action, low strength.
DaB Davis	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
DbB Davis Variant	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
EaB*:					
Egan	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
Chancellor	Severe: wetness, floods.	Severe: shrink-swell, floods, low strength.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, low strength.	Severe: floods, shrink-swell, low strength.
EbB*, EbC*:					
Egan	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
Ethan	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
Trent	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, frost action, floods.
EcA*:					
Egan	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
Wentworth	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, frost action.
EcB*:					
Egan	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
Wentworth	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength, frost action.

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
EdA*:					
Egan	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
Whitewood	Severe: wetness, floods.	Severe: floods, wetness, low strength.	Severe: wetness, floods, low strength.	Severe: floods, wetness, low strength.	Severe: floods, low strength, wetness.
EhA*:					
Enet	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Delmont	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
EhB*:					
Enet	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Delmont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
EkD Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
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, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
Bonilla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
EoD*:					
Ethan	Moderate: slope.	Moderate: shrink-swell, slope, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: slope.	Severe: low strength.
Davis	Moderate: slope.	Moderate: shrink-swell, slope, low strength.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
EpD*:					
Ethan	Moderate: slope.	Moderate: shrink-swell, slope, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: slope.	Severe: low strength.
Talmo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: 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
Fa----------------- Forney	Severe: wetness.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: low strength, shrink-swell.
Ga----------------- Grable	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Gb----------------- Graceville	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action, low strength.
Ha----------------- Haynie	Moderate: too clayey.	Slight------------	Moderate: wetness.	Slight------------	Severe: frost action.
Hb----------------- Haynie	Moderate: too clayey, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.
Ja----------------- James	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.
La----------------- Lakeport	Severe: wetness.	Severe: shrink-swell, low strength, floods.	Severe: wetness, shrink-swell, floods.	Severe: shrink-swell, low strength, floods.	Severe: low strength, frost action, shrink-swell.
Lb----------------- Lamo	Severe: wetness, floods.	Severe: low strength, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Severe: floods, low strength, frost action.
Lc, Ld------------- Luton	Severe: wetness, too clayey, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, low strength, floods.
Oa----------------- Onawa	Severe: wetness, floods.	Severe: floods, shrink-swell, low strength.	Severe: wetness, floods, shrink-swell.	Severe: floods, shrink-swell, low strength.	Severe: wetness, low strength, shrink-swell.
Ob----------------- Owego	Severe: wetness, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.
Pa. Pits, gravel					
Ra----------------- Redstoe Variant	Moderate: slope.	Severe: low strength.	Severe: low strength.	Severe: slope, low strength.	Severe: low strength.
Rb, Rc------------- Roxbury	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Sa----------------- Salix	Moderate: wetness, floods.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, frost action.
Sb----------------- Salmo	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, 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
SdA: Sarpy	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
SeA*:					
Sarpy	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Grable	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
TaE*:					
Talmo	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Thurman	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tb: Tetonka	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, wetness.
TcC*:					
Thurman	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Ethan	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
TdA: Trent	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, frost action, floods.
Wa: Waubonsie	Severe: wetness, floods, too clayey.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.
WbA: Wentworth	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, frost action.
WcB*:					
Wentworth	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength, frost action.
Trent	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, frost action, floods.
Wd: Worthing	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
We: Worthing	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.

* 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
Ba, Bb, Bc---------- Baltic	Severe: percs slowly, wetness, floods.	Slight-----------	Severe: too clayey, floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
BdE*:					
Betts--------------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Gavins-------------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, area reclaim.
Be----------------- Blake	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness, too clayey.
Bf----------------- Blencoe	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Bg*:					
Blencoe------------	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Gayville-----------	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: excess sodium.
BhB*:					
Blendon------------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Thurman------------	Slight-----------	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
Bk----------------- Blyburg	Moderate: percs slowly, floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
Bm----------------- Bon	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
BnA*:					
Bonilla------------	Severe: floods, percs slowly, wetness.	Slight-----------	Severe: floods, wetness.	Severe: floods.	Fair: too clayey.
Crossplain---------	Severe: percs slowly, wetness, floods.	Slight-----------	Severe: wetness, floods.	Severe: wetness, floods.	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
BoE*:					
Boyd	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Ethan	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ca Chancellor	Severe: percs slowly, floods, wetness.	Slight	Severe: floods, wetness.	Severe: floods, wetness.	Fair: too clayey, hard to pack.
Cb Clamo	Severe: floods, percs slowly, wetness.	Severe: floods.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.
Cc Clamo Variant	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
CdA Clarno	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
CeB*:					
Clarno	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Bonilla	Severe: floods, percs slowly, wetness.	Slight	Severe: floods, wetness.	Severe: floods.	Fair: too clayey.
ChA*:					
Clarno	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Crossplain	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Stickney	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
CkA*:					
Clarno	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Crossplain	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Tetonka	Severe: floods, percs slowly, wetness.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
CoE*:					
Crofton	Severe: slope.	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
CoE*:					
Boyd	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
CmE*:					
Crofton	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Nora	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
DaB: Davis	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
DbB: Davis Variant	Severe: floods.	Severe: seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
EaB*:					
Egan	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Chancellor	Severe: percs slowly, floods, wetness.	Slight	Severe: floods, wetness.	Severe: floods, wetness.	Fair: too clayey, hard to pack.
EbB*:					
Egan	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Trent	Severe: floods, percs slowly.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
EbC*:					
Egan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Trent	Severe: floods, percs slowly.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
EcA*:					
Egan	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Wentworth	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
EcB*:					
Egan	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Wentworth	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.

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
EdA*:					
Egan	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Whitewood	Severe: percs slowly, wetness, floods.	Slight	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
EhA*, EhB*:					
Enet	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Delmont	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
EkD Ethan	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey, large stones.	Severe: slope.	Poor. slope.
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.	Moderate: too clayey.	Slight	Fair: too clayey.
Bonilla	Severe: floods, percs slowly, wetness.	Moderate: seepage.	Severe: floods, wetness.	Severe: floods.	Fair: too clayey.
EoD*:					
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
Davis	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
EpD*:					
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
Talmo	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Fa Forney	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness, too clayey, floods.	Poor: wetness, too clayey.
Ga Grable	Severe: floods.	Severe: seepage.	Severe: seepage, floods.	Severe: floods, seepage.	Poor: too sandy, seepage.
Gb Graceville	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.

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
Ha------------------ Haynie	Severe: percs slowly.	Moderate: seepage, wetness.	Slight-----------	Slight-----------	Good.
Hb------------------ Haynie	Moderate: floods, wetness.	Moderate: seepage, wetness.	Moderate: floods.	Moderate: floods.	Good.
Ja------------------ James	Severe: floods, percs slowly, wetness.	Severe: floods.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.
La------------------ Lakeport	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Lb------------------ Lamo	Severe: percs slowly, wetness, floods.	Severe: floods.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: too clayey.
Lc, Ld-------------- Luton	Severe: percs slowly, wetness, floods.	Slight-----------	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
Oa------------------ Onawa	Severe: wetness, floods.	Severe: seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Fair: wetness.
Ob------------------ Owego	Severe: percs slowly, wetness, floods.	Slight-----------	Severe: wetness, too clayey floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
Pa. Pits, gravel					
Ra------------------ Redstoe Variant	Moderate: slope, percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey, hard to pack.
Rb, Rc-------------- Roxbury	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Good.
Sa------------------ Salix	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
Sb------------------ Salmo	Severe: percs slowly, floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
SdA----------------- Sarpy	Severe: floods.	Severe: seepage.	Severe: seepage, floods.	Severe: seepage, floods.	Poor: too sandy, seepage.
SeA*:					
Sarpy---------------	Severe: floods.	Severe: seepage.	Severe: seepage, floods.	Severe: seepage, floods.	Poor: too sandy, seepage.
Grable--------------	Severe: floods.	Severe: seepage.	Severe: seepage, floods.	Severe: floods, seepage.	Poor: too sandy, seepage.

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
TaE*:					
Talmo	Severe: slope.	Severe: slope, seepage.	Severe: seepage, slope.	Severe: slope, seepage.	Poor: slope, small stones.
Thurman	Severe: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage, slope.	Poor: slope, too sandy, seepage.
Tb: Tetonka	Severe: floods, percs slowly, wetness.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
TcC*:					
Thurman	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
Ethan	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
TdA: Trent	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
Wa: Waubonsie	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, too clayey, floods.	Severe: wetness, floods, seepage.	Poor: too clayey, wetness.
WbA: Wentworth	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
WcB*:					
Wentworth	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Trent	Severe: floods.	Moderate: slope, seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
Wd: Worthing	Severe: percs slowly, floods, wetness.	Slight	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: wetness, too clayey.
We: Worthing	Severe: floods, wetness, percs slowly.	Severe: wetness, floods.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: 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," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ba: Baltic	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Bb, Bc: Baltic	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
BdE*:				
Betts	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Gavins	Poor: slope, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer, area reclaim.
Be: Blake	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Bf: Blencoe	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Bg*:				
Blencoe	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Gayville	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess sodium, excess salt.
BhB*:				
Blendon	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
Thurman	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bk: Blyburg	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bm: Bon	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
BnA*:				
Bonilla	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Crossplain	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
BoE*:				
Boyd	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BoE*:				
Ethan	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Ca: Chancellor	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Cb: Clamo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Cc: Clamo Variant	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
CdA: Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
CeB*:				
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bonilla	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
ChA*:				
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Crossplain	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Stickney	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess salt, excess sodium.
CkA*:				
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Crossplain	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Tetonka	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
CoE*:				
Crofton	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Boyd	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.
CmE*:				
Crofton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Nora	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
DaB: Davis	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
DbB: Davis Variant	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
EaB*:				
Egan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Chancellor	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
EbB*, EbC*:				
Egan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Trent	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
EcA*, EcB*:				
Egan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Wentworth	Poor: low_strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
EdA*:				
Egan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Whitewood	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
EhA*, EhB*:				
Enet	Good	Good	Poor: excess fines.	Good.
Delmont	Good	Good	Good	Poor: small stones.
EkD: Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
EmE*:				
Ethan	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Betts	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
EnC*:				
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bonilla	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EoD*:				
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
Davis	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
EpD*:				
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
Talmo	Good	Good	Good	Poor: small stones, area reclaim.
Fa: Forney	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Ga: Grable	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
Gb: Graceville	Good	Fair: excess fines.	Fair: excess fines.	Fair: too clayey.
Ha: Haynie	Fair: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Hb: Haynie	Fair: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Ja: James	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess salt, wetness.
La: Lakeport	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Lb: Lamo	Poor: shrink-swell, frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Lc, Ld: Luton	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey.
Oa: Onawa	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Ob: Owego	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Pa. Pits, gravel				
Ra: Redstoe Variant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Rb, Rc: Roxbury	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Sa: Salix	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Sb: Salmo	Severe: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, excess salt.
SdA: Sarpy	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
SeA*:				
Sarpy	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Grable	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
TaE*:				
Talmo	Poor: slope.	Good	Good	Poor: slope, small stones, area reclaim.
Thurman	Fair: slope.	Fair: excess fines.	Unsuited: excess fines.	Poor: slope.
Tb: Tetonka	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
TcC*:				
Thurman	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
TdA: Trent	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Wa: Waubonsie	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
WbA: Wentworth	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
WcB*:				
Wentworth	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Trent	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Wd: Worthing	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
We: Worthing	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

* 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. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ba, Bb, Bc: Baltic	Favorable	Wetness, hard to pack.	Percs slowly, frost action, floods.	Percs slowly, slow intake, wetness.	Not needed	Wetness, percs slowly.
BdE*:						
Betts	Slope	Favorable	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
Gavins	Slope, seepage, depth to rock.	Thin layer	Not needed	Slope, rooting depth, erodes easily.	Slope, depth to rock, erodes easily.	Rooting depth, slope, erodes easily.
Be: Blake	Seepage	Wetness, piping.	Frost action	Wetness	Not needed	Favorable.
Bf: Blencoe	Seepage	Hard to pack, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Not needed	Wetness, percs slowly.
Bg*:						
Blencoe	Seepage	Hard to pack, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Not needed	Wetness, percs slowly.
Gayville	Seepage	Wetness, excess salt, piping.	Percs slowly, excess salt, excess sodium.	Wetness, percs slowly, excess sodium.	Not needed	Excess salt, excess sodium, erodes easily.
BhB*:						
Blendon	Seepage	Seepage, piping.	Not needed	Favorable	Too sandy	Favorable.
Thurman	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Too sandy, soil blowing.	Droughty.
Bk: Blyburg	Seepage	Piping	Not needed	Favorable	Not needed	Erodes easily.
Bm: Bon	Seepage	Piping	Not needed	Floods	Not needed	Favorable.
BnA*:						
Bonilla	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.
Crossplain	Favorable	Wetness	Percs slowly, frost action, floods.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
BoE*:						
Boyd	Slope, depth to rock.	Hard to pack, thin layer.	Not needed	Slow intake, percs slowly, rooting depth.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Ethan	Slope	Favorable	Not needed	Slope	Slope	Slope, erodes easily.
Ca: Chancellor	Favorable	Hard to pack, wetness.	Percs slowly, floods.	Wetness, percs slowly, floods.	Not needed	Favorable.
Cb: Clamo	Favorable	Wetness, hard to pack.	Percs slowly, frost action, floods.	Percs slowly, wetness.	Not needed	Wetness, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Cc: Clamo Variant	Seepage	Piping, wetness.	Floods, frost action.	Wetness, percs slowly.	Not needed	Wetness, percs slowly.
CdA: Clarno	Favorable	Favorable	Not needed	Favorable	Not needed	Erodes easily.
CeB*:						
Clarno	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Bonilla	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.
ChA*:						
Clarno	Favorable	Favorable	Not needed	Favorable	Not needed	Erodes easily.
Crossplain	Favorable	Wetness	Percs slowly, frost action, floods.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
Stickney	Favorable	Hard to pack, excess salt.	Not needed	Percs slowly, excess salt, excess sodium.	Not needed	Excess salt, excess sodium, erodes easily.
CkA*:						
Clarno	Favorable	Favorable	Not needed	Favorable	Not needed	Erodes easily.
Crossplain	Favorable	Wetness	Percs slowly, frost action, floods.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
Tetonka	Favorable	Wetness, hard to pack.	Percs slowly, floods, frost action.	Floods, percs slowly, wetness.	Not needed	Wetness, percs slowly.
CoE*:						
Crofton	Seepage, slope.	Favorable	Not needed	Erodes easily, slope.	Erodes easily, slope.	Slope, erodes easily.
Boyd	Slope, depth to rock.	Hard to pack, thin layer.	Not needed	Slow intake, percs slowly, rooting depth.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
CmE*:						
Crofton	Seepage, slope.	Favorable	Not needed	Erodes easily, slope.	Erodes easily, slope.	Slope, erodes easily.
Nora	Slope, seepage.	Favorable	Not needed	Slope	Slope, erodes easily.	Slope, erodes easily.
DaB: Davis	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
DbB: Davis Variant	Seepage	Seepage, piping.	Not needed	Floods	Too sandy	Favorable.
EaB*:						
Egan	Favorable	Hard to pack	Not needed	Percs slowly	Erodes easily	Erodes easily.
Chancellor	Favorable	Hard to pack, wetness.	Percs slowly, floods.	Wetness, percs slowly, floods.	Not needed	Favorable.
EbB*:						
Egan	Favorable	Hard to pack	Not needed	Percs slowly	Erodes easily	Erodes easily.
Ethan	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Trent	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
EbC*:						
Egan	Slope	Hard to pack	Not needed	Slope, percs slowly.	Erodes easily	Erodes easily.
Ethan	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
Trent	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.
EcA*:						
Egan	Favorable	Hard to pack	Not needed	Percs slowly	Not needed	Erodes easily.
Wentworth	Seepage	Favorable	Not needed	Favorable	Not needed	Erodes easily.
EcB*:						
Egan	Favorable	Hard to pack	Not needed	Percs slowly	Erodes easily	Erodes easily.
Wentworth	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
EdA*:						
Egan	Favorable	Hard to pack	Not needed	Percs slowly	Not needed	Erodes easily.
Whitewood	Favorable	Wetness, hard to pack.	Floods, frost action.	Wetness, floods.	Not needed	Wetness, erodes easily.
EhA*:						
Enet	Seepage	Seepage	Not needed	Favorable	Not needed	Favorable.
Delmont	Seepage	Seepage	Not needed	Droughty	Not needed	Droughty.
EhB*:						
Enet	Seepage	Seepage	Not needed	Favorable	Too sandy	Favorable.
Delmont	Seepage	Seepage	Not needed	Droughty	Too sandy	Droughty.
EkD Ethan	Slope	Large stones	Not needed	Slope, large stones.	Slope, large stones.	Slope, large stones.
EmE*:						
Ethan	Slope	Favorable	Not needed	Slope	Slope	Slope, erodes easily.
Betts	Slope	Favorable	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
EnC*:						
Ethan	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
Bonilla	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.
EoD*:						
Ethan	Slope	Favorable	Not needed	Slope	Slope	Slope, erodes easily.
Davis	Seepage, slope.	Favorable	Not needed	Slope	Slope	Slope.
EpD*:						
Ethan	Slope	Favorable	Not needed	Slope	Slope	Slope, erodes easily.
Talmo	Seepage, slope.	Seepage	Not needed	Droughty, slope.	Too sandy, slope.	Slope, droughty.
Fa Forney	Favorable	Wetness, hard to pack.	Percs slowly	Wetness, percs slowly.	Not needed	Wetness, percs slowly.
Ga Grable	Seepage	Piping	Not needed	Droughty, floods.	Not needed	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Gb: Graceville	Seepage	Seepage	Not needed	Favorable	Not needed	Favorable.
Ha, Hb: Haynie	Seepage	Thin layer	Not needed	Percs slowly	Not needed	Favorable.
Ja: James	Favorable	Hard to pack, wetness.	Percs slowly, frost action, excess salt.	Wetness, percs slowly.	Not needed	Excess salt, wetness, percs slowly.
La: Lakeport	Favorable	Hard to pack, wetness.	Frost action	Wetness	Not needed	Erodes easily.
Lb: Lamo	Favorable	Hard to pack, wetness.	Floods, frost action.	Floods, wetness.	Not needed	Favorable.
Lc, Ld: Luton	Favorable	Hard to pack, wetness.	Percs slowly, floods.	Wetness, slow intake, percs slowly.	Not needed	Wetness, percs slowly.
Oa: Onawa	Seepage	Wetness	Percs slowly, floods, frost action.	Percs slowly, wetness, floods.	Not needed	Erodes easily, percs slowlv.
Ob: Owego	Favorable	Wetness, hard to pack.	Percs slowly	Wetness, percs slowly, slow intake.	Not needed	Wetness.
Pa. Pits, gravel						
Ra: Redstoe Variant	Seepage, slope.	Hard to pack, piping.	Not needed	Slope	Favorable	Slope.
Rb, Rc: Roxbury	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.
Sa: Salix	Seepage	Favorable	Not needed	Favorable	Not needed	Erodes easily.
Sb: Salmo	Favorable	Wetness	Floods, excess salt, frost action.	Excess salt, floods, wetness.	Not needed	Excess salt, wetness.
SdA: Sarpy	Seepage	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Not needed	Droughty.
SeA*:						
Sarpy	Seepage	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Not needed	Droughty.
Grable	Seepage	Piping	Not needed	Droughty, floods.	Not needed	Favorable.
TaE*:						
Talmo	Seepage, slope.	Seepage	Not needed	Droughty, slope.	Too sandy, slope.	Slope, droughty.
Thurman	Slope, seepage.	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Slope, too sandy, soil blowing.	Droughty, slope.
Tb: Tetonka	Favorable	Wetness, hard to pack.	Percs slowly, floods, frost action.	Floods, percs slowly, wetness.	Not needed	Wetness, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
TcC*:						
Thurman	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Too sandy, soil blowing.	Droughty.
Ethan	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
TdA Trent	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.
Wa Waubonsie	Favorable	Wetness, hard to pack.	Frost action, percs slowly, floods.	Wetness, floods, soil blowing.	Not needed	Wetness.
WbA Wentworth	Seepage	Favorable	Not needed	Favorable	Not needed	Erodes easily.
WcB*:						
Wentworth	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
Trent	Seepage	Favorable	Not needed	Floods	Erodes easily	Erodes easily.
Wd Worthing	Favorable	Hard to pack, wetness.	Floods, frost action, percs slowly.	Floods, wetness, percs slowly.	Not needed	Wetness, percs slowly.
We Worthing	Favorable	Hard to pack, wetness.	Percs slowly, floods, frost action.	Wetness, percs slowly.	Not needed	Wetness, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ba----------------- Baltic	0-16	Clay loam--------	CL, ML	A-4, A-6	0	100	95-100	90-100	70-85	30-40	5-15
	16-36	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-70	20-40
	36-60	Silty clay, silty clay loam, clay loam.	CL, CH, MH	A-6, A-7	0	100	95-100	80-100	65-95	35-70	15-35
Bb, Bc------------- Baltic	0-24	Silty clay-------	CH, MH	A-7	0	100	100	90-100	85-100	50-65	20-35
	24-36	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-70	20-40
	36-60	Silty clay, silty clay loam, clay loam.	CL, CH, MH	A-6, A-7	0	100	95-100	80-100	65-95	35-70	15-35
BdE*: Betts--------------	0-3	Loam-------------	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
	3-32	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	32-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
Gavins------------	0-4	Silt loam--------	ML, MH	A-7	0	100	100	90-100	85-100	40-55	15-25
	4-16	Silt loam, silty clay, loam.	ML, MH	A-7	0	100	95-100	90-100	85-100	40-60	15-28
	16-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Be----------------- Blake	0-17	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	10-25
	17-53	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	90-100	85-100	30-45	5-20
	53-60	Loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	85-95	40-65	<25	NP-5
Bf----------------- Blencoe	0-21	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	30-50
	21-27	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	41-60	20-30
	27-60	Very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-85	30-40	5-15
Bg*: Blencoe-----------	0-21	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	30-50
	21-27	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	41-60	20-30
	27-60	Very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-85	30-40	5-15
Gayville----------	0-6	Silty clay loam	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	5-20
	6-14	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	12-25
	14-22	Silty clay loam	CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	8-20
	22-60	Very fine sandy loam, silt loam.	ML, CL-ML	A-4	0	100	100	95-100	70-85	<25	NP-7
BhB*: Blendon-----------	0-8	Loam-------------	ML, CL	A-4, A-6	0	100	100	85-100	60-75	25-40	3-15
	8-33	Fine sandy loam, sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	100	60-100	35-60	20-33	NP-10
	33-60	Fine sandy loam, loamy fine sand, loamy sand.	SM, SP-SM, SC, SM-SC	A-2, A-4	0	100	90-100	50-100	10-45	<30	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
BhB*:											
Thurman-----------	0-18	Fine sandy loam	SM	A-4	0	100	100	70-85	35-50	---	NP
	18-60	Loamy sand, fine sand, very fine sand.	SM, SP-SM	A-2, A-3	0	100	100	85-100	5-25	---	NP
Bk----------------- Blyburg	0-19	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	22-40	3-20
	19-60	Silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	50-90	22-35	3-12
Bm----------------- Bon	0-36	Loam------------	CL-ML, CL	A-4, A-6	0	100	95-100	80-95	60-85	25-40	5-15
	36-50	Stratified silt loam to fine sandy loam.	CL, ML	A-4, A-6	0	100	95-100	80-95	60-85	30-40	5-15
	50-60	Stratified silt loam to loamy sand.	CL-ML, ML, SM, SM-SC	A-4	0	95-100	95-100	75-95	35-75	<30	NP-7
BnA*:											
Bonilla-----------	0-7	Loam------------	CL-ML, CL	A-4, A-6	0	100	95-100	75-100	50-90	25-35	5-15
	7-40	Loam, clay loam	CL	A-6	0	100	95-100	85-100	60-90	30-40	10-20
	40-60	Loam, clay loam	CL	A-6	0-5	95-100	95-100	85-100	60-90	30-40	10-20
Crossplain---------	0-14	Clay loam-------	CL	A-4, A-6	0	100	100	90-100	70-80	30-40	9-19
	14-32	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-85	40-55	15-30
	32-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
BoE*:											
Boyd--------------	0-30	Silty clay------	CH, MH	A-7	0	100	95-100	95-100	90-100	65-90	30-55
	30-60	Weathered bedrock.	CH, MH	A-7	0	100	95-100	95-100	90-100	65-90	30-55
Ethan-------------	0-4	Loam------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	4-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	16-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Ca----------------- Chancellor	0-19	Silty clay loam	CL, CH, MH	A-6, A-7	0	100	100	95-100	85-95	35-55	15-25
	19-37	Silty clay, silty clay loam.	CL, CH, MH	A-7	0	100	100	95-100	85-100	40-60	15-30
	37-60	Silty clay loam, clay loam, loam.	CL, CH	A-6, A-7	0	100	100	85-95	70-85	35-55	15-25
Cb----------------- Clamo	0-7	Silty clay loam	CL, CH, MH	A-7	0	100	95-100	90-100	85-100	40-60	15-28
	7-60	Silty clay loam, silty clay.	CL, CH, MH	A-7	0	100	95-100	90-100	85-100	45-75	20-40
Cc----------------- Clamo Variant	0-16	Silty clay loam	CL, CH, MH	A-7	0	100	100	95-100	85-100	40-65	15-28
	16-26	Silty clay loam, silt loam.	CL, CH, MH	A-6, A-7	0	100	100	95-100	85-100	35-55	11-25
	26-60	Silt loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	90-100	75-100	30-40	5-15
CdA---------------- Clarno	0-11	Loam------------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	11-33	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	33-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CeB*:											
Clarno------------	0-11	Loam------------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	11-33	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	33-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Bonilla-----------	0-7	Loam------------	CL-ML, CL	A-4, A-6	0	100	95-100	75-100	50-90	25-35	5-15
	7-40	Loam, clay loam	CL	A-6	0	100	95-100	85-100	60-90	30-40	10-20
	40-60	Loam, clay loam	CL	A-6	0-5	95-100	95-100	85-100	60-90	30-40	10-20
ChA*:											
Clarno------------	0-11	Loam------------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	11-33	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	33-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Crossplain--------	0-14	Clay loam-------	CL	A-4, A-6	0	100	100	90-100	70-80	30-40	9-19
	14-32	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-85	40-55	15-30
	32-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
Stickney----------	0-10	Silt loam-------	CL	A-4, A-6	0	100	95-100	85-95	60-90	30-40	8-15
	10-26	Clay loam, silty clay loam, clay.	CL, CH, MH	A-6, A-7	0	100	95-100	85-100	65-95	35-60	14-35
	26-60	Clay loam, loam, silty clay loam.	CL, CH, MH, ML	A-6, A-7	0-5	95-100	90-100	80-100	55-90	35-55	10-30
CkA*:											
Clarno------------	0-11	Loam------------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	11-30	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	30-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Crossplain--------	0-14	Clay loam-------	CL	A-4, A-6	0	100	100	90-100	70-80	30-40	9-19
	14-32	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-85	40-55	15-30
	32-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
Tetonka-----------	0-17	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	27-40	5-15
	17-21	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	10-25
	21-48	Clay, silty clay, clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	65-100	40-70	15-35
	48-60	Clay loam, silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	100	95-100	80-100	55-95	30-60	11-30
CoE*:											
Crofton-----------	0-6	Silt loam-------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-22
	6-60	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	95-100	32-40	11-18
Boyd--------------	0-30	Silty clay------	CH, MH	A-7	0	100	95-100	95-100	90-100	65-90	30-55
	30-60	Weathered bedrock.	CH, MH	A-7	0	100	95-100	95-100	90-100	65-90	30-55
CmE*:											
Crofton-----------	0-6	Silt loam-------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-22
	6-60	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	95-100	32-40	11-18
Nora--------------	0-7	Silt loam-------	CL, CL-ML	A-4, A-6, A-7	0	100	100	95-100	85-100	28-45	6-23
	7-30	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	11-27
	30-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	95-100	85-100	27-45	6-24

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DaB----------------- Davis	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-85	25-40	5-20
	9-30	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-85	25-40	5-20
	30-60	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-20
DbB----------------- Davis Variant	0-12	Loam-------------	ML, CL	A-4, A-6	0	100	95-100	95-100	60-75	30-40	5-15
	12-30	Stratified gravelly sandy loam to very fine sandy loam.	SM, SC, ML, CL-ML	A-4	0	95-100	75-100	60-90	35-65	20-30	3-10
	30-60	Stratified gravelly loamy fine sand to loamy fine sand.	SM	A-2	0	95-100	70-100	55-90	15-35	<25	NP
EaB*:											
Egan---------------	0-7	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	7-28	Silty clay loam	CL, CH	A-6, A-7	0	100	100	90-100	80-100	35-55	15-35
	28-60	Clay loam, loam	CL, CH, ML	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-35
Chancellor---------	0-19	Silty clay loam	CL, CH, MH	A-6, A-7	0	100	100	95-100	85-95	35-55	15-25
	19-37	Silty clay, silty clay loam.	CL, CH, MH	A-7	0	100	100	95-100	85-100	40-60	15-30
	37-60	Silty clay loam, clay loam, loam.	CL, CH	A-6, A-7	0	100	100	85-95	70-85	35-55	15-25
EbB*:											
Egan---------------	0-7	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	7-28	Silty clay loam	CL, CH	A-6, A-7	0	100	100	90-100	80-100	35-55	15-35
	28-60	Clay loam, loam	CL, CH, ML	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-35
Ethan--------------	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	16-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Trent--------------	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	11-25
	13-34	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	11-25
	34-45	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-100	35-50	11-25
	45-60	Clay loam, loam	CL	A-6, A-7	<5	100	95-100	85-100	70-85	35-50	11-25
EbC*:											
Egan---------------	0-7	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	7-28	Silty clay loam	CL, CH	A-6, A-7	0	100	100	90-100	80-100	35-55	15-35
	28-60	Clay loam, loam	CL, CH, ML	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-35
Ethan--------------	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	16-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Trent--------------	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	11-25
	13-34	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	11-25
	34-45	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-100	35-50	11-25
	45-60	Clay loam, loam	CL	A-6, A-7	<5	100	95-100	85-100	70-85	35-50	11-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
EcA*, EcB*:											
Egan	0-7	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	7-28	Silty clay loam	CL, CH	A-6, A-7	0	100	100	90-100	80-100	35-55	15-35
	28-60	Clay loam, loam	CL, CH, ML	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-35
Wentworth	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	10-32	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
	32-60	Stratified silty clay loam to silt loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	60-100	30-50	5-25
EdA*:											
Egan	0-7	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	7-28	Silty clay loam	CL, CH	A-6, A-7	0	100	100	90-100	80-100	35-55	15-35
	28-60	Clay loam, loam	CL, CH, ML	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-35
Whitewood	0-19	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	80-95	35-55	15-30
	19-42	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	80-95	35-55	15-30
	42-60	Silty clay loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	90-100	75-95	35-55	15-30
EhA*, EhB*:											
Enet	0-8	Loam	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
	8-25	Loam, clay loam, sandy clay loam.	CL, ML, SC, CL-ML	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	25-34	Loam, fine sandy loam, sandy loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	85-95	60-95	40-75	20-40	5-15
	34-60	Sand and gravel	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0	60-90	45-70	10-60	0-15	<20	NP-5
Delmont	0-7	Loam	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	7-18	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
	18-60	Sand and gravel	SP, SM, GP, GM	A-1, A-2	0-5	60-100	40-70	15-50	0-30	<25	NP-5
EkD	0-4	Stony loam	CL, CL-ML	A-4, A-6	20-50	95-100	90-100	80-95	55-80	25-40	5-15
Ethan	4-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	8-20
	16-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-50	10-25
EmE*:											
Ethan	0-4	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	4-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	16-60	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	0-3	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
	3-32	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	32-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
EnC*:											
Ethan	0-8	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	16-60	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 PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
EnC*:											
Bonilla	0-7	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	75-100	50-90	25-35	5-15
	7-40	Loam, clay loam	CL	A-6	0	100	95-100	85-100	60-90	30-40	10-20
	40-60	Stratified clay loam to fine sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0-5	95-100	85-100	70-95	40-90	20-35	5-15
EoD*:											
Ethan	0-4	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	4-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	16-60	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	0-9	Loam	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-85	25-40	5-20
	9-30	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-85	25-40	5-20
	30-60	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-20
EpD*:											
Ethan	0-4	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	4-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	16-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Talmo	0-9	Loam, gravelly loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0-5	80-100	70-100	55-95	40-75	20-35	5-15
	9-60	Sand and gravel	GW, GM, SW, SM	A-1	0-5	40-95	30-65	15-35	0-15	<20	NP-5
Fa: Forney	0-16	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	41-60	20-35
	16-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
Ga: Grable	0-7	Silt loam	CL	A-4, A-6	0	100	100	80-95	50-75	25-40	8-20
	7-28	Silt loam, very fine sandy loam.	CL	A-4, A-6	0	100	100	80-95	50-75	25-40	8-20
	28-60	Fine sand, loamy sand, sand.	SM, SM-SC, SP-SM	A-2, A-3	0	100	100	65-80	5-35	<20	NP-5
Gb: Graceville	0-16	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	35-45	11-20
	16-45	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	8-20
	45-60	Sand and gravel	SM, GW-GM, SW-SM, GM	A-1, A-2	0	40-80	30-70	20-50	5-30	<25	NP-4
Ha: Haynie	0-9	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	9-53	Silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	53-60	Silty clay, silty clay, loam.	CL, CH	A-7	0	100	100	90-100	85-100	40-60	15-35
Hb: Haynie	0-16	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	16-60	Silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ja----------------- James	0-4	Silty clay loam	CL, CH, MH	A-7	0	100	100	90-100	85-100	40-65	15-30
	4-60	Silty clay, clay, silty clay loam.	CL, CH, MH	A-7	0	100	100	90-100	85-100	45-80	20-40
La----------------- Lakeport	0-19	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	41-60	20-35
	19-44	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-100	41-60	20-35
	44-60	Silt loam, loam, clay loam.	CL	A-6	0	100	100	90-100	85-95	25-40	11-20
Lb----------------- Lamo	0-16	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	85-95	40-65	14-35
	16-60	Silty clay loam, silt loam, silty clay.	CL, CH, ML, MH	A-7, A-6	0	100	100	95-100	85-95	35-60	10-35
Lc, Ld------------- Luton	0-16	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
	16-24	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
	24-60	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
Oa----------------- Onawa	0-7	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
	7-30	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
	30-60	Silt loam, loamy very fine sand, loam.	CL, CL-ML, SM	A-4, A-6	0	100	100	95-100	40-85	20-40	5-20
Ob----------------- Owego	0-16	Silty clay, silty clay loam	CH, CL, ML, MH	A-7	0	100	100	95-100	85-95	40-65	14-35
	16-36	Silt loam--------	CL, ML	A-4, A-6	0	100	100	95-100	90-100	30-40	5-15
	36-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	30-55
Pa. Pits, gravel											
Ra----------------- 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-6, A-7	0	100	100	95-100	85-100	40-55	10-20
Rb----------------- Roxbury	0-12	Loam-------------	CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-45	8-20
	12-42	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	96-100	80-98	30-50	8-25
	42-60	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-50	7-25
Rc----------------- Roxbury	0-12	Silt loam--------	CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-45	8-20
	12-42	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	96-100	80-98	30-50	8-25
	42-60	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-50	7-25
Sa----------------- Salix	0-16	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	41-60	20-35
	16-34	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-50	20-30
	34-60	Silt loam, loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	95-100	90-100	30-40	5-15
Sb----------------- Salmo	0-20	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	10-20
	20-34	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	10-20
	34-60	Silty clay loam, silty clay.	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-50	10-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
SdA----------------- Sarpy	0-9	Loamy fine sand	SM	A-2	0	100	100	60-80	15-35	---	NP
	9-60	Loamy fine sand, fine sand.	SM	A-2	0	100	100	60-80	15-35	---	NP
SeA*:											
Sarpy---------------	0-9	Loamy fine sand	SM	A-2	0	100	100	60-80	15-35	---	NP
	9-60	Loamy fine sand, fine sand.	SM	A-2	0	100	100	60-80	15-35	---	NP
Grable--------------	0-7	Silt loam--------	CL	A-4, A-6	0	100	100	80-95	50-75	25-40	8-20
	7-28	Silt loam, very fine sandy loam.	CL	A-4, A-6	0	100	100	80-95	50-75	25-40	8-20
	28-60	Fine sand, loamy sand, sand.	SM, SM-SC, SP-SM	A-2, A-3	0	100	100	65-80	5-35	<20	NP-5
TaE*:											
Talmo---------------	0-9	Loam-------------	CL, SC, SM-SC, CL-ML	A-4, A-6	0-5	80-100	70-100	55-95	40-75	20-35	5-15
	9-60	Sand and gravel	GW, GM, SW, SM	A-1	0-5	40-95	30-65	15-35	0-15	<20	NP-5
Thurman-------------	0-18	Fine sandy loam	SM, SP-SM	A-2, A-3	0	100	100	90-100	5-30	---	NP
	18-60	Loamy fine sand, fine sand, very fine sand.	SM, SP-SM	A-2, A-3	0	100	100	85-100	5-25	---	NP
Tb------------------ Tetonka	0-17	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	27-40	5-15
	17-21	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	10-25
	21-48	Clay, silty clay, clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	65-100	40-70	15-35
	48-60	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	95-100	80-100	55-95	30-60	11-30
TcC*:											
Thurman-------------	0-18	Fine sandy loam	SM, SP-SM	A-2, A-3	0	100	100	90-100	5-30	---	NP
	18-60	Loamy fine sand, fine sand, very fine sand.	SM, SP-SM	A-2, A-3	0	100	100	85-100	5-25	---	NP
Ethan---------------	0-4	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	4-16	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	16-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
TdA----------------- Trent	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	11-25
	13-34	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	11-25
	34-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-100	35-50	11-25
Wa------------------ Waubonsie	0-26	Very fine sandy loam.	SM, SC, SM-SC	A-4	0	100	100	80-90	36-50	15-25	2-10
	26-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
WbA----------------- Wentworth	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	10-32	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
	32-60	Stratified silty clay loam to silt loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	60-100	30-50	5-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WcB*:											
Wentworth----------	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	10-32	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
	32-60	Stratified silty clay loam to silt loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	60-100	30-50	5-25
Trent--------------	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	11-25
	13-34	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	11-25
	34-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-100	35-50	11-25
Wd------------------ Worthing	0-14	Silty clay loam	CL	A-7	0	100	100	95-100	85-95	42-50	17-22
	14-44	Silty clay, silty clay loam.	CH, MH	A-7	0	100	100	95-100	85-100	50-70	22-35
	44-60	Silty clay, silty clay loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	90-100	70-95	35-60	20-35
We------------------ Worthing	0-14	Silty clay loam	CL	A-7	0	100	100	95-100	85-95	40-50	15-25
	14-44	Silty clay, clay	CH	A-7	0	100	100	95-100	80-100	50-70	25-40
	44-60	Silty clay, silty clay loam, clay loam.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	70-95	40-65	15-30

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" 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 K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
Ba----------------- Baltic	0-16	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.28	5	4L
	16-36	0.06-0.2	0.11-0.18	7.4-8.4	2-4	High-------	0.28		
	36-60	0.06-0.6	0.08-0.17	7.4-8.4	2-4	High-------	0.28		
Bb, Bc------------- Baltic	0-24	0.06-0.2	0.13-0.18	7.4-8.4	<2	High-------	0.28	5	4
	24-36	0.06-0.2	0.11-0.18	7.4-8.4	2-4	High-------	0.28		
	36-60	0.06-0.6	0.08-0.17	7.4-8.4	2-4	High-------	0.28		
BdE*:									
Betts--------------	0-3	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	0.28	5	4L
	3-32	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37		
	32-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate	0.37		
Gavins-------------	0-4	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low--------	0.43	2	4L
	4-16	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low--------	0.43		
	16-60	---	---	---	---	-----------	---		
Be----------------- Blake	0-17	0.2-2.0	0.19-0.22	7.4-8.4	<2	Moderate	0.28	5	4L
	17-53	0.2-2.0	0.19-0.22	7.4-8.4	<2	Moderate	0.28		
	53-60	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low--------	0.17		
Bf----------------- Blencoe	0-21	<0.06	0.12-0.14	6.1-7.3	<2	High-------	0.28	5	4
	21-27	0.2-2.0	0.18-0.20	6.6-7.3	<2	High-------	0.43		
	27-60	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43		
Bg*:									
Blencoe------------	0-21	<0.06	0.12-0.14	6.1-7.3	<2	High-------	0.28	5	4
	21-27	0.2-2.0	0.18-0.20	6.6-7.3	<2	High-------	0.43		
	27-60	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43		
Gayville-----------	0-6	0.6-2.0	0.16-0.19	6.6-9.0	2-4	Moderate	0.28	3	7
	6-14	<0.06	0.10-0.16	7.9-9.0	4-16	High-------	0.28		
	14-22	0.2-0.6	0.14-0.16	7.9-9.5	4-16	High-------	0.28		
	22-60	0.2-2.0	0.15-0.17	7.9-9.5	4-16	Low--------	0.43		
BhB*:									
Blendon------------	0-8	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low--------	0.20	5	5
	8-33	0.6-6.0	0.11-0.18	6.1-7.3	<2	Low--------	0.20		
	33-60	2.0-20	0.08-0.15	6.6-8.4	<2	Low--------	0.20		
Thurman------------	0-18	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low--------	0.17	5	3
	18-60	6.0-20	0.06-0.11	6.1-7.3	<2	Low--------	0.17		
Bk----------------- Blyburg	0-19	0.6-2.0	0.21-0.24	6.6-8.4	<2	Low--------	0.32	5	5
	19-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43		
Bm----------------- Bon	0-36	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low--------	0.24	5	6
	36-50	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low--------	0.32		
	50-60	0.6-6.0	0.11-0.16	7.4-8.4	<2	Low--------	0.32		
BnA*:									
Bonilla------------	0-7	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low--------	0.24	5	6
	7-40	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24		
	40-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.43		
Crossplain---------	0-14	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	0.24	5	6
	14-32	0.06-0.6	0.11-0.17	6.1-7.3	<2	High-------	0.32		
	32-60	0.06-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	0.32		
BoE*:									
Boyd---------------	0-30	<0.2	0.08-0.14	6.6-8.4	<2	High-------	0.28	4	4
	30-60	<0.06	---	6.6-8.4	<2	High-------	0.28		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
BoE*:									
Ethan	0-4	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	4-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Ca	0-19	0.06-0.6	0.13-0.19	6.1-7.3	<2	High	0.28	5	7
Chancellor	19-37	0.06-0.2	0.11-0.19	6.1-7.3	<2	High	0.28		
	37-60	0.06-0.6	0.14-0.20	7.4-8.4	<2	High	0.28		
Cb	0-7	0.06-0.2	0.16-0.19	6.6-7.8	<2	High	0.28	5	7
Clamo	7-60	0.06-0.2	0.13-0.18	6.6-8.4	2-8	High	0.28		
Cc	0-16	0.06-0.2	0.14-0.18	6.6-7.8	<2	High	0.28	5	7
Clamo Variant	16-26	0.06-0.6	0.19-0.22	6.6-7.8	<2	Moderate	0.28		
	26-60	0.6-2.0	0.16-0.19	7.4-8.4	2-4	Low	0.28		
CdA	0-11	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6
Clarno	11-33	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	33-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
CeB*:									
Clarno	0-11	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6
	11-33	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	33-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Bonilla	0-7	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.24	5	6
	7-40	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24		
	40-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.43		
ChA*:									
Clarno	0-11	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6
	11-33	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	33-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Crossplain	0-14	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	0.24	5	6
	14-32	0.06-0.6	0.11-0.17	6.1-7.3	<2	High	0.32		
	32-60	0.06-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	0.32		
Stickney	0-10	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.37	3	6
	10-26	0.06-0.2	0.16-0.19	6.1-7.8	4-16	High	0.37		
	26-60	0.06-0.6	0.14-0.18	7.4-8.4	>4	High	0.37		
CkA*:									
Clarno	0-11	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6
	11-30	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37		
	30-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Crossplain	0-14	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	0.24	5	6
	14-32	0.06-0.6	0.11-0.17	6.1-7.3	<2	High	0.32		
	32-60	0.06-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	0.32		
Tetonka	0-17	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6
	17-21	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.32		
	21-48	<0.06	0.13-0.19	6.1-7.3	<2	High	0.32		
	48-60	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High	0.32		
CoE*:									
Crofton	0-6	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low	0.43	5	4L
	6-60	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.43		
Boyd	0-30	<0.2	0.08-0.14	6.6-8.4	<2	High	0.28	4	4
	30-60	<0.06	---	6.6-8.4	<2	High	0.28		
CmE*:									
Crofton	0-6	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low	0.43	5	4L
	6-60	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.43		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
CmE*:									
Nora------------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	6
	7-30	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	0.43		
	30-60	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
DaB-------------- Davis	0-9	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28	5	6
	9-30	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.28		
	30-60	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28		
DbB-------------- Davis Variant	0-12	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low--------	0.20	5	6
	12-30	2.0-6.0	0.12-0.15	6.6-7.8	<2	Low--------	0.20		
	30-60	2.0-20	0.09-0.13	7.4-8.4	<2	Low--------	0.20		
EaB*:									
Egan------------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7
	7-28	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
	28-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate	0.43		
Chancellor------	0-19	0.06-0.6	0.13-0.19	6.1-7.3	<2	High-------	0.28	5	7
	19-37	0.06-0.2	0.11-0.19	6.1-7.3	<2	High-------	0.28		
	37-60	0.06-0.6	0.14-0.20	7.4-8.4	<2	High-------	0.28		
EbB*:									
Egan------------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7
	7-28	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
	28-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate	0.43		
Ethan-----------	0-8	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	8-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Trent-----------	0-13	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.28	5	7
	13-34	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43		
	34-45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
	45-60	0.2-0.6	0.16-0.20	7.4-8.4	<2	Moderate	0.43		
EbC*:									
Egan------------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7
	7-28	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
	28-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate	0.43		
Ethan-----------	0-8	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	8-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Trent-----------	0-13	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.28	5	7
	13-34	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43		
	34-45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
	45-60	0.2-0.6	0.16-0.20	7.4-8.4	<2	Moderate	0.43		
EcA*, EcB*:									
Egan------------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7
	7-28	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
	28-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate	0.43		
Wentworth-------	0-10	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7
	10-32	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	0.43		
	32-60	0.6-2.0	0.17-0.20	7.4-8.4	2-8	Moderate	0.43		
EdA*:									
Egan------------	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7
	7-28	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
	28-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate	0.43		
Whitewood-------	0-19	0.2-2.0	0.19-0.22	6.1-7.8	<2	Moderate	0.28	5	7
	19-42	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.43		
	42-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	0.43		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
EhA*, EhB*:									
Enet-------------	0-8	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low--------	0.28	4	6
	8-25	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low--------	0.28		
	25-34	0.6-6.0	0.11-0.20	6.6-7.8	<2	Low--------	0.28		
	34-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low--------	0.10		
Delmont----------	0-7	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low--------	0.28	3	6
	7-18	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low--------	0.28		
	18-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low--------	0.10		
EkD--------------- Ethan	0-4	0.6-2.0	0.11-0.15	6.1-7.8	<2	Moderate	0.28	5	6
	4-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
EmE*:									
Ethan------------	0-4	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	4-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Betts------------	0-3	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	0.28	5	4L
	3-32	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37		
	32-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate	0.37		
EnC*:									
Ethan------------	0-8	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	8-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Bonilla----------	0-7	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low--------	0.24	5	6
	7-40	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24		
	40-60	0.2-2.0	0.12-0.18	7.4-8.4	2-8	Moderate	0.43		
EoD*:									
Ethan------------	0-4	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	4-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Davis------------	0-9	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28	5	6
	9-30	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.28		
	30-60	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28		
EpD*:									
Ethan------------	0-4	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	4-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
Talmo------------	0-9	0.6-2.0	0.11-0.20	6.6-7.8	<2	Low--------	0.20	2	6
	9-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low--------	0.10		
Fa---------------- Forney	0-16	<0.06	0.11-0.13	6.1-7.8	<2	High-------	0.28	5	4
	16-60	<0.06	0.11-0.13	6.1-7.8	<2	High-------	0.28		
Ga---------------- Grable	0-7	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low--------	0.32	4	4L
	7-28	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.43		
	28-60	>6.0	0.02-0.07	7.4-8.4	<2	Low--------	0.15		
Gb---------------- Graceville	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7
	16-45	0.6-2.0	0.17-0.22	6.1-7.8	<2	Moderate	0.32		
	45-60	6.0-20	0.03-0.06	6.1-7.8	<2	Low--------	0.10		
Ha---------------- Haynie	0-9	0.6-2.0	0.18-0.20	6.6-8.4	<2	Low--------	0.37	5	4L
	9-53	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.37		
	53-60	<0.2	0.08-0.12	7.4-8.4	<2	High-------	0.37		
Hb---------------- Haynie	0-16	0.6-2.0	0.14-0.19	6.6-7.8	<2	Moderate	0.37	5	4L
	16-60	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.37		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
Ja----------------- James	0-4	0.2-0.6	0.13-0.16	7.4-9.0	>2	High-------	0.28	5	4
	4-60	<0.2	0.09-0.14	7.4-9.0	>4	High-------	0.28		
La----------------- Lakeport	0-19	0.2-2.0	0.18-0.20	6.1-7.3	<2	High-------	0.28	5	4
	19-44	0.2-0.6	0.17-0.19	6.6-7.8	<2	High-------	0.28		
	44-60	0.6-2.0	0.17-0.19	7.4-8.4	<2	Moderate	0.43		
Lb----------------- Lamo	0-16	0.2-0.6	0.21-0.23	7.4-8.4	<2	High-------	0.20	5	7
	16-60	0.2-0.6	0.18-0.20	7.4-8.4	<2	High-------	0.28		
Lc, Ld------------- Luton	0-16	<0.06	0.12-0.14	6.6-7.8	<2	High-------	0.28	5	4
	16-24	<0.06	0.12-0.14	6.6-7.8	<2	High-------	0.28		
	24-60	<0.06	0.11-0.13	6.6-8.4	<2	High-------	0.28		
Oa----------------- Onawa	0-7	0.06-0.2	0.12-0.14	7.4-8.4	<2	High-------	0.32	5	4
	7-30	0.06-0.2	0.12-0.14	7.4-8.4	<2	High-------	0.32		
	30-60	0.6-6.0	0.20-0.22	7.4-8.4	<2	Moderate	0.43		
Ob----------------- Owego	0-16	<0.06	0.12-0.14	6.1-7.3	<2	High-------	0.32	5	4
	16-36	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.32		
	36-60	<0.06	0.11-0.13	7.4-8.4	<2	High-------	0.32		
Pa. Pits, gravel									
Ra----------------- Redstoe Variant	0-12	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low--------	0.28	4	4L
	12-60	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low--------	0.43		
Rb, Rc------------- Roxbury	0-12	0.6-2.0	0.22-0.24	6.6-8.4	<2	Moderate	0.32	5	4L
	12-42	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43		
	42-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43		
Sa----------------- Salix	0-16	0.6-2.0	0.21-0.23	6.6-7.8	<2	Moderate	0.28	5	6
	16-34	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43		
	34-60	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.43		
Sb----------------- Salmo	0-20	0.2-0.6	0.19-0.24	6.6-8.4	4-16	Moderate	0.28	5	7
	20-34	0.2-0.6	0.17-0.20	7.4-8.4	4-16	Moderate	0.28		
	34-60	0.2-0.6	0.11-0.20	7.4-8.4	4-16	Moderate	0.28		
SdA---------------- Sarpy	0-9	>6.0	0.05-0.09	6.6-8.4	<2	Low--------	0.15	5	1
	9-60	>6.0	0.05-0.09	7.4-8.4	<2	Low--------	0.15		
SeA*:									
Sarpy--------------	0-9	>6.0	0.05-0.09	6.6-8.4	<2	Low--------	0.15	5	1
	9-60	>6.0	0.05-0.09	7.4-8.4	<2	Low--------	0.15		
Grable-------------	0-7	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low--------	0.32	4	4L
	7-28	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.43		
	28-60	>6.0	0.02-0.07	7.4-8.4	<2	Low--------	0.15		
TaE*:									
Talmo--------------	0-9	0.6-2.0	0.11-0.20	6.6-7.8	<2	Low--------	0.20	2	6
	9-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low--------	0.10		
Thurman------------	0-18	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	18-60	6.0-20	0.06-0.11	6.1-7.3	<2	Low--------	0.17		
Tb----------------- Tetonka	0-17	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6
	17-21	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.32		
	21-48	<0.06	0.13-0.19	6.1-7.3	<2	High-------	0.32		
	48-60	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High-------	0.32		
TcC*:									
Thurman------------	0-18	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2
	18-60	6.0-20	0.06-0.11	6.1-7.3	<2	Low--------	0.17		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
TcC*:									
Ethan------------	0-4	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	5	6
	4-16	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37		
	16-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	0.37		
TdA---------------- Trent	0-13	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.28	5	7
	13-34	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43		
	34-60	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
Wa----------------- Waubonsie	0-26	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low--------	0.24	5	4L
	26-60	<0.2	0.11-0.13	7.4-8.4	<2	High-------	0.24		
WbA---------------- Wentworth	0-10	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7
	10-32	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	0.43		
	32-60	0.6-2.0	0.17-0.20	7.4-8.4	2-8	Moderate	0.43		
WcB*:									
Wentworth--------	0-10	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7
	10-32	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	0.43		
	32-60	0.6-2.0	0.17-0.20	7.4-8.4	2-8	Moderate	0.43		
Trent------------	0-13	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.28	5	7
	13-34	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43		
	34-60	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43		
Wd----------------- Worthing	0-14	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7
	14-44	0.06-0.2	0.13-0.18	6.1-7.3	<2	High-------	0.28		
	44-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High-------	0.28		
We----------------- Worthing	0-14	0.2-0.6	0.19-0.22	5.6-7.3	<2	High-------	0.28	5	7
	14-44	0.06-0.2	0.13-0.18	6.1-7.3	<2	High-------	0.28		
	44-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High-------	0.28		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ba, Bb Baltic	D	Common	Brief	Mar-Oct	0-5.0	Apparent	Jan-Dec	>60	---	High	High	Moderate.
Bc Baltic*	D	Frequent	Long	Nov-Jun	+1-5.0	Apparent	Jan-Dec	>60	---	High	High	Moderate.
BdE**:												
Betts	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Gavins	C	None	---	---	>6.0	---	---	10-20	Rippable	Moderate	Moderate	High.
Be Blake	B	Rare	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High	High	Low.
Bf Blencoe	D	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.
Bg**:												
Blencoe	D	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.
Gayville	D	Common	Brief	Mar-Oct	2.0-3.0	Apparent	Oct-Jun	>60	---	Moderate	High	Moderate.
BhB**:												
Blendon	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Thurman	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Bk Blyburg	B	Rare	---	---	>6.0	---	---	>60	---	High	Low	Low.
Bm Bon	B	Common	Brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Moderate	Low.
BnA**:												
Bonilla	B	Common	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	>60	---	Moderate	High	Moderate.
Crossplain	C/D	Common	Brief	Sep-Jun	1.0-4.0	Perched	Sep-Jun	>60	---	High	High	Moderate.
BoE**:												
Boyd	D	None	---	---	>6.0	---	---	20-40	Rippable	Low	High	Moderate.
Ethan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Ca Chancellor	C	Frequent	Brief	Sep-Jun	1.5-3.0	Perched	Sep-Jun	>60	---	---	High	Moderate.
Cb Clamo	C/D	Common	Long	Mar-Oct	0-3.0	Apparent	Oct-Jun	>60	---	High	High	High.
Cc Clamo Variant	C/D	Frequent	Long	Mar-Oct	0-1.0	Apparent	Oct-Jun	>60	---	High	High	Moderate.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
CdA----------------- Clarno	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Moderate.
CeB**:												
Clarno------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Moderate.
Bonilla-----------	B	Common-------	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	>60	---	Moderate	High------	Moderate.
ChA**:												
Clarno------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Moderate.
Crossplain--------	C/D	Common-------	Brief------	Sep-Jun	1.0-4.0	Perched	Sep-Jun	>60	---	High------	High------	Moderate.
Stickney----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	High.
CkA**:												
Clarno------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Moderate.
Crossplain--------	C/D	Common-------	Brief------	Sep-Jun	1.0-4.0	Perched	Sep-Jun	>60	---	High------	High------	Moderate.
Tetonka*----------	C/D	Common-------	Very long	Jan-Dec	+1-1.0	Perched	Jan-Dec	>60	---	High------	High------	Moderate.
CoE**:												
Crofton-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Boyd--------------	D	None---------	---	---	>6.0	---	---	20-40	Rippable	Low-------	High------	Moderate.
CmE**:												
Crofton-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Nora--------------	B	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate	Low.
DaB----------------- Davis	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
DbB----------------- Davis Variant	B	Frequent-----	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	High------	Low.
EaB**:												
Egan--------------	B	None---------	---	---	>6.0	---	---	>60	---	High------	High------	Moderate.
Chancellor--------	C	Frequent-----	Brief------	Sep-Jun	1.5-3.0	Perched	Sep-Jun	>60	---	---	High------	Moderate.
EbB**, EbC**:												
Egan--------------	B	None---------	---	---	>6.0	---	---	>60	---	High------	High------	Moderate.
Ethan-------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Trent-------------	B	Rare to common.	Very brief	Apr-Oct	4.0-6.0	Perched	Oct-Jun	>60	---	High------	High------	Moderate.
EcA**, EcB**:												
Egan--------------	B	None---------	---	---	>6.0	---	---	>60	---	High------	High------	Moderate.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
EcA**, EcB**:												
Wentworth	B	None	---	---	>6.0	---	---	>60	---	High	High	Low.
EdA**:												
Egan	B	None	---	---	>6.0	---	---	>60	---	High	High	Moderate.
Whitewood	C/D	Common	Very brief	Sep-Jun	0-2.0	Perched	Sep-Jun	>60	---	High	High	Low.
EhA**, EhB**:												
Enet	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Delmont	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
EkD: Ethan	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
EmE**:												
Ethan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Betts	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
EnC**:												
Ethan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Bonilla	B	Common	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	>60	---	Moderate	High	Moderate.
EoD**:												
Ethan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Davis	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
EpD**:												
Ethan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Talmo	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Fa: Forney	D	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	Moderate	High	Low.
Ga: Grable	B	Common	Very brief	Mar-Jun	>6.0	---	---	>60	---	Low	Low	Low.
Gb: Graceville	B	Rare	---	---	>6.0	---	---	>60	---	High	Moderate	Low.
Ha, Hb: Haynie	B	Rare to none	---	---	4.0-6.0	Perched	Oct-Jun	>60	---	High	Low	Low.
Ja: James	D	Frequent	Long	Mar-Oct	0-1.0	Apparent	Oct-Jun	>60	---	High	High	High.
La: Lakeport	B	Rare	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High	High	Low.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Lb Lamo	C	Occasional	Brief	Mar-Aug	2.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.
Lc, Ld Luton	D	Common	Brief	Mar-Jun	0-1.0	Apparent	Nov-May	>60	---	Moderate	High	Low.
Oa Onawa	D	Common	Brief	Mar-Jun	2.0-4.0	Apparent	Nov-May	>60	---	High	High	Low.
Ob Owego	D	Common	Brief	Mar-Jun	1.0-3.0	Apparent	Nov-May	>60	---	Moderate	High	Low.
Pa. Pits, gravel												
Ra Redstoe Variant	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Rb, Rc Roxbury	B	Common	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low	Low.
Sa Salix	B	Rare	---	---	3.0-5.0	Apparent	Nov-May	>60	---	High	Moderate	Low.
Sb Salmo	C/D	Common	Brief	Mar-Oct	0-2.5	Apparent	Sep-Jun	>60	---	High	High	High.
SdA Sarpy	A	Frequent	Brief to long.	Nov-Jun	>6.0	---	---	>60	---	Low	Low	Low.
SeA**: Sarpy	A	Frequent	Brief to long.	Nov-Jun	>6.0	---	---	>60	---	Low	Low	Low.
Grable	B	Common	Very brief	Mar-Jun	>6.0	---	---	>60	---	Low	Low	Low.
TaE**: Talmo	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Thurman	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Tb Tetonka*	C/D	Common	Very long	Jan-Dec	+1-1.0	Perched	Jan-Dec	>60	---	High	High	Moderate.
TcC**: Thurman	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Ethan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
TdA Trent	B	Rare to common.	Very brief	Apr-Oct	4.0-6.0	Perched	Oct-Jun	>60	---	High	High	Moderate.
Wa Waubonsie	B	Common	Very brief	Mar-Jun	1.0-3.0	Apparent	Nov-Jun	>60	---	High	High	Low.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
WbA----------------- Wentworth	B	None----------	---	---	>6.0	---	---	>60	---	High------	High------	Low.
WcB**:												
Wentworth----------	B	None----------	---	---	>6.0	---	---	>60	---	High------	High------	Low.
Trent--------------	B	Rare to common.	Very brief	Apr-Oct	4.0-6.0	Perched	Oct-Jun	>60	---	High------	High------	Moderate.
Wd------------------ Worthing	D	Common-------	Very long	Jan-Dec	0-1.0	Perched	Jan-Dec	>60	---	High------	High------	Moderate.
We------------------ Worthing*	D	Frequent-----	Very long	Jan-Dec	+3-0.5	Perched	Jan-Dec	>60	---	High------	High------	High.

* A plus sign preceding the range in depth to the water table indicates that the water table can be the specified number of feet above the surface. It applies only to the first number in the range.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Baltic	Fine, montmorillonitic (calcareous), mesic Cumulic Haplaquolls
Betts	Fine-loamy, mixed (calcareous), mesic Typic Ustorthents
*Blake	Fine-silty, mixed (calcareous), mesic Aquic Udifluvents
*Blencoe	Clayey over loamy, montmorillonitic, mesic Aquic Hapludolls
Blendon	Coarse-loamy, mixed, mesic Pachic Haplustolls
Blyburg	Coarse-silty, mixed, mesic Fluventic Hapludolls
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
Clamo	Fine, montmorillonitic, mesic Cumulic Haplaquolls
Clamo Variant	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
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
Davis Variant	Coarse-loamy, mixed, (calcareous), mesic Mollic Ustifluvents
Delmont	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplustolls
Egan	Fine-silty, mixed, mesic Udic Haplustolls
Enet	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Ethan	Fine-loamy, mixed, mesic Entic Haplustolls
*Forney	Fine, montmorillonitic, nonacid, mesic Vertic Fluvaquents
Gavins	Loamy, carbonatic, mesic, shallow Typic Ustorthents
Gayville	Fine, montmorillonitic, mesic Leptic Natrustolls
Grable	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), mesic Mollic Udifluvents
Graceville	Fine-silty, mixed, mesic Pachic Haplustolls
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
James	Fine, montmorillonitic (calcareous), mesic Cumulic Haplaquolls
*Lakeport	Fine, montmorillonitic, mesic Aquic Hapludolls
Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Luton	Fine, montmorillonitic, mesic Vertic Haplaquolls
Nora	Fine-silty, mixed, mesic Udic Haplustolls
Onawa	Clayey over loamy, montmorillonitic (calcareous), mesic Mollic Fluvaquents
*Owego	Fine, montmorillonitic, nonacid, mesic Mollic Fluvaquents
Redstoe Variant	Fine-silty, mixed, mesic Typic Calciustolls
Roxbury	Fine-silty, mixed, mesic Cumulic Haplustolls
*Salix	Fine-silty, mixed, mesic Typic Hapludolls
Salmo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Sarpy	Mixed, mesic Typic Udipsamments
*Stickney	Fine, montmorillonitic, mesic Glossic Natrustolls
Talmo	Sandy-skeletal, mixed, mesic Udorthentic Haplustolls
Tetonka	Fine, montmorillonitic, mesic Argiaquic Argialbolls
*Thurman	Sandy, mixed, mesic Udorthentic Haplustolls
Trent	Fine-silty, mixed, mesic Pachic Haplustolls
Waubonsie	Coarse-loamy over clayey, mixed (calcareous), mesic Aquic Udifluvents
Wentworth	Fine-silty, mixed, mesic Udic Haplustolls
*Whitewood	Fine-silty, mixed, mesic Cumulic Haplaquolls
Worthing	Fine, montmorillonitic, mesic Typic Argiaquolls

☆ U.S. GOVERNMENT PRINTING OFFICE : 1979 O - 290-040

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.