United States Department of Agriculture

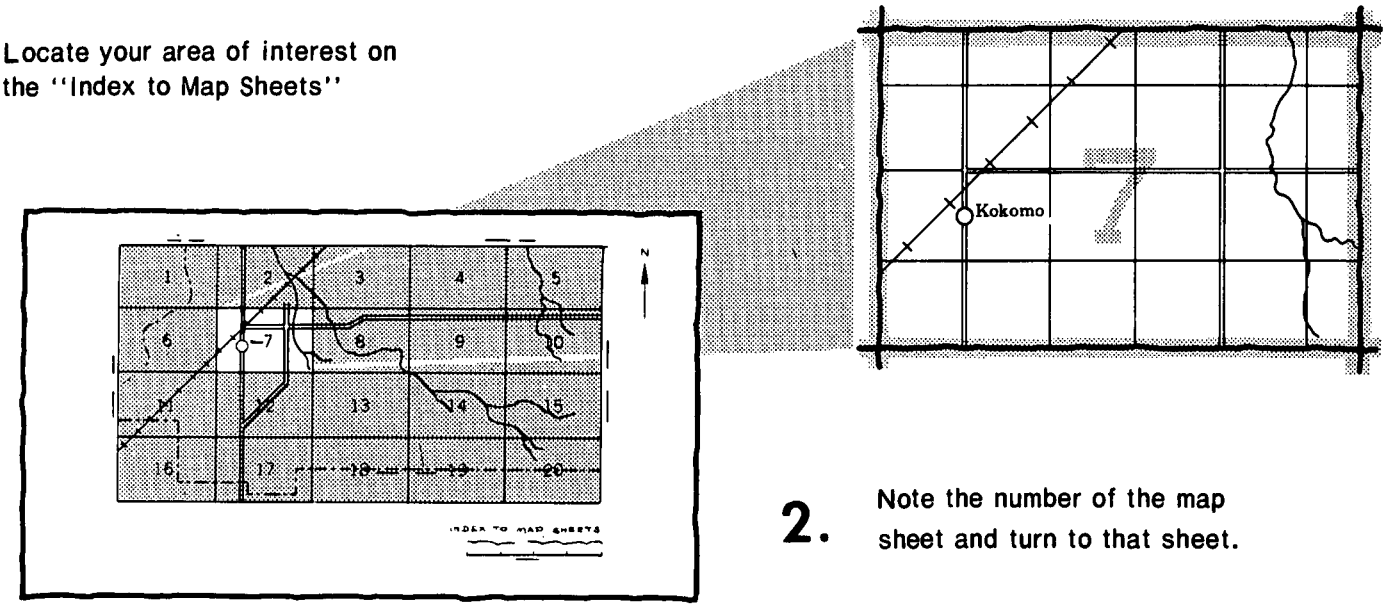
Soil Conservation Service

In cooperation with South Dakota Agricultural Experiment Station

Soil Survey of Miner County, South Dakota

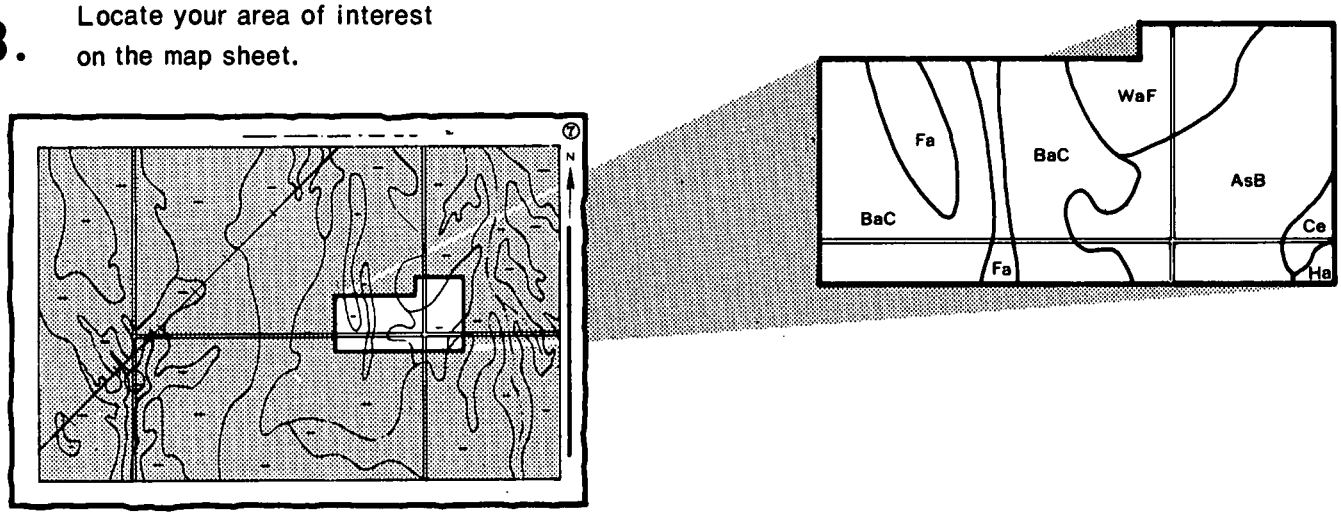
HOW TO USE

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

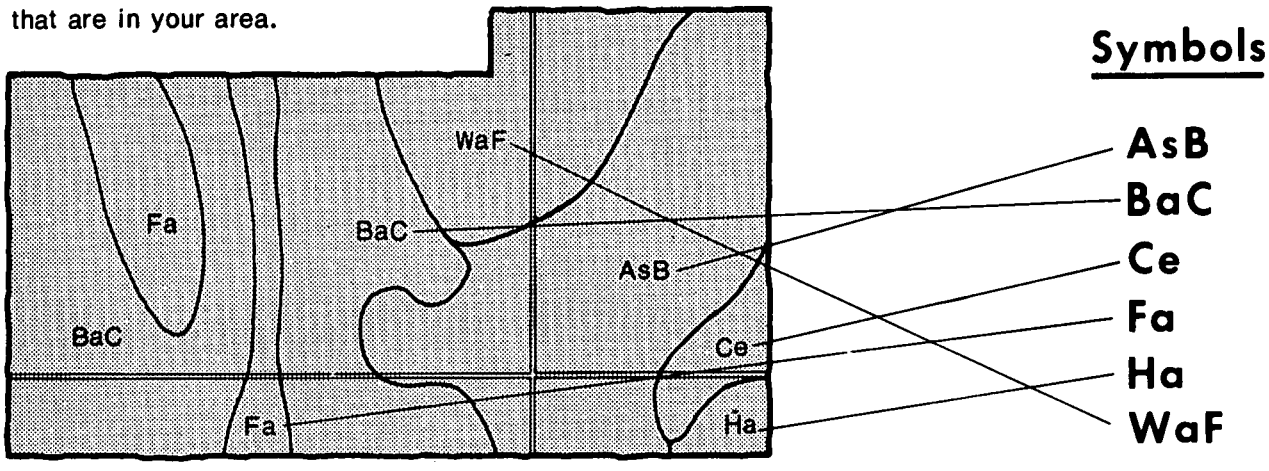


2. Note the number of the map sheet and turn to that sheet.

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

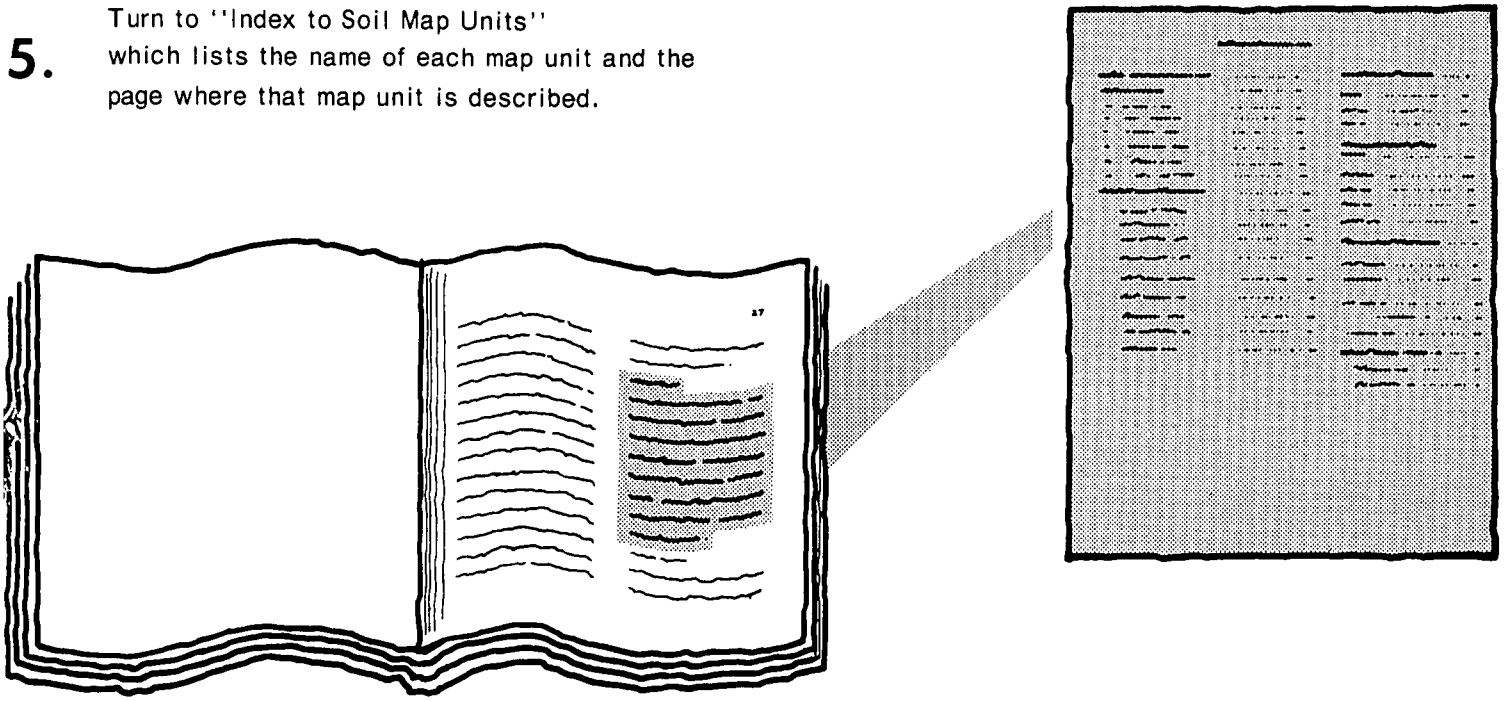


4. List the map unit symbols that are in your area.

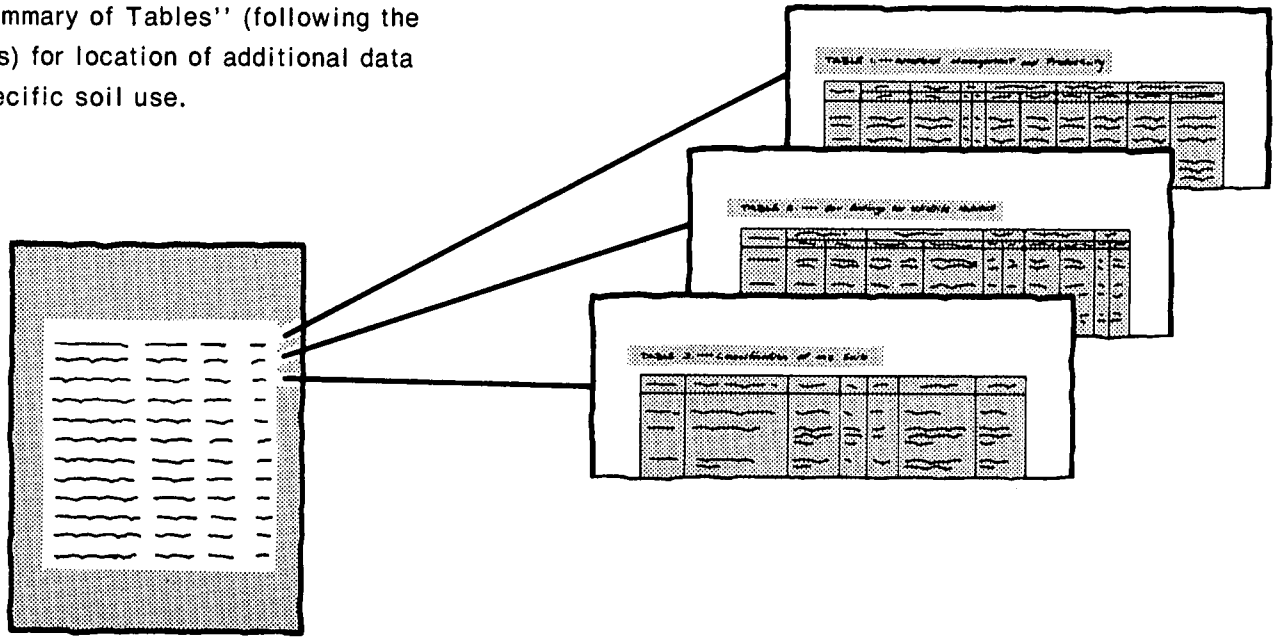


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1982. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. 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 Miner County Conservation District. Some financial assistance was furnished by the South Dakota Department of Revenue and the Miner County Commissioners.

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

Cover: Harvesting corn for silage in an area of Clarno-Bonilla loams, 0 to 3 percent slopes. The Clarno soil is on the higher parts of the landscape, and the Bonilla soil is in the swales.

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Soil Series

Issued December 1984

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Summary of Tables

Foreword

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

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

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

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

R. D. Swenson
State Conservationist
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Soil Survey of
Miner County, South Dakota

By Jerald L. Alexander, Soil Conservation Service

Soils surveyed by Jerald L. Alexander, Robert D. Nielsen,
and Scott W. Anderson, Soil Conservation Service

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

MINER COUNTY is in the east-central part of South Dakota (fig. 1). It has a total of 366,099 acres, which includes about 1,408 acres of water. Howard is the county seat. Other towns and communities are Canova, Carthage, Epiphany, Fedora, Roswell, and Vilas. Only a few buildings and foundations mark the former village of Argonne.

About 73 percent of the acreage in the county is cropland, and 26 percent supports native grasses (*3*). Alfalfa, corn, oats, spring wheat, and barley are the main crops. Grain sorghum, rye, and sunflowers also are grown. Farming is diversified. Livestock and livestock products are the main source of income, but income from cash crops also is important.

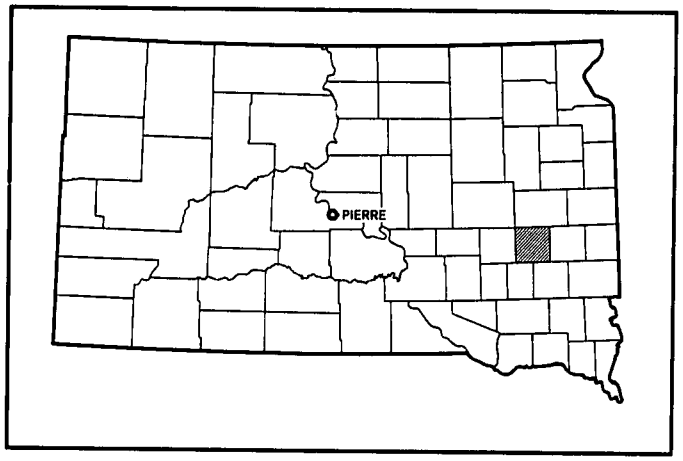

Figure 1.—Location of Miner County in South Dakota.

General Nature of the County

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

Climate

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

Miner County is usually quite warm in summer. Hot spells frequently occur, and cool days occasionally occur. The county is very cold in winter, when arctic air frequently surges over the area. Most precipitation falls during the warm period, and rainfall is heaviest late in spring and early in summer. Snowfall is normally not too heavy, and it is blown into drifts, so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Howard, South Dakota, in the period 1951 to 1979. 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 17 degrees F, and the average daily minimum temperature is 7 degrees. The lowest temperature on record, which occurred at Howard on January 29, 1966, is -35 degrees. In summer the average temperature is 72 degrees, and

the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred at Howard on July 10, 1966, is 109 degrees.

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

The total annual precipitation is 21.32 inches. Of this, about 16 inches, or 75 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14 inches. The heaviest 1-day rainfall during the period of record was 2.71 inches at Howard on June 15, 1967. Thunderstorms occur on about 44 days each year, and most occur in summer. Hail falls in scattered small areas during some of these storms.

The average seasonal snowfall is nearly 28 inches. The greatest snow depth at any one time during the period of record was 27 inches. On an average of 24 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each winter.

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

Physiography, Relief, and Drainage

Miner County is almost entirely on the James River Lowland, except for a small part of the northeast corner, which lies on the Coteau des Prairies (*4*). The county is characterized by a nearly level to undulating landscape in all areas, except for those near drainageways.

The western part of the county is drained by Redstone, Rock, and Wolf Creeks, which flow into the James River. The eastern part is drained by the West Fork of the Vermillion River, the Little Vermillion River, and the East Fork of the Vermillion River. These streams carry only a little water in all periods, except for the spring and just after heavy rainfall.

Land elevation ranges from 1,315 feet above sea level in the southwestern part of the county to about 1,780 feet in the northeastern part.

Settlement

Miner County was named after Ephraim Miner, an early territorial legislator. It was established by the Territorial Legislature in 1868. The original county included Sanborn County and the northern half of the present Miner County. After a reorganization in 1880, it included all of the present Miner and Sanborn Counties. The present boundaries were established in 1883 (*5*).

The first homesteaders arrived in 1879. Settlement increased rapidly after the extension of railroads into the county. Howard was selected as the county seat in 1882. The population of the county was 5,165 by 1890 and peaked at 8,560 in 1920. It declined to 3,739 by 1980. Howard, the largest town, has a population of 1,169.

Railroads served the county from 1881 to the late 1970's. South Dakota Highways 34 and 35 and U.S. Highway 81 are the main highways. Most rural areas are served by all-weather roads, which carry traffic to centers of trade.

Farming

Farming is the principal enterprise in Miner County. About 90 percent of the farm income is derived from the sale of livestock and livestock products (*10*). Many of the crops are used as feed for livestock.

In 1978, there were 546 farms in the county. The farms average about 599 acres in size. The trend is toward fewer and larger farms.

About 73 percent of the acreage is used for cultivated crops or for tame pasture and hay, and about 26 percent is range (*3*). Dryland farming is dominant. The main cropping system is row crops and small grain grown in rotation with legumes. Corn, oats, spring wheat, and barley are the main crops. Alfalfa, intermediate wheatgrass, and smooth bromegrass are the main crops grown for hay. According to the South Dakota Crop and Livestock Reporting Service, corn was grown on 62,000 acres in 1980, oats on 48,000 acres, wheat on 18,500 acres, barley on 12,000 acres, sunflowers on 5,300 acres, sorghum on 2,400 acres, and rye on 1,500 acres.

Natural Resources

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

The principal source of water for domestic use and for livestock is shallow wells. Dugouts in areas of Baltic, Hoven, Tetonka, and Worthing soils provide additional water for livestock and wildlife. The water for shallow wells is in glacial till deposits at a depth of about 15 to 200 feet. Deep wells are an additional source of water. The water for these wells is in sandstone at a depth of 225 to 630 feet. Water quantity generally is greater and quality poorer in the deep wells.

Whitetail deer and upland game birds, such as ring-necked pheasant and gray partridge, are the chief wildlife resources in the county. The potholes and wetlands provide wildlife production areas.

The deposits of sand and gravel in the county are mainly along the West Fork of the Vermillion River. Because of an excessive amount of fine rock fragments, such as shale, chalk, and clay ironstone, the sand and gravel are unsuitable as concrete aggregate or as construction material. They are suitable, however, as subgrade material for roads and as bituminous aggregate.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; and the kinds of crops and native plants growing on the soils. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if

ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

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

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

General Soil Map Units

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

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

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

The associations on the general soil map of the county are described on the pages that follow. The names of the associations do not coincide exactly with those on the general soil maps in the published surveys of Hanson, Lake, McCook, and Sanborn Counties, which are adjacent to this county. Differences are the result of variations in the design and composition of map units or changes and refinements in series concepts.

Soil Descriptions

1. Egan-Huntimer-Trent association

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

This association is on glacial till plains characterized by smooth slopes, swales, and a few scattered depressions. Slopes generally are short. They mainly are gently undulating and undulating, but some areas are nearly level. In most areas the drainage pattern is poorly defined, but it is well defined along the larger drainageways.

This association makes up about 1 percent of the county. It is about 40 percent Egan soils, 30 percent Huntimer soils, 20 percent Trent soils, and 10 percent minor soils (fig. 2).

The well drained Egan soils are in convex areas. Slopes range from 1 to 7 percent. Typically, the surface soil is dark gray silty clay loam. The subsoil is brown and pale brown silty clay loam. It is calcareous in the lower part. The underlying material is pale brown and light brownish gray, calcareous silty clay loam and clay loam.

The well drained Huntimer soils are in smooth areas. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark gray silty clay loam. The subsoil is grayish brown and brown silty clay and pale yellow, calcareous silty clay loam. The underlying material is light gray, mottled, calcareous silty clay loam.

The moderately well drained Trent soils are in swales. Slopes range from 1 to 4 percent. Typically, the surface soil is dark gray silty clay loam. The subsoil is dark grayish brown and light yellowish brown silty clay loam and silt loam. It is calcareous in the lower part. The underlying material is light yellowish brown, pale brown, and very pale brown, mottled, calcareous silt loam.

Minor in this association are the somewhat poorly drained Chancellor soils in drainageways, the loamy Clarno and Ethan soils on the steeper parts of the landscape, and the poorly drained Tetonka and Worthing soils in depressions.

About 95 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. Conserving moisture and controlling erosion are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and openland wildlife habitat.

2. Arlo-Baltic association

Poorly drained, nearly level and level, loamy and silty soils on flood plains

This association is on flood plains that are dissected by meandering channels. It makes up about 1 percent of the county. It is about 60 percent Arlo soils, 30 percent Baltic soils, and 10 percent minor soils (see fig. 2).

Arlo soils are on the high parts of the flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray clay loam. Below this is a transitional layer of gray and dark gray clay loam. The upper part of the underlying material is light brownish gray clay loam. The lower part is stratified loamy sand, gravelly sand, and loamy fine sand. The soil is calcareous throughout.

Baltic soils are on the low parts of the flood plains. Slopes are less than 1 percent. Typically, the surface layer is dark gray silty clay loam. The subsoil is dark gray silty clay. The underlying material is gray, mottled silty

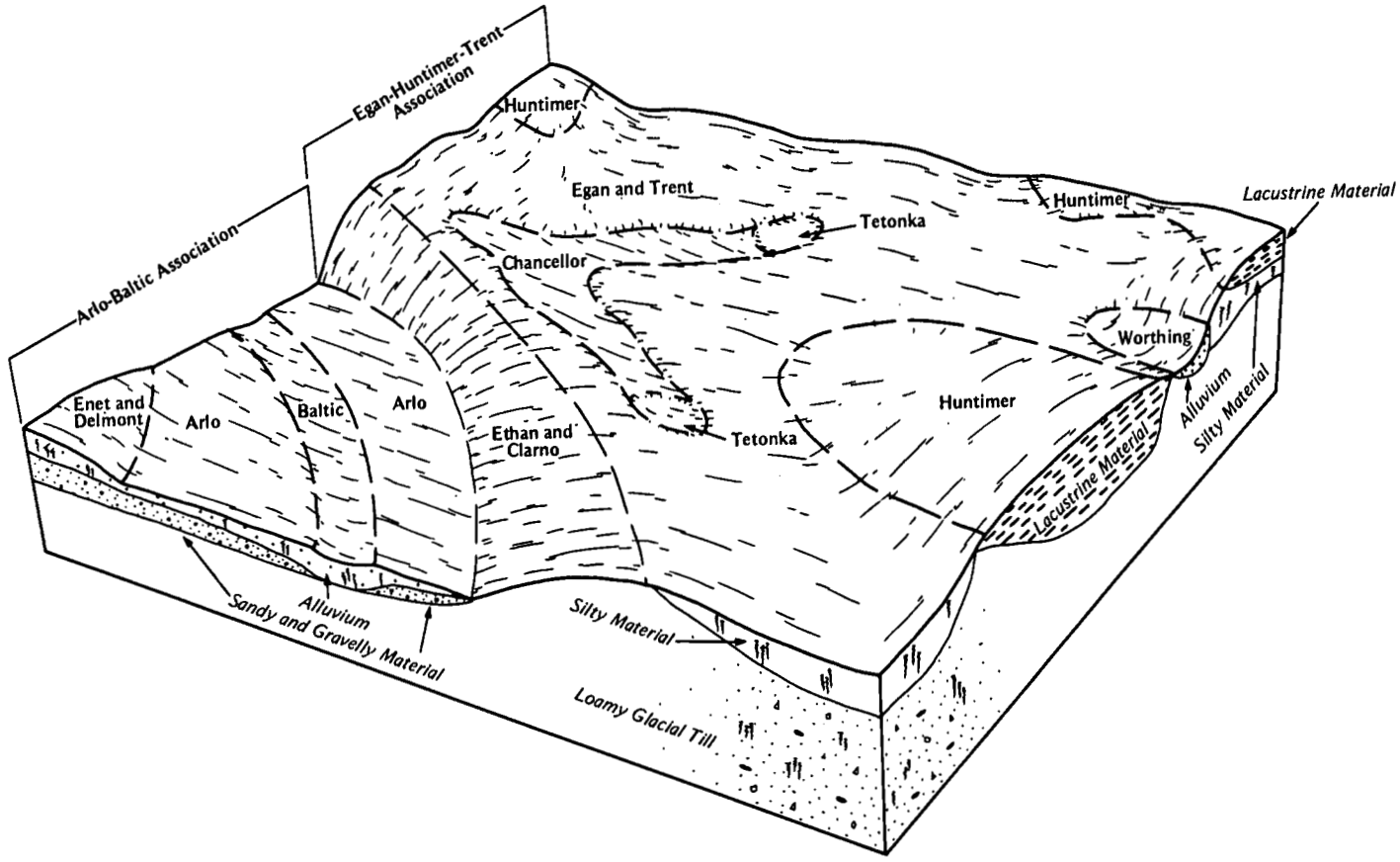

Figure 2.—Pattern of soils and parent material in the Egan-Huntimer-Trent and Arlo-Baltic associations.

clay and silty clay loam. The soil is calcareous throughout.

Minor in this association are the well drained Enet and somewhat excessively drained Delmont soils on terraces and the somewhat poorly drained Lamo soils in positions on the landscape similar to those of the Arlo soils.

About 60 percent of this association is cropland. Some areas support native grasses and are used for grazing or wildlife habitat. Corn, small grain, and alfalfa are the main crops. Controlling wetness is the main concern in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and openland and rangeland wildlife habitat.

3. Bon-Clarno association

Well drained, nearly level to strongly sloping, loamy soils on flood plains and uplands

This association is on flood plains and valley sides along the deeper drainageways. In many areas the nearly level, smooth slopes on the flood plains are broken by drainage channels and meander scars. The slopes on the valley sides mainly are gently sloping and moderately sloping, but in some areas they are strongly sloping. They are short and convex.

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

Bon soils are on flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark grayish brown loam. The subsurface layer is dark grayish brown, brown, and very dark gray loam and silt loam. It is calcareous in the lower part. The underlying material is pale brown and grayish brown, calcareous loam.

Clarno soils are on valley sides. In this association they generally have a slope of 2 to 15 percent. Typically, the surface layer is very dark grayish brown loam. The subsoil is dark grayish brown, brown, and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown and light brownish gray, mottled, calcareous clay loam.

Minor in this association are the moderately well drained Bonilla soils in upland swales; the poorly drained

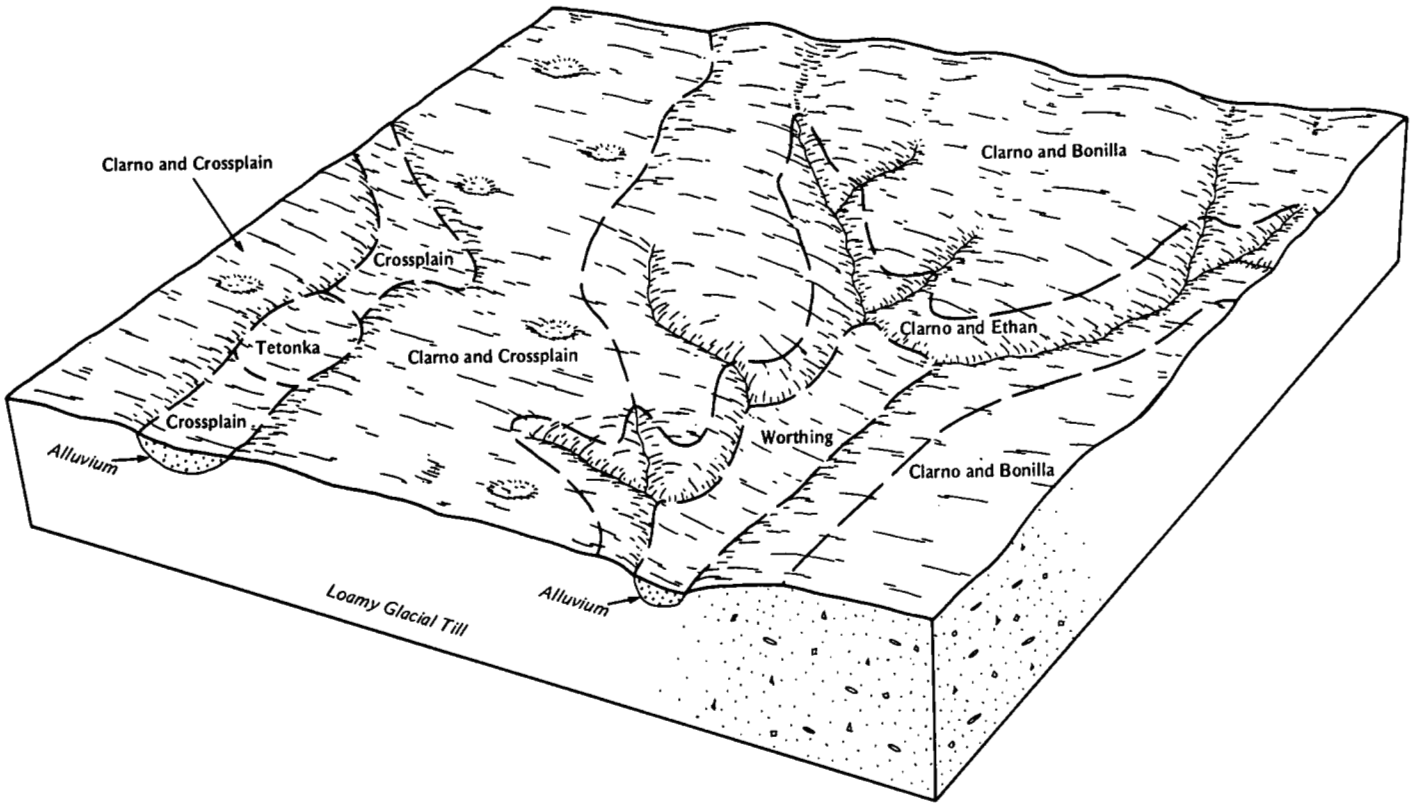

Figure 3.—Pattern of soils and parent material in the Clarno-Bonilla-Crossplain association.

Clamo and Lamo soils, which are slightly lower on the flood plains than the Bon soils; Davis soils, which are deeper to free carbonates than the major soils and are on foot slopes and fans; and the calcareous Ethan soils on the steeper side slopes.

About 80 percent of this association is range. Some areas are used as cropland. Small grain and alfalfa are the main crops. They are grown mainly on the larger tracts of the Bon soils. Conserving moisture and controlling erosion are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and rangeland wildlife habitat. The slope of the Clarno soils is a limitation. Trees and shrubs near the channels in some areas of the Bon soils provide excellent cover for wildlife and livestock.

4. Clarno-Bonilla-Crossplain association

Well drained to somewhat poorly drained, nearly level to moderately sloping, loamy soils on uplands and in upland swales and drainageways

This association is on glacial till plains characterized by rises interrupted by swales and shallow drainageways. Slopes generally are short. They mainly are nearly level to undulating but are moderately sloping along the drainageways. The drainage pattern is poorly defined in most areas, but it is well defined along the drainageways.

This association makes up about 43 percent of the county. It is about 45 percent Clarno soils, 25 percent Bonilla soils, 20 percent Crossplain soils, and 10 percent minor soils (fig. 3).

The well drained and moderately well drained Clarno soils are on rises. In this association they generally have a slope of 0 to 9 percent. Typically, the surface layer is very dark grayish brown loam. The subsoil is dark grayish brown, brown, and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown and light brownish gray, mottled, calcareous clay loam.

The moderately well drained Bonilla soils are in smooth areas and swales. Slopes range from 0 to 6 percent. Typically, the surface soil is very dark gray loam. The subsoil is dark grayish brown and light yellowish brown loam and clay loam. It is calcareous in

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

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

Minor in this association are the calcareous Ethan soils on ridges and on the steeper side slopes along the drainageways; the moderately well drained, sodium affected Stickney soils on flats; and the poorly drained Tetonka and Worthing soils in depressions.

About 95 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. Conserving moisture and controlling erosion are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and openland wildlife habitat.

5. Stickney-Dudley-Jerauld association

Moderately well drained, nearly level to undulating, loamy and silty, sodium affected soils on uplands

This association is on glacial till plains characterized by smooth areas and rises interrupted by a few swales and depressions. The drainage pattern is poorly defined in areas where drainageways terminate in small depressions. It is well defined, however, along the larger drainageways.

This association makes up about 4 percent of the county. It is about 35 percent Stickney soils, 30 percent Dudley soils, 25 percent Jerauld soils, and 10 percent minor soils.

Stickney soils are in plane or slightly convex areas. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark gray loam. The subsurface layer is grayish brown loam. The subsoil is very dark gray and grayish brown clay loam. It is calcareous in the lower part. The underlying material is light brownish gray and pale yellow, calcareous loam.

Dudley soils are in smooth areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray silt loam. The subsurface layer is gray silt loam. The subsoil is dark grayish brown clay loam. In the lower part it is calcareous and has nests of salts. The underlying material is grayish brown, mottled, calcareous clay loam.

Jerauld soils are in pits and small depressions. Slopes range from 0 to 2 percent. Typically, the surface layer is gray silt loam. The subsoil is dark gray and grayish brown silty clay. In the lower part it is calcareous and has nests of salts. The underlying material is grayish brown and pale brown, calcareous clay loam. It is mottled in the lower part.

Minor in this association are the well drained Clarno and Houdek soils on the higher convex parts of the landscape, the poorly drained Durrstein soils on flood plains, and the poorly drained Hoven and Tetonka soils in depressions.

About 65 percent of this association is cropland. Alfalfa and tame grasses are the main crops. Small grain and corn are grown in some areas. Areas that are dominated by the Dudley and Jerauld soils support native grasses and are used for grazing. Measures that increase the rate of water intake, conserve moisture, and improve tilth are the main management needs if the major soils are cultivated. The association is suited to cultivated crops and to openland wildlife habitat, tame pasture and hay, and range. The sodium affected subsoil in the major soils is a limitation.

6. Houdek-Dudley-Stickney association

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

This association is on glacial till plains characterized by slight rises and plane or slightly concave areas. Slopes mainly are undulating, but some areas are nearly level. The drainage pattern is poorly defined in areas where drainageways terminate in small depressions.

This association makes up about 26 percent of the county. It is about 40 percent Houdek soils, 25 percent Dudley soils, 20 percent Stickney soils, and 15 percent minor soils (fig. 4).

The well drained Houdek soils are on rises. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is dark brown, brown, and pale brown clay loam. It is mottled and calcareous in the lower part. The underlying material is pale brown, mottled, calcareous clay loam.

The moderately well drained Dudley soils are in slightly concave areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray silt loam. The subsurface layer is gray silt loam. The subsoil is dark grayish brown clay loam. In the lower part it is calcareous and has nests of salts. The underlying material is grayish brown, mottled, calcareous clay loam.

The moderately well drained Stickney soils are in plane or slightly convex areas. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark gray loam. The subsurface layer is grayish brown loam. The subsoil is very dark gray and grayish brown clay loam. It is calcareous in the lower part. The underlying material is light brownish gray and pale yellow, calcareous loam.

Minor in this association are Clarno, Crossplain, Durrstein, Hoven, Jerauld, and Tetonka soils. Clarno soils are similar to the Houdek soils and are in similar positions on the landscape. The somewhat poorly drained Crossplain soils are in shallow drainageways. The poorly drained Durrstein soils are on flood plains. The poorly drained Hoven and Tetonka soils are in depressions. Jerauld soils have visible salts near the surface. They are in small pits and depressions.

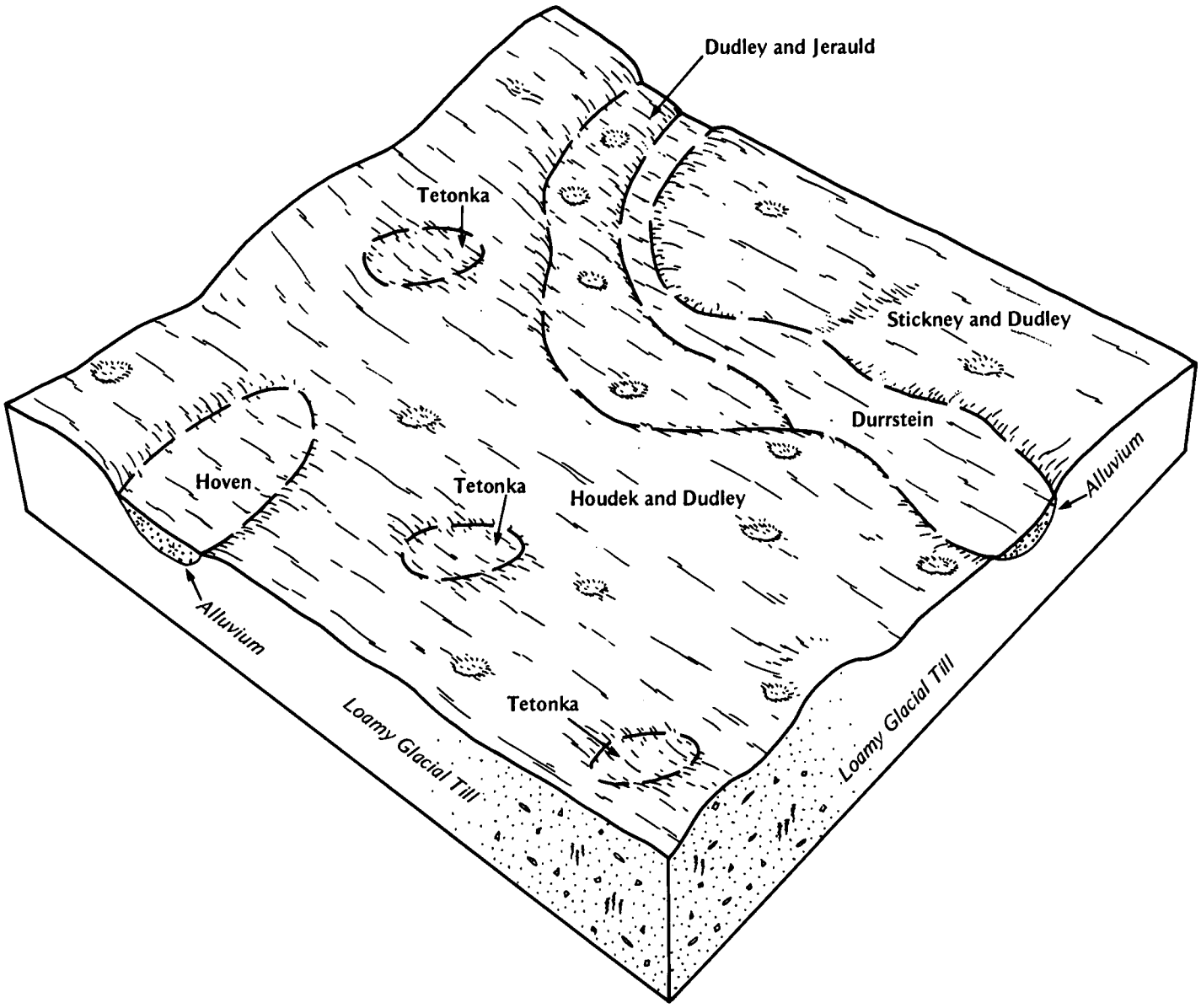

Figure 4.—Pattern of soils and parent material in the Houdek-Dudley-Stickney association.

About 70 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. Conserving moisture, improving tilth, and controlling erosion are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and openland wildlife habitat. The sodium affected subsoil in the Dudley and Stickney soils is a limitation.

7. Clarno-Stickney association

Well drained and moderately well drained, nearly level to undulating, loamy soils on uplands

This association is on glacial till plains characterized by slight rises and smooth areas. Slopes mainly are undulating, but some areas are nearly level. The drainage pattern is poorly defined in areas where drainageways terminate in small depressions.

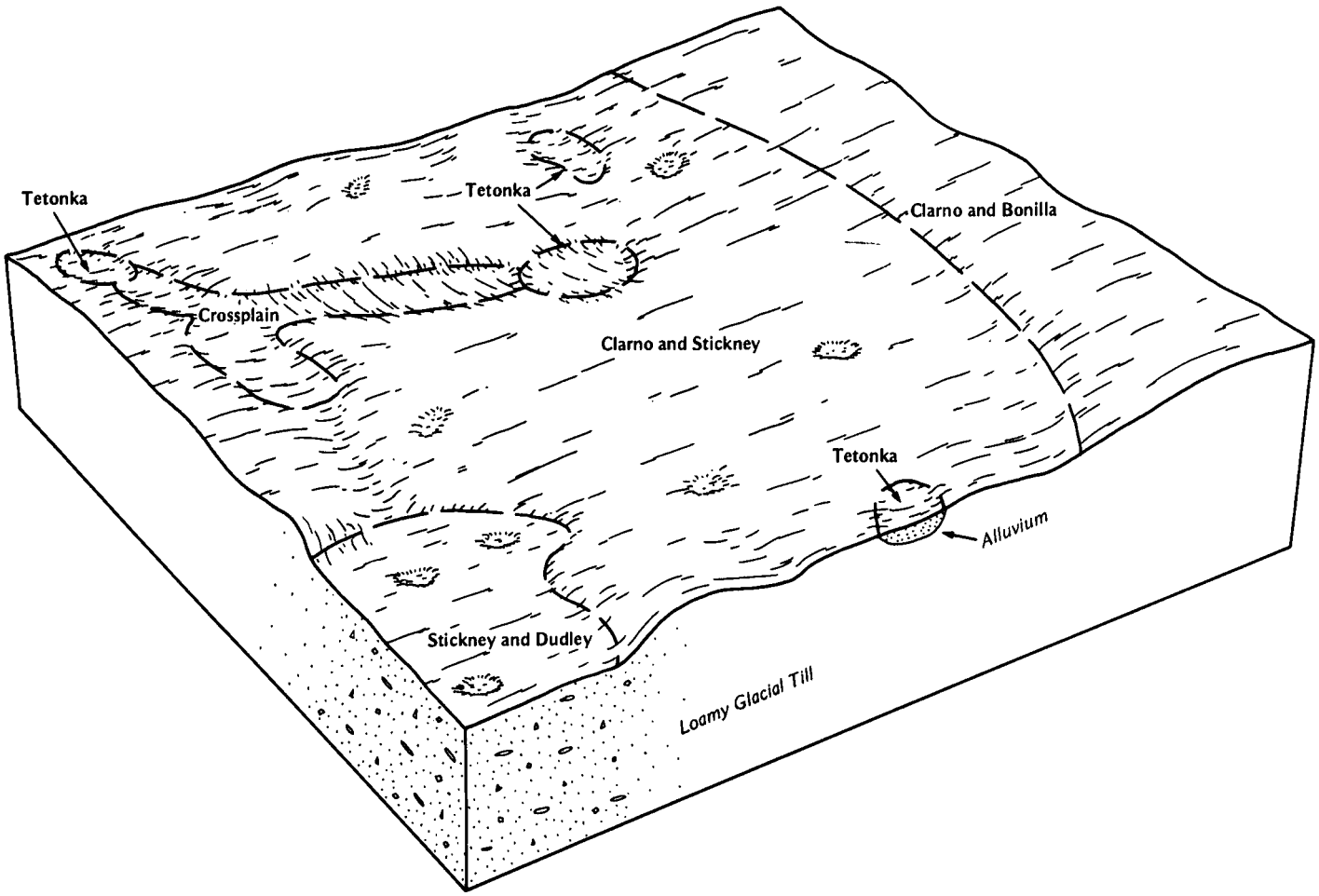

Figure 5.—Pattern of soils and parent material in the Clarno-Stickney association.

This association makes up about 16 percent of the county. It is about 60 percent Clarno soils, 25 percent Stickney soils, and 15 percent minor soils (fig. 5).

The well drained Clarno soils are on rises. In this association they generally have a slope of 0 to 6 percent. Typically, the surface layer is very dark grayish brown loam. The subsoil is dark grayish brown, brown, and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown and light brownish gray, mottled, calcareous clay loam.

The moderately well drained Stickney soils are in smooth areas. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark gray loam. The subsurface layer is grayish brown loam. The subsoil is very dark gray and grayish brown clay loam. It is calcareous in the lower part. The underlying material is light brownish gray and pale yellow, calcareous loam.

Minor in this association are Bonilla, Crossplain, Dudley, Ethan, and Tetonka soils. The moderately well drained Bonilla soils are in swales. The somewhat poorly drained Crossplain soils are in shallow drainageways. Dudley soils have columnar structure in the subsoil. They are in positions on the landscape similar to those of the Stickney soils. The calcareous Ethan soils are on ridges. The poorly drained Tetonka soils are in depressions.

About 90 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. Conserving moisture and controlling erosion are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and openland wildlife habitat. The sodium affected subsoil in the Stickney soils is a limitation.

Detailed Soil Map Units

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

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

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

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

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

Some map units are made of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Houdek-Dudley-Tetonka complex, 0 to 3 percent slopes, is an example.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. They are identified by a special symbol on the soil maps.

The names of some map units identified on the detailed soil maps do not fully agree with those identified on the maps in the published surveys of Hanson, Lake, McCook, and Sanborn Counties, which are adjacent to this county. Differences are the result of variations in the design and composition of map units or changes and refinements in series concepts.

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

Soil Descriptions

Ar—Arlo clay loam. This poorly drained, nearly level soil is on flood plains. It is frequently flooded for brief periods after heavy rainfall or rapid snowmelt. It is moderately deep to sandy and gravelly material. Areas range from 5 to 300 acres in size and are long and narrow.

Typically, the surface layer is dark gray clay loam about 7 inches thick. The next 18 inches is gray and dark gray, friable clay loam. The upper part of the underlying material is light brownish gray, mottled clay loam. The lower part to a depth of 60 inches is light brownish gray, stratified loamy sand, gravelly sand, and loamy fine sand. The soil is calcareous throughout. In places the sand and gravel are below a depth of 40 inches.

Included with this soil in mapping are small areas of Baltic and Delmont soils. These soils make up less than 15 percent of any one mapped area. Baltic soils contain more clay throughout than the Arlo soil and are more than 40 inches deep to gravelly material. They are in positions on the landscape similar to those of the Arlo soil. The somewhat excessively drained Delmont soils are on slight rises near the edges of some mapped areas. They are 14 to 18 inches deep to gravelly material.

Organic matter content is moderate and fertility medium in the Arlo soil. Tilth is fair. Permeability is moderate in the upper part of the soil and rapid in the sandy and gravelly underlying material. Available water capacity is high. A seasonal high water table is within a depth of 2 feet in the spring of most years. Runoff is slow. The shrink-swell potential is moderate in the upper part of the soil and low in the sandy and gravelly underlying material.

Most of the acreage is used for tame pasture and hay. This soil is suited to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, reed canarygrass, and smooth bromegrass.

This soil is suited to cultivated crops. Because of the wetness, late planted crops are better suited than early planted crops. The availability of plant nutrients is adversely affected by the high content of lime. Fieldwork is delayed in some years because of the wetness and the flooding. Installing a drainage system reduces the wetness. Leaving crop residue on the surface improves fertility and helps to control wind erosion.

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

This soil is suited to native grasses, but very few areas are used for range. The native vegetation dominantly is big bluestem, indiangrass, prairie cordgrass, and sedges. Overused areas are dominated by sedges, saltgrass, and Kentucky bluegrass.

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

Ba—Baltic silty clay loam. This deep, poorly drained, level soil is on flood plains and in depressions in the uplands. It is frequently flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to 150 acres in size and are long and narrow or circular.

Typically, the surface layer is dark gray silty clay loam about 6 inches thick. The subsurface layer also is dark gray silty clay loam. It is about 9 inches thick. The subsoil is dark gray silty clay about 27 inches thick. The underlying material to a depth of 60 inches is gray, mottled silty clay and silty clay loam. The soil is calcareous throughout. In places free carbonates are leached to a depth of more than 10 inches.

Included with this soil in mapping are small areas of Arlo and Lamo soils. These soils make up less than 10 percent of any one mapped area. They are on flood plains. Arlo soils are underlain by sandy and gravelly material. The somewhat poorly drained Lamo soils contain less clay throughout than the Baltic soil.

Organic matter content and fertility are high in the Baltic soil. Tilth is fair. Permeability is slow. Available water capacity is high. A seasonal high water table is within a depth of 2 feet most of the year. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is used for tame pasture and hay. This soil is suited to tame pasture and hay. Examples of suitable pasture plants are Garrison creeping foxtail, reed canarygrass, and western wheatgrass.

This soil is suited to range. The native vegetation dominantly is prairie cordgrass, reed canarygrass, and switchgrass. Overused areas are dominated by sedges, rushes, Kentucky bluegrass, saltgrass, and western wheatgrass.

If drained, this soil is suited to cultivated crops and to windbreaks and environmental plantings. The trees and shrubs that require an abundant moisture supply grow especially well. Many areas cannot be drained because of a lack of suitable outlets.

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

Bn—Bon loam. This deep, well drained, nearly level soil is on flood plains. It is subject to rare flooding. Areas are 30 to 300 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is about 33 inches of dark grayish brown, brown, and very dark gray loam and silt loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown and grayish brown, calcareous loam.

Included with this soil in mapping are small areas of Bonilla and Clarno soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained Bonilla soils are in swales on uplands. Clarno soils do not have dark colors below a depth of 20 inches. They are on uplands.

Organic matter content and fertility are high in the Bon soil. Tilth is good. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 4 to 6 feet in the spring of most years. Runoff is slow.

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

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

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

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

Bo—Bon loam, channeled. This deep, moderately well drained and well drained, nearly level soil is on flood

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

plains that are dissected into many small tracts by narrow channels and partly filled stream meanders (fig. 6). It is frequently flooded in areas adjacent to the channel and is subject to rare flooding on high parts of the flood plain. Areas are 10 to more than 100 acres in size and are long and narrow.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is about 33 inches of dark grayish brown, brown, and very dark gray loam and silt loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown and grayish brown, calcareous loam. In some areas it is stratified with thin layers of coarser textured material. In places the upper 20 inches is noncalcareous.

Included with this soil in mapping are small areas of Clarno, Delmont, Enet, and Ethan soils. These soils make up less than 10 percent of any one mapped area. Clarno and Ethan soils do not have dark colors below a depth of 20 inches. They are on uplands. Delmont and Enet soils are underlain by sandy and gravelly material. They are on terraces.

Organic matter content and fertility are high in the Bon soil. Tilth is good. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 4 to 6 feet in the rarely flooded areas and 2 to 6 feet in the frequently flooded areas. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. This soil is suited to range. The native vegetation dominantly is big bluestem and lesser amounts of green needlegrass and western wheatgrass. Overused areas are dominated by Kentucky bluegrass, foxtail barley, and saltgrass.

Because of the meandering channels and the flooding, this soil generally is unsuited to cultivated crops. In areas that are accessible to farm machinery, it is suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass grow well. Silt and debris deposited by floodwater in some years damage pasture plants and hinder haying.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. They can be planted by hand. Because of the meandering stream channels, however, they generally cannot be planted by machine.

The capability unit is VIw-1; Subirrigated range site (frequently flooded areas) and Overflow range site (rarely flooded areas).

Ca—Chancellor-Tetonka complex. These deep, level soils are on uplands. The somewhat poorly drained Chancellor soil is in swales and shallow drainageways. It is frequently flooded. The poorly drained Tetonka soil is in the lower depressions in the drainageways and

swales. It is ponded part of the year. Areas are 5 to 90 acres in size and are long and narrow. They are 40 to 45 percent Chancellor soil and 35 to 40 percent Tetonka soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Chancellor soil is very dark gray silty clay loam about 7 inches thick. The subsurface layer also is very dark gray silty clay loam about 7 inches thick. The subsoil is about 29 inches of dark gray and grayish brown, very firm silty clay and light brownish gray, very firm, calcareous silty clay loam. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam. In some areas the surface layer is silt loam. In places the soil contains more sand throughout.

Typically, the surface layer of the Tetonka soil is dark gray and dark grayish brown silt loam about 16 inches thick. The subsurface layer is light gray silt loam about 7 inches thick. The subsoil is dark gray and gray silty clay loam about 28 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam.

Included with these soils in mapping are small areas of Egan and Trent soils. These included soils make up 20 to 25 percent of any one mapped area. The well drained Egan soils are on uplands. The moderately well drained Trent soils are in swales.

Organic matter content is high in the Chancellor soil and moderate in the Tetonka soil. Fertility is high in the Chancellor soil and medium in the Tetonka soil. Tilth is fair in both soils. Permeability is slow. Available water capacity is high. The Chancellor soil has a seasonal water table within a depth of 3 feet during wet periods. The Tetonka soil has one within a depth of 1 foot part of the year. As much as 1 foot of water ponds on this soil during some wet periods. Runoff is slow on the Chancellor soil and ponded on the Tetonka soil. The shrink-swell potential is high in both soils.

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

These soils are suited to range. The native vegetation dominantly is big bluestem and needlegrass on the Chancellor soil and prairie cordgrass, sedges, western wheatgrass, and reedgrass on the Tetonka soil. Overused areas are dominated by Kentucky bluegrass and western wheatgrass.

The Chancellor soil is suited to windbreaks and environmental plantings, but the Tetonka soil generally is unsuited unless it is drained. The trees and shrubs that require an abundant supply of moisture grow especially well on the Chancellor soil.

The Chancellor soil is in capability unit IIw-2, Overflow range site; the Tetonka soil is in capability unit IIw-1, if drained, and in Wet Meadow range site.

Cc—Clamo silty clay loam. This deep, poorly drained, level soil is on flood plains. It is occasionally flooded. Areas are 20 to 100 acres in size and are long and narrow.

Typically, the surface layer is dark gray silty clay loam about 7 inches thick. The subsurface layer is dark gray silty clay about 7 inches thick. The subsoil is gray, calcareous silty clay about 28 inches thick. The underlying material to a depth of 60 inches is gray, stratified silt loam and sandy clay loam. In places the soil is calcareous throughout.

Included with this soil in mapping are small areas of Arlo, Durrstein, and Lamo soils. These soils make up less than 15 percent of any one mapped area. Arlo soils are underlain by sandy and gravelly material. They are slightly higher on the flood plain than the Clamo soil. Durrstein soils have a sodium affected subsoil. Lamo soils contain less clay between depths of 10 and 40 inches than the Clamo soil. Durrstein and Lamo soils are in positions on the landscape similar to those of the Clamo soil.

Organic matter content and fertility are high in the Clamo soil. Tilth is fair. Permeability is slow. Available water capacity is high. A seasonal high water table is within a depth of 3 feet most of the year. Runoff is very slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, western wheatgrass, and reed canarygrass. In wet years late planted crops are better suited than small grain because the wetness delays planting in the spring. The soil dries slowly after rains because it is slowly permeable. It becomes compacted if cultivated when wet. Increasing the water intake rate and improving tilth are management concerns. Open drainage ditches help to remove excess water in some areas. Leaving crop residue on the surface, applying animal manure, including grasses and legumes in the cropping system, and deferring tillage when the soil is wet increase the water intake rate and improve tilth.

This soil is suited to range. The native vegetation dominantly is big bluestem and lesser amounts of green needlegrass and western wheatgrass. Overused areas are dominated by western wheatgrass, foxtail barley, and saltgrass.

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

The capability unit is IIw-2; Overflow range site.

CfA—Clarno-Bonilla loams, 0 to 3 percent slopes. These deep, nearly level and gently undulating soils are on uplands. The well drained Clarno soil is on slight rises. The moderately well drained Bonilla soil is in swales. It is occasionally flooded for very brief periods in the spring. Areas are 20 to 150 acres in size and are irregular in shape. They are 50 to 55 percent Clarno soil and 30 to 35 percent Bonilla soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and light brownish gray, mottled, calcareous loam. In places the subsoil contains more clay. In some areas the surface layer and the subsoil contain more silt and less sand.

Typically, the surface layer of the Bonilla soil is very dark gray loam about 9 inches thick. The subsurface layer also is very dark gray loam. It is about 4 inches thick. The subsoil is about 24 inches of dark grayish brown and light yellowish brown, friable loam and clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. In places it is stratified silt and sand. In some areas the surface layer and the subsoil contain more silt and less sand.

Included with these soils in mapping are small areas of Crossplain, Stickney, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The somewhat poorly drained Crossplain soils are in the deeper swales. Stickney soils have a sodium affected subsoil. They are in positions on the landscape similar to those of the Bonilla soil. The poorly drained Tetonka soils are in depressions.

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

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

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

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

The Clarno soil is in capability unit IIc-2, Silty range site; the Bonilla soil is in capability unit IIc-3, Overflow range site.

CfB—Clarno-Bonilla loams, 1 to 6 percent slopes. These deep, nearly level to undulating soils are on uplands. The well drained Clarno soil is on the upper slopes. The moderately well drained Bonilla soil is in swales (fig. 7). It is occasionally flooded for brief periods in the spring. Areas are 20 to 150 acres in size and are irregular in shape. They are 55 to 60 percent Clarno soil and 25 to 30 percent Bonilla soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and light brownish gray, mottled, calcareous clay loam. In places the subsoil contains more clay. In some areas the surface layer and the subsoil contain more silt and less sand.

Typically, the surface layer of the Bonilla soil is very dark gray loam about 9 inches thick. The subsurface layer also is very dark gray loam. It is about 4 inches thick. The subsoil is about 24 inches of dark grayish brown and light yellowish brown, friable loam and clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray loam. In places it is stratified silt and sand. In some areas the surface layer and the subsoil contain more silt.

Included with these soils in mapping are small areas of Crossplain, Ethan, Stickney, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The somewhat poorly drained Crossplain soils are in the deeper swales. Ethan soils have lime

Figure 7.—An area of Clarno-Bonilla loams, 1 to 6 percent slopes. The Bonilla soil is lower on the landscape than the Clarno soil.

near the surface. They are on ridges and knolls. Stickney soils have a sodium affected subsoil. They are in positions on the landscape similar to those of the Bonilla soil. The poorly drained Tetonka soils are in depressions.

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

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

These soils are suited to windbreaks and environmental plantings. The species that require an abundant supply of moisture grow especially well on the Bonilla soil.

These soils are suited to range. The native vegetation dominantly is big bluestem, green needlegrass, and western wheatgrass. Overused areas are dominated by western wheatgrass and needleandthread.

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

CgA—Clarno-Crossplain loams, 0 to 2 percent slopes. These deep, gently undulating soils are on uplands. The moderately well drained Clarno soil is on the higher parts of the landscape. The somewhat poorly drained Crossplain soil is in swales. It is frequently flooded for brief periods in the spring. Areas are 50 to 400 acres in size and are irregular in shape. They are 45 to 50 percent Clarno soil and 30 to 35 percent Crossplain soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and light brownish gray, mottled, calcareous clay loam. In places the subsoil contains more clay. In some areas the surface layer and the subsoil contain more silt and less sand.

Typically, the surface layer of the Crossplain soil is dark gray loam about 11 inches thick. The subsoil is dark gray and olive gray, firm clay loam about 33 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is light olive gray and pale olive, mottled, calcareous loam. In some areas the surface layer and the subsoil contain more silt and less sand.

Included with these soils in mapping are small areas of Bonilla, Stickney, and Tetonka soils. These included soils make up less than 25 percent of any one mapped area. Bonilla soils contain less clay in the subsoil than the Crossplain soil. They are in shallow swales. Stickney soils have a sodium affected subsoil. They are in areas between the Clarno and Crossplain soils. The poorly drained Tetonka soils are in depressions.

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

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture in the Clarno soil and improve tilth in the Crossplain soil are the main management needs. Minimizing tillage, leaving crop residue on the surface, applying animal manure, and including grasses and legumes in the cropping system are examples. Farming is delayed in some years when the Crossplain soil receives runoff from the adjacent uplands, but in most years the additional moisture is beneficial.

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

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

The Clarno soil is in capability unit IIc-2, Silty range site; the Crossplain soil is in capability unit IIw-1, Overflow range site.

CkB—Clarno-Ethan complex, 2 to 6 percent slopes. These deep, well drained, undulating soils are on uplands. The Clarno soil is on smooth side slopes. The Ethan soil is on the upper convex side slopes and knolls. Areas are 10 to several hundred acres in size and are irregular in shape. They are 55 to 60 percent Clarno soil and 25 to 30 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and light brownish gray, mottled, calcareous clay loam. In places the subsoil contains more clay. In some areas the surface layer and the subsoil contain more silt and less sand.

Typically, the surface layer of the Ethan soil is brown, calcareous clay loam about 8 inches thick. The subsoil is light yellowish brown, friable, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the depth to the underlying material is less than 16 inches.

Included with these soils in mapping are small areas of Bonilla, Crossplain, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The moderately well drained Bonilla and somewhat poorly drained Crossplain soils are in swales. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Clarno soil and low in the Ethan soil. Fertility is medium in the Clarno soil and low in the Ethan soil. Tilth is good in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

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

These soils are suited to windbreaks and environmental plantings. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well on the Clarno soil. No trees or shrubs grow well on the Ethan soil; optimum survival and growth are unlikely. Planting on the contour helps to control erosion.

These soils are suited to range. The native vegetation on the Clarno soil dominantly is green needlegrass and western wheatgrass. That on the Ethan soil dominantly is little bluestem and green needlegrass. Overused areas are dominated by western wheatgrass and needleandthread.

The Clarno soil is in capability unit IIe-2, the Ethan soil in capability unit IIIe-12; both soils are in Silty range site.

CnA—Clarno-Stickney-Tetonka complex, 0 to 2 percent slopes. These deep, gently undulating soils are on uplands. The well drained Clarno soil is on the higher parts of the landscape. The moderately well drained Stickney soil is on smooth slopes. The poorly drained Tetonka soil is in depressions. It is ponded part of the year. Areas are 10 to more than 100 acres in size and are irregular in shape. They are 35 to 40 percent Clarno soil, 30 to 35 percent Stickney soil, and 15 to 20 percent Tetonka soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and light brownish gray, mottled, calcareous clay loam. In places the subsoil contains more clay.

Typically, the surface layer of the Stickney soil is very dark gray loam about 6 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is very dark gray and grayish brown clay loam about 26 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray and pale yellow, calcareous loam.

Typically, the surface layer of the Tetonka soil is dark gray and dark grayish brown silt loam about 16 inches thick. The subsurface layer is light gray silt loam about 7 inches thick. The subsoil is dark gray and gray silty clay loam about 25 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam.

Included with these soils in mapping are small areas of Bonilla, Crossplain, Dudley, and Jerauld soils. These included soils make up less than 20 percent of any one mapped area. The moderately well drained Bonilla and somewhat poorly drained Crossplain soils are in swales. Dudley and Jerauld soils have columnar structure in the subsoil. Dudley soils are in positions on the landscape similar to those of the Stickney soil. Jerauld soils are in small pits and depressions.

Organic matter content is moderate and fertility medium in the Clarno, Stickney, and Tetonka soils. The sodium in the Stickney soil adversely affects the growth of most plants. Tilth is good in the Clarno and Stickney soils and fair in the Tetonka soil. Permeability is moderate in the subsoil of the Clarno soil and moderately slow in the underlying material. It is slow in the Stickney and Tetonka soils. Available water capacity is high in all three soils. The Tetonka soil has a seasonal high water table within a depth of 1 foot part of the year. As much as 1 foot of water may pond on this soil during wet periods. Runoff is slow on the Clarno and Stickney soils. It is ponded on the Tetonka soil. The shrink-swell potential is moderate in the Clarno soil and high in the Stickney and Tetonka soils.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Garrison creeping foxtail and reed canarygrass also are suited to the Tetonka soil. Measures that conserve moisture in the Clarno and Stickney soils and control the ponding on the Tetonka soil are the main management needs. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system conserve moisture and improve water intake. In most years planting is delayed on the Tetonka soil because of the ponding. Surface drains help to remove the excess water.

These soils are suited to range. The native vegetation on the Clarno and Stickney soils dominantly is western wheatgrass, big bluestem, and green needlegrass. That

on the Tetonka soil is prairie cordgrass, reedgrass, sedges, and western wheatgrass. Overused areas are dominated by western wheatgrass and blue grama. The extent of sedges increases in overused areas of the Tetonka soil.

The Clarno and Stickney soils are suited to windbreaks and environmental plantings, but the Tetonka soil is unsuited unless it is drained. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well on the Clarno and Stickney soils.

The Clarno soil is in capability unit IIc-2, Silty range site; the Stickney soil is in capability unit IIIs-1, Clayey range site; the Tetonka soil is in capability unit IIw-1, if drained, and in Wet Meadow range site.

CnB—Clarno-Stickney-Tetonka complex, 0 to 6 percent slopes. These deep, level to undulating soils are on uplands. The well drained Clarno soil is on the higher parts of the landscape. The moderately well drained Stickney soil is on the smooth, less sloping parts. The poorly drained Tetonka soil is in depressions. It is ponded part of the year. Areas are 10 to 160 acres in size and are irregular in shape. They are 35 to 40 percent Clarno soil, 25 to 30 percent Stickney soil, and 15 to 20 percent Tetonka soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and light brownish gray, mottled, calcareous clay loam. In places the subsoil contains more clay.

Typically, the surface layer of the Stickney soil is very dark gray loam about 6 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is very dark gray and grayish brown clay loam about 26 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray and pale yellow, calcareous loam.

Typically, the surface layer of the Tetonka soil is dark gray and dark grayish brown silt loam about 16 inches thick. The subsurface layer is light gray silt loam about 7 inches thick. The subsoil is dark gray and gray silty clay loam about 28 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam.

Included with these soils in mapping are small areas of Bonilla, Crossplain, and Dudley soils. These included soils make up less than 25 percent of any one mapped area. The moderately well drained Bonilla and somewhat poorly drained Crossplain soils are in swales. Dudley soils have columnar structure in the subsoil. They are in positions on the landscape similar to those of the Stickney soil.

Organic matter content is moderate and fertility medium in the Clarno, Stickney, and Tetonka soils. The sodium in the Stickney soil adversely affects the growth of most plants. Tilth is good in the Clarno and Stickney soils and fair in the Tetonka soil. Permeability is moderate in the subsoil of the Clarno soil and moderately slow in the underlying material. It is slow in the Stickney and Tetonka soils. Available water capacity is high in all three soils. The Tetonka soil has a seasonal water table within a depth of 1 foot part of the year. As much as 1 foot of water may pond on this soil during wet periods. Runoff is medium on the Clarno and Stickney soils. It is very slow or ponded on the Tetonka soil. The shrink-swell potential is moderate in the Clarno soil and high in the Stickney and Tetonka soils.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Garrison creeping foxtail and reed canarygrass also are suited to the Tetonka soil. Measures that control erosion and conserve moisture in areas of the Clarno and Stickney soils and control the ponding on the Tetonka soil are the main management needs. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system conserve moisture and improve water intake. Contour farming, grassed waterways, and terraces also can help to control erosion, but slopes in most areas are too short or too irregular for contouring and terracing. In most years planting is delayed on the Tetonka soil because of the ponding. Surface drains help to remove the excess water.

These soils are suited to range. The native vegetation on the Clarno and Stickney soils dominantly is western wheatgrass, big bluestem, and green needlegrass. That on the Tetonka soil is prairie cordgrass, reedgrass, sedges, and western wheatgrass. Overused areas are dominated by western wheatgrass and blue grama. The extent of sedges increases in overused areas of the Tetonka soil.

The Clarno and Stickney soils are suited to windbreaks and environmental plantings, but the Tetonka soil is unsuited unless it is drained. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well on the Clarno and Stickney soils.

The Clarno soil is in capability unit IIe-2, Silty range site; the Stickney soil is in capability unit IIIe-3, Clayey range site; the Tetonka soil is in capability unit IIw-1, if drained, and in Wet Meadow range site.

Ct—Crossplain-Tetonka complex. These deep, nearly level and level soils are on uplands. The somewhat poorly drained Crossplain soil is in swales and

shallow drainageways. It is frequently flooded. The poorly drained Tetonka soil is in the lower depressions in the drainageways and swales. It is ponded part of the year. Areas are 5 to 90 acres in size and are long and narrow. They are 40 to 45 percent Crossplain soil and 35 to 40 percent Tetonka soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Crossplain soil is dark gray loam about 11 inches thick. The subsoil is dark gray and olive gray, firm clay loam about 33 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is light olive gray and pale olive, mottled, calcareous loam. In some areas the surface layer and the subsoil contain more silt and less sand.

Typically, the surface layer of the Tetonka soil is dark gray and dark grayish brown silt loam about 16 inches thick. The subsurface layer is light gray silt loam about 7 inches thick. The subsoil is dark gray and gray silty clay loam about 28 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam.

Included with these soils in mapping are small areas of Bonilla and Clarno soils. These included soils make up 20 to 25 percent of any one mapped area. The moderately well drained Bonilla soils are in shallow swales. The well drained Clarno soils are on the high parts of the landscape.

Organic matter content is high in the Crossplain soil and moderate in the Tetonka soil. Fertility is high in the Crossplain soil and medium in the Tetonka soil. Tilth is fair in both soils. Permeability is slow. Available water capacity is high. The Crossplain soil has a seasonal water table within a depth of 3 feet during wet periods. The Tetonka soil has one within a depth of 1 foot part of the year. As much as 1 foot of water ponds on this soil during some wet periods. Runoff is slow on the Crossplain soil and ponded on the Tetonka soil. The shrink-swell potential is high in both soils.

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

These soils are suited to range. The native vegetation dominantly is big bluestem and green needlegrass on the Crossplain soil and prairie cordgrass, sedges, western wheatgrass, and reedgrass on the Tetonka soil. Overused areas are dominated by Kentucky bluegrass and western wheatgrass.

The Crossplain soil is suited to windbreaks and environmental plantings, but the Tetonka soil is unsuited unless it is drained. The trees and shrubs that require an abundant supply of moisture grow especially well on the Crossplain soil.

The Crossplain soil is in capability unit IIw-2, Overflow range site; the Tetonka soil is in capability unit IIw-1, if drained, and in Wet Meadow range site.

Da—Davis loam, 1 to 4 percent slopes. This deep, well drained, very gently sloping and gently sloping soil is on foot slopes and fans in the uplands. Areas are 5 to 50 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray loam about 6 inches thick. The subsoil is very dark gray, dark grayish brown, and grayish brown loam about 44 inches thick. The underlying material to a depth of 60 inches is pale brown, mottled, calcareous loam. In some areas lime is within a depth of 20 inches.

Included with this soil in mapping are small areas of Clarno and Ethan soils. These soils make up less than 15 percent of any one mapped area. They are on uplands. Their dark colors do not extend below a depth of 20 inches.

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

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

This soil is suited to range. The native vegetation dominantly is big bluestem and western wheatgrass. Overused areas are dominated by western wheatgrass, needleandthread, blue grama, and Kentucky bluegrass.

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

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

Do—Dudley-Jerauld silt loams. These deep, nearly level, moderately well drained soils are on uplands. The

Dudley soil is slightly higher on the landscape than the Jerauld soil. The Jerauld soil is in small pits and depressions. Areas are 40 to several hundred acres in size and are irregular in shape. They are 45 to 50 percent Dudley soil and 40 to 45 percent Jerauld soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Dudley soil is dark gray silt loam about 6 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is dark grayish brown, very firm clay loam about 20 inches thick. In the lower part it is calcareous and has nests of salts. The underlying material to a depth of 60 inches is grayish brown, mottled, calcareous clay loam.

Typically, the surface layer of the Jerauld soil is gray silt loam about 2 inches thick. The subsoil is dark gray and grayish brown, very firm silty clay about 22 inches thick. In the lower part it is calcareous and has nests of salts. The underlying material to a depth of 60 inches is grayish brown and pale brown, calcareous clay loam. It is mottled in the lower part.

Included with these soils in mapping are small areas of Clarno, Durrstein, Hoven, and Stickney soils. These included soils make up less than 15 percent of any one mapped area. The well drained Clarno soils are on the high parts of the landscape. They do not have a sodium affected subsoil. The very poorly drained Durrstein soils are along narrow drainageways. The poorly drained Hoven soils are in depressions. Stickney soils do not have columnar structure in the subsoil. They are in positions on the landscape similar to those of the Dudley soil. Also included are slick spots and other small barren areas that are very saline.

Organic matter content is moderate in the Dudley soil and low in the Jerauld soil. Fertility is medium in the Dudley soil and low in the Jerauld soil. Both soils have a sodium affected subsoil that adversely affects root penetration. Tilth is poor. Permeability is slow in the Dudley soil and very slow in the Jerauld soil. Available water capacity is high in the Dudley soil and moderate in the Jerauld soil. Runoff is slow on both soils. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. These soils are suited to range. Productivity is limited on the Jerauld soil, however, because the dense claypan subsoil restricts the penetration of plant roots. The native vegetation dominantly is western wheatgrass, green needlegrass, and blue grama. Overused areas are dominated by blue grama and buffalograss. The extent of saltgrass increases in overused areas of the Jerauld soil.

These soils are suited to cultivated crops. The dense claypan subsoil and high content of sodium, however, adversely affect crop growth by restricting root penetration and the rate of water intake. Tilling is difficult because the dense subsoil is near the surface. If the soils are cultivated when wet, they become cloddy. Leaving crop residue on the surface and including grasses and legumes in the cropping system improve fertility and tilth, increase the rate of water intake, and conserve moisture.

The Dudley soil is suited to alfalfa, crested wheatgrass, intermediate wheatgrass, and pubescent wheatgrass for tame pasture and hay. No grasses grow well, however, on the Jerauld soil.

The Dudley soil is suited to windbreaks and environmental plantings, but the Jerauld soil generally is unsuited. The sodium affected subsoil is the main limitation. Optimum growth and survival are unlikely on the Dudley soil. No trees and shrubs grow well on the Jerauld soil.

The Dudley soil is in capability unit IVs-2, Claypan range site; the Jerauld soil is in capability unit VIs-1, Thin Claypan range site.

Du—Durrstein silt loam. This deep, poorly drained, nearly level soil is on flood plains. It is frequently flooded for brief periods. Areas are 5 to 100 acres in size and are irregular in shape.

Typically, the surface layer is light gray silt loam about 2 inches thick. The subsoil is dark gray silty clay about 31 inches thick. It has nests of gypsum in the middle and lower parts. The underlying material to a depth of 60 inches is light gray and olive gray, calcareous clay loam. It is mottled in the lower part. In some places the soil has a surface layer of dark gray silt loam about 2 inches thick and a subsurface layer of gray silt loam about 1 inch thick. In other places it does not have soluble salts within a depth of 16 inches.

Included with this soil in mapping are small areas of Clamo soils. These soils make up less than 15 percent of any one mapped area. They do not have a sodium affected subsoil. They are in positions on the landscape similar to those of the Durrstein soil.

Organic matter content and fertility are low in the Durrstein soil. The sodium in this soil adversely affects the growth of most plants. Tilth is poor. Permeability is very slow. Available water capacity is moderate. A seasonal high water table is within a depth of 1.5 feet most of the year. Runoff is very slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. This soil is suited to range. The native vegetation dominantly is western wheatgrass, inland saltgrass, and cordgrass. Overused areas are dominated by foxtail barley, inland saltgrass, thin stands of western wheatgrass, and weeds. Grazing when the soil is wet causes surface compaction and puddling, both of which result in a decrease in the extent of desirable grasses. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings. It is suited to tame pasture and hay, but the dense, compact subsoil, the high content of salts, and the flooding limit the

choice of suitable species. Tall wheatgrass is the best suited grass.

The capability unit is VIw-4; Saline Lowland range site.

EbB—Egan-Trent silty clay loams, 1 to 4 percent slopes. These deep, gently undulating and undulating soils are on uplands. The well drained Egan soil is on the higher convex parts of the landscape. The moderately well drained Trent soil is in swales. It is subject to rare flooding. Areas are 15 to 160 acres in size and are long and irregular in shape. They are 50 to 60 percent Egan soil and 20 to 25 percent Trent soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface soil of the Egan soil is dark gray silty clay loam about 9 inches thick. The subsoil is brown and pale brown silty clay loam about 21 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown and light brownish gray, mottled, calcareous silty clay loam and clay loam. In places the clay loam glacial till is below a depth of 38 inches.

Typically, the surface layer of the Trent soil is dark gray silty clay loam about 7 inches thick. The subsurface layer also is dark gray silty clay loam. It is about 4 inches thick. The subsoil is about 27 inches of dark grayish brown and light yellowish brown, friable silty clay loam and silt loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, pale brown, and very pale brown, mottled, calcareous silt loam. In some areas it is calcareous clay loam glacial till.

Included with these soils in mapping are small areas of Chancellor, Huntimer, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in shallow drainageways. Huntimer soils contain more clay in the subsoil than the Egan soil. They are in positions on the landscape similar to those of the Egan soil. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate in the Egan soil and high in the Trent soil. Fertility is medium in the Egan soil and high in the Trent soil. Tilth is good in both soils. Permeability is moderate in the subsoil of the Egan soil and slow in the underlying material. It is moderate in the Trent soil. Available water capacity is high in both soils. Runoff is medium on the Egan soil and slow on the Trent soil. The shrink-swell potential is moderate in both soils.

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

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

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

The Egan soil is in capability unit IIe-3, the Trent soil in capability unit I-3; both soils are in Silty range site.

EdA—Enet-Delmont loams, 0 to 4 percent slopes. These gently undulating and undulating soils are on terraces along the major drainageways. The well drained Enet soil is on the smoother parts of the landscape. It is moderately deep to gravelly material. The somewhat excessively drained Delmont soil is on short, convex slopes and narrow ridges. It is shallow to gravelly material. Areas are 5 to 100 acres in size and are irregular in shape. They are 50 to 70 percent Enet soil and 25 to 35 percent Delmont soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Enet soil is dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, friable loam about 15 inches thick. The upper part of the underlying material is grayish brown, calcareous sandy clay loam. The lower part to a depth of 60 inches is multicolored, calcareous gravelly sandy loam. In places the surface layer and the subsoil are sandy loam. In some areas the soil has a seasonal high water table.

Typically, the surface layer of the Delmont soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown and brown, friable loam about 10 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the surface layer is sandy loam. In some areas the gravelly underlying material is within a depth of 10 inches.

Included with these soils in mapping are small areas of Bonilla, Davis, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. They are not underlain by gravelly material. Bonilla soils are in swales. Davis soils are on foot slopes. The poorly drained Tetonka soils are in depressions.

Organic matter content is moderate and fertility medium in the Enet and Delmont soils. Because of the porous underlying material, root development is limited and the soils are droughty. Tilth is good. Permeability is moderate in the upper part of the soils and rapid in the

gravelly underlying material. Available water capacity is moderate or low in the Enet soil and low in the Delmont soil. Runoff is slow on both soils.

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

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

These soils are suited to native grasses, but they are droughty. The native vegetation on the Enet soil dominantly is green needlegrass, western wheatgrass, and lesser amounts of bluestems. That on the Delmont soil dominantly is needleandthread, blue grama, hairy grama, and threadleaf sedge. Overused areas are dominated by western wheatgrass, blue grama, and threadleaf sedge. After continued overuse, Kentucky bluegrass, blue grama, and weeds dominate the site.

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

The Enet soil is in capability unit IIIs-2, Silty range site; the Delmont soil is in capability unit IVs-1, Shallow to Gravel range site.

EgC—Ethan-Clarno complex, 6 to 9 percent slopes. These deep, well drained, gently rolling soils are in areas on uplands where slopes generally are short and complex. The Ethan soil is on ridges and knolls. The Clarno soil is on side slopes. Areas are 5 to 85 acres in size and are long and narrow. They are 45 to 50 percent Ethan soil and 35 to 40 percent Clarno soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is brown, calcareous clay loam about 8 inches thick. The subsoil is light yellowish brown, friable, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the depth to the underlying material is less than 16 inches.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and light brownish gray, mottled, calcareous clay loam. In places the subsoil contains more clay. In some areas the surface layer and the subsoil contain more silt and less sand.

Included with these soils in mapping are small areas of Bonilla, Crossplain, Davis, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The moderately well drained Bonilla and somewhat poorly drained Crossplain soils are in swales and shallow drainageways. Davis soils have dark colors that extend below a depth of 20 inches. They are on foot slopes. The poorly drained Tetonka soils are in depressions.

Organic matter content is low in the Ethan soil and moderate in the Clarno soil. Fertility is low in the Ethan soil and medium in the Clarno soil. Tilth is good in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

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

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

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

The Ethan soil is in capability unit IVe-3, the Clarno soil in capability unit IIIe-2; both soils are in Silty range site.

EgD—Ethan-Clarno complex, 9 to 15 percent slopes. These deep, well drained, strongly sloping and rolling soils are on uplands. The Ethan soil is on the convex upper side slopes, knolls, and ridges. The Clarno soil is on smooth side slopes and broad ridgetops. Scattered stones are on the surface in some areas. Areas are 5 to 50 acres in size and are long and narrow. They are 50 to 55 percent Ethan soil and 30 to 35 percent Clarno soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is brown, calcareous clay loam about 8 inches thick. The subsoil is light yellowish brown, friable clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the depth to the underlying material is less than 16 inches.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown, brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and light brownish gray, mottled, calcareous clay loam. In places the subsoil contains more clay. In some areas the surface layer and the subsoil contain more silt and less sand.

Included with these soils in mapping are small areas of Bonilla, Davis, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The moderately well drained Bonilla soils are in swales. Davis soils have dark colors that extend below a depth of 20 inches. They are on foot slopes. The poorly drained Tetonka soils are in depressions.

Organic matter content is low in the Ethan soil and moderate in the Clarno soil. Tilth is good in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Runoff is rapid. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. These soils are suited to range. The native vegetation dominantly is green needlegrass, western wheatgrass, and needleandthread. Overused areas are dominated by blue grama and Kentucky bluegrass.

These soils are suited to tame pasture and hay but generally are unsuited to cultivated crops. Examples of suitable pasture plants are alfalfa, smooth bromegrass, and intermediate wheatgrass.

These soils are suited to windbreaks and environmental plantings, but the high content of lime in the surface layer of the Ethan soil is a limitation. All climatically suited trees and shrubs grow well on the Clarno soil, except for those that require an abundant supply of moisture. Optimum growth and survival are unlikely on the Ethan soil. Planting on the contour helps to control erosion.

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

EmB—Ethan-Egan complex, 3 to 7 percent slopes. These deep, well drained, gently sloping and moderately sloping soils are on uplands. The Ethan soil is on narrow ridges and the upper side slopes. The Egan soil is on the lower slopes and broader ridges. Areas are 5 to 70 acres in size and are long and narrow. They are 45 to 50 percent Ethan soil and 30 to 40 percent Egan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is brown, calcareous clay loam about 8 inches thick. The subsoil is light yellowish brown, friable, calcareous clay loam about 10 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the depth to the underlying material is less than 16 inches.

Typically, the surface soil of the Egan soil is dark gray silty clay loam about 9 inches thick. The subsoil is brown and pale brown silty clay loam about 21 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown and light brownish gray, calcareous silty clay loam and clay loam. In places, the clay loam glacial till is below a depth of 40 inches and the subsoil contains more clay.

Included with these soils in mapping are small areas of Chancellor and Trent soils. These included soils make up less than 25 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in deep swales. The moderately well drained Trent soils are in shallow swales. They are dark to a depth of more than 20 inches.

Organic matter content is low in the Ethan soil and moderate in the Egan soil. Fertility is low in the Ethan soil and medium in the Egan soil. Tilth is good in both soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

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

These soils are suited to range. The native vegetation on the Ethan soil dominantly is little bluestem and green needlegrass. That on the Egan soil dominantly is green needlegrass and western wheatgrass. Overused areas are dominated by Kentucky bluegrass and weeds.

These soils are suited to windbreaks and environmental plantings, but the high content of lime in the surface layer of the Ethan soil is a limitation. All

climatically suited trees and shrubs grow well on the Egan soil, except for those that require an abundant supply of moisture. Optimum growth and survival are unlikely on the Ethan soil. Planting on the contour helps to control erosion.

The Ethan soil is in capability unit IIIe-6, the Egan soil in capability unit IIe-3; both soils are in Silty range site.

HdA—Houdek-Dudley complex, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Houdek soil is on slight rises. The moderately well drained Dudley soil is on flats and in small depressions. Areas are 5 to several hundred acres in size and are irregular in shape. They are 40 to 50 percent Houdek soil and 25 to 35 percent Dudley soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Houdek soil is dark grayish brown loam about 6 inches thick. The subsoil is dark brown, brown, and pale brown, friable clay loam about 21 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown, mottled, calcareous clay loam. In some areas the subsoil contains less clay.

Typically, the surface layer of the Dudley soil is dark gray silt loam about 6 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is dark grayish brown, very firm clay loam about 20 inches thick. In the lower part it is calcareous and has nests of salts. The underlying material to a depth of 60 inches is grayish brown, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Hoven, Jerauld, Stickney, and Tetonka soils. These included soils make up less than 25 percent of any one mapped area. The poorly drained Hoven and Tetonka soils are in depressions. Jerauld soils have visible salts within a depth of 16 inches. They are in small pits and depressions. Stickney soils do not have columnar structure in the subsoil. They are in positions on the landscape similar to those of the Dudley soil.

Organic matter content is moderate and fertility medium in the Houdek and Dudley soils. The sodium affected subsoil in the Dudley soil adversely affects the growth of most plants. Tilth is good in the Houdek soil and poor in the Dudley soil. Permeability is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. It is slow in the Dudley soil. Available water capacity is high in both soils. Runoff is slow. The shrink-swell potential is moderate in the Houdek soil and high in the Dudley soil.

Most of the acreage is cropland. Tame pasture and hay are the main crops. These soils are suited to cultivated crops and to tame pasture and hay. The dense claypan subsoil and high content of sodium in the Dudley soil, however, adversely affect crop growth by restricting root penetration and the rate of water intake. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable pasture plants. The main management needs in cultivated areas are measures that conserve moisture, improve tilth, and increase the rate of water intake. Tilling is difficult in areas of the Dudley soil because the dense claypan subsoil is near the surface. If the soils are cultivated when wet, they become cloddy. Leaving crop residue on the surface and including grasses and legumes in the cropping system conserve moisture, improve tilth, and increase the rate of water intake. Chiseling and subsoiling also improve tilth and increase the rate of water intake.

These soils are suited to range. The native vegetation on the Houdek soil dominantly is western wheatgrass and green needlegrass. That on the Dudley soil dominantly is western wheatgrass and blue grama. Overused areas are dominated by blue grama and western wheatgrass. The extent of buffalograss increases in overused areas of the Dudley soil.

These soils are suited to windbreaks and environmental plantings, but the dense claypan subsoil in the Dudley soil is a limitation. All climatically suited trees and shrubs grow well on the Houdek soil, except for those that require an abundant supply of moisture. Optimum growth and survival are unlikely on the Dudley soil.

The Houdek soil is in capability unit IIc-2, Silty range site; the Dudley soil is in capability unit IVs-2, Claypan range site.

HdB—Houdek-Dudley complex, 2 to 6 percent slopes. These deep, undulating soils are on uplands. The well drained Houdek soil is on the higher parts of the landscape. The moderately well drained Dudley soil is on side slopes and in smooth areas. Areas are 5 to 100 acres in size and are irregular in shape. They are 40 to 50 percent Houdek soil and 25 to 35 percent Dudley soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Houdek soil is dark grayish brown loam about 6 inches thick. The subsoil is dark brown, brown, and pale brown, friable clay loam about 21 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown, mottled, calcareous clay loam. In some areas the subsoil contains less clay.

Typically, the surface layer of the Dudley soil is dark grayish brown silt loam about 6 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is dark grayish brown, very firm clay loam about 20 inches thick. In the lower part it is calcareous and has nests of salts. The underlying material to a depth of 60 inches is grayish brown, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Hoven, Jerauld, Stickney, and Tetonka soils. These

Figure 8.—Native grasses in an area of the Houdek-Dudley complex, 2 to 6 percent slopes.

included soils make up less than 25 percent of any one mapped area. The poorly drained Hoven and Tetonka soils are in depressions. Jerauld soils have visible salts within a depth of 16 inches. They are in small pits and depressions. Stickney soils do not have columnar structure in the subsoil. They are in positions on the landscape similar to those of the Dudley soil.

Organic matter content is moderate and fertility medium in the Houdek and Dudley soils. The sodium affected subsoil in the Dudley soil adversely affects the growth of most plants. Tilth is good in the Houdek soil and poor in the Dudley soil. Permeability is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. It is slow in the Dudley soil. Available water capacity is high in both soils. Runoff is medium on the Houdek soil and slow on the Dudley soil. The shrink-swell potential is moderate in the Houdek soil and high in the Dudley soil.

Most of the acreage supports native grasses and is used for grazing (fig. 8). These soils are suited to range. The native vegetation on the Houdek soil dominantly is green needlegrass and western wheatgrass. That on the Dudley soil dominantly is western wheatgrass and blue grama. Overused areas are dominated by western wheatgrass and blue grama. The extent of buffalograss increases in overused areas of the Dudley soil.

These soils are suited to cultivated crops and to tame pasture and hay. The dense claypan subsoil and high content of sodium in the Dudley soil, however, adversely affect crop growth by restricting root penetration and the rate of water intake. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable pasture plants. The main management needs in cultivated areas are measures that control erosion, conserve moisture, improve tilth, and increase the rate of water intake. Tilling is difficult in areas of the Dudley soil because the dense claypan subsoil is near the surface. If the soils are cultivated when wet, they become cloddy. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system conserve moisture, help to control erosion, improve tilth, and increase the rate of water intake. Chiseling and subsoiling also improve tilth and increase the rate of water intake.

These soils are suited to windbreaks and environmental plantings, but the claypan subsoil in the Dudley soil is a limitation. All climatically suited trees and shrubs grow well on the Houdek soil, except for those that require an abundant supply of moisture. Optimum growth and survival are unlikely on the Dudley soil.

The Houdek soil is in capability unit IIe-2, Silty range site; the Dudley soil is in capability unit IVs-3, Claypan range site.

HgA—Houdek-Dudley-Tetonka complex, 0 to 3 percent slopes. These deep, nearly level and gently undulating soils are on uplands. The well drained Houdek soil is on slight rises. The moderately well drained Dudley soil is on flats and in small depressions. The poorly drained Tetonka soil is in depressions. It is ponded during part of the year. Areas are 50 to several hundred acres in size and are irregular in shape. They are 35 to 40 percent Houdek soil, 30 to 35 percent Dudley soil, and 15 to 20 percent Tetonka soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Houdek soil is dark grayish brown loam about 6 inches thick. The subsoil is dark brown, brown, and pale brown, friable clay loam about 21 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown, mottled, calcareous clay loam. In some areas the subsoil contains less clay.

Typically, the surface layer of the Dudley soil is dark grayish brown silt loam about 6 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is dark grayish brown, very firm clay loam about 20 inches thick. In the lower part it is calcareous and has nests of salts. The underlying material to a depth of 60 inches is grayish brown, mottled, calcareous clay loam.

Typically, the surface layer of the Tetonka soil is dark gray and dark grayish brown silt loam about 16 inches thick. The subsurface layer is light gray silt loam about 7 inches thick. The subsoil is dark gray and gray silty clay loam about 28 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam.

Included with these soils in mapping are small areas of Crossplain, Hoven, Jerauld, and Stickney soils. These included soils make up less than 20 percent of any one mapped area. The somewhat poorly drained Crossplain soils are in shallow drainageways. The poorly drained Hoven soils have columnar structure in the subsoil. They are in positions on the landscape similar to those of the Tetonka soil. Jerauld soils have salts within a depth of 16 inches. They are in small pits and depressions. Stickney soils do not have columnar structure and contain more clay in the subsoil than the Houdek soil. They are in positions on the landscape similar to those of the Dudley soil.

Organic matter content is moderate and fertility medium in the Houdek, Dudley, and Tetonka soils. The sodium affected subsoil in the Dudley soil adversely affects the growth of most plants. Tilth is good in the Houdek soil, poor in the Dudley soil, and fair in the Tetonka soil. Permeability is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. It is slow in the Dudley and Tetonka soils. Available water capacity is high in all three soils. The Tetonka soil has a seasonal high water table within a depth of 1 foot part of the year. As much as 1 foot of water may pond on this soil during wet periods. Runoff is slow on the Houdek and Dudley soils and ponded on the Tetonka soil. The shrink-swell potential is moderate in the Houdek soil and high in the Dudley and Tetonka soils.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay, but the dense claypan subsoil and high content of sodium in the Dudley soil and the wetness of the Tetonka soil are limitations. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and smooth bromegrass. Garrison creeping foxtail and reed canarygrass also are suited to the Tetonka soil. Measures that conserve moisture in the Houdek soil, improve tilth in the Dudley soil, and reduce the wetness of the Tetonka soil are the main management needs in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system conserve moisture and improve tilth. Chiseling and subsoiling improve tilth and increase the rate of water intake. In most years planting is delayed because of the wetness of the Tetonka soil. Surface drains help to remove the excess water.

The Houdek and Dudley soils are suited to windbreaks and environmental plantings, but the Tetonka soil is generally unsuited unless it is drained. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well on the Houdek soil. Optimum growth and survival are unlikely on the Dudley soil because the claypan subsoil is a limitation.

The Houdek soil is in capability unit IIc-2, Silty range site; the Dudley soil is in capability unit IVs-2, Claypan range site; the Tetonka soil is in capability unit IIw-1, if drained, and in Wet Meadow range site.

HgB—Houdek-Dudley-Tetonka complex, 0 to 6 percent slopes. These deep, nearly level to undulating soils are on uplands. The well drained Houdek soil is on the high parts of the landscape. The moderately well drained Dudley soil is on flats and in small depressions. The poorly drained Tetonka soil is in depressions. It is ponded part of the year. Areas are 20 to 300 acres in size and are irregular in shape. They are 35 to 40 percent Houdek soil, 25 to 30 percent Dudley soil, and 25 to 30 percent Tetonka soil. The three soils occur as areas so closely intermingled or small that mapping them separately is not practical.

Typically, the surface layer of the Houdek soil is dark grayish brown loam about 6 inches thick. The subsoil is dark brown, brown, and pale brown, friable clay loam about 21 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown, mottled, calcareous clay loam. In some areas the subsoil contains less clay.

Typically, the surface layer of the Dudley soil is dark grayish brown silt loam about 6 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is dark grayish brown, very friable clay loam about 20 inches thick. In the lower part it is calcareous and has nests of salts. The underlying material to a depth of 60 inches is grayish brown, mottled, calcareous clay loam.

Typically, the surface layer of the Tetonka soil is dark gray and dark grayish brown silt loam about 16 inches thick. The subsurface layer is light gray silt loam about 7 inches thick. The subsoil is dark gray and gray silty clay loam about 28 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam.

Included with these soils in mapping are small areas of Hoven, Jerauld, and Stickney soils. These included soils make up less than 15 percent of any one mapped area. The poorly drained Hoven soils have columnar structure in the subsoil. They are in positions on the landscape similar to those of the Tetonka soil. Jerauld soils have visible salts within a depth of 16 inches. Stickney soils do not have columnar structure and contain more clay in the subsoil than the Houdek soil. They are in positions on the landscape similar to those of the Dudley soil.

Organic matter content is moderate and fertility medium in the Houdek, Dudley, and Tetonka soils. The sodium affected subsoil in the Dudley soil adversely affects the growth of most plants. Tilth is good in the Houdek soil, poor in the Dudley soil, and fair in the Tetonka soil. Permeability is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. It is slow in the Dudley and Tetonka soils. Available water capacity is high in all three soils. The Tetonka soil has a seasonal high water table within a depth of 1 foot part of the year. As much as 1 foot of water ponds on this soil during some wet periods. Runoff is medium on the Houdek and Dudley soils and ponded on the Tetonka soil. The shrink-swell potential is moderate in the Houdek soil and high in the Dudley and Tetonka soils.

Most of the acreage is cropland. Tame pasture and hay are the main crops. These soils are suited to cultivated crops and to tame pasture and hay, but the claypan subsoil and high content of sodium in the Dudley soil and the wetness of the Tetonka soil are limitations. Alfalfa, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants. Garrison creeping foxtail and reed canarygrass also are suited to the Tetonka soil. Measures that control erosion and conserve moisture in the Houdek soil, improve tilth in the Dudley soil, and reduce the wetness of the Tetonka soil are the main management needs in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, improve tilth, and increase the rate of water intake. Chiseling and subsoiling also improve tilth and increase the rate of water intake. In most years planting is delayed because of the wetness of the Tetonka soil. Surface drains help to remove the excess water.

These soils are suited to range. The native vegetation dominantly is green needlegrass, blue grama, and western wheatgrass on the Houdek and Dudley soils and prairie cordgrass, reedgrass, sedges, and western wheatgrass on the Tetonka soil. Overused areas are dominated by western wheatgrass and blue grama. The extent of sedges increases in overused areas of the Tetonka soil.

The Houdek and Dudley soils are suited to windbreaks and environmental plantings, but the Tetonka soil is generally unsuited unless it is drained. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well on the Houdek soil. Optimum growth and survival are unlikely on the Dudley soil because the claypan subsoil is a limitation.

The Houdek soil is in capability unit IIe-2, Silty range site; the Dudley soil is in capability unit IVs-3, Claypan range site; the Tetonka soil is in capability unit IIw-1, if drained, and in Wet Meadow range site.

Ho—Hoven silt loam. This deep, level, poorly drained soil is in depressions in the uplands. It is ponded during wet periods. Areas are 5 to 20 acres in size and are oval or oblong.

Typically, the surface layer is dark gray silt loam about 4 inches thick. The subsurface layer is light gray silty clay loam about 1 inch thick. The subsoil is about 32 inches of dark gray, very firm silty clay and grayish brown, mottled, very firm clay loam. The underlying material to a depth of 60 inches is light brownish gray and light gray, mottled, calcareous clay loam. In places visible salts are within a depth of 16 inches.

Included with this soil in mapping are small areas of Jerauld and Tetonka soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained Jerauld soils are along the outer edges of the depressions. Tetonka soils do not have columnar structure in the subsoil. They are in positions on the landscape similar to those of the Hoven soil.

Organic matter content is moderate and fertility medium in the Hoven soil. The content of sodium adversely affects the growth of most plants. Permeability is very slow. Available water capacity is moderate. A seasonal high water table is within a depth of 1.5 feet part of the year. As much as 1.0 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. This soil is suited to range. The native vegetation dominantly is western wheatgrass and a lesser amount of sedges. Overused areas are dominated by Kentucky bluegrass and saltgrass. The extent of

sedges and rushes increases during wet years, and the extent of buffalograss increases during periods of drought. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings because of the ponding. It is suited to tame pasture and hay, but only the water-tolerant pasture plants grow well. Garrison creeping foxtail and western wheatgrass are the best suited species.

The capability unit is VIs-1; Closed Depression range site.

HuA—Huntimer silty clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are 5 to 160 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is about 21 inches of grayish brown and brown, firm silty clay and pale yellow, calcareous silty clay loam. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam. In places clay loam glacial till is at a depth of 24 to 35 inches.

Included with this soil in mapping are small areas of Chancellor and Trent soils. These soils make up less than 10 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in shallow drainageways. The moderately well drained Trent soils are in swales.

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

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

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

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

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

HxB—Huntimer-Egan silty clay loams, 2 to 6 percent slopes. These deep, gently sloping, well drained soils are on uplands. The Huntimer soil is on the smooth parts of the landscape. The Egan soil is on convex side slopes and narrow ridges. Areas are 6 to 140 acres in size and are long and narrow or irregular in shape. They are about 50 percent Huntimer soil and 35 to 40 percent Egan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Huntimer soil is very dark gray silty clay loam about 10 inches thick. The subsoil is about 21 inches of grayish brown and brown, firm silty clay and pale yellow, firm, calcareous silty clay loam. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam.

Typically, the surface soil of the Egan soil is dark gray silty clay loam about 9 inches thick. The subsoil is brown and pale brown, friable silty clay loam about 21 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown and light brownish gray, mottled, calcareous silty clay loam and clay loam. In places the carbonates are closer to the surface.

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. The somewhat poorly drained Chancellor soils are in shallow drainageways. The calcareous Ethan soils are on ridges and the upper side slopes. The moderately well drained Trent soils are in swales.

Organic matter content is high in the Huntimer soil and moderate in the Egan soil. Fertility is high in the Huntimer soil and medium in the Egan soil. Tilth is good in both soils. Permeability is moderately slow in the Huntimer soil. It is moderate in the subsoil of the Egan soil and moderately slow in the underlying material. Available water capacity is high in both soils. Runoff is medium. The shrink-swell potential is high in the Huntimer soil and moderate in the Egan soil.

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

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

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

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

La—Lamo silty clay loam. This deep, somewhat poorly drained, nearly level soil is on flood plains. It is

occasionally flooded. Areas are 20 to 100 acres in size and generally are long and narrow.

Typically, the surface layer is very dark gray silty clay loam about 7 inches thick. The subsurface layer is very dark gray, calcareous silty clay loam about 14 inches thick. The next 6 inches is gray, calcareous silty clay loam. The underlying material to a depth of 60 inches is dark gray, calcareous silty clay loam. It is mottled in the lower part.

Included with this soil in mapping are small areas of Arlo, Bon, and Clamo soils. These soils make up less than 20 percent of any one mapped area. The poorly drained Arlo and Clamo soils are in positions on the landscape similar to those of the Lamo soil. Arlo soils are underlain by gravelly and sandy material. The moderately well drained Bon soils are higher on the flood plain than the Lamo soil.

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

Most of the acreage is cropland. This soil is well suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth bromegrass.

This soil is suited to range. The native vegetation dominantly is big bluestem, switchgrass, and prairie cordgrass. Overused areas are dominated by Kentucky bluegrass, sedges, and weeds.

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

The capability unit is IIw-2; Subirrigated range site.

Sd—Stickney-Dudley complex. These deep, moderately well drained, nearly level soils are on uplands. The Stickney soil is on the slightly higher parts of the landscape. The Dudley soil is in small depressions. Areas are 40 to several hundred acres in size and are irregular in shape. They are 45 to 50 percent Stickney soil and 40 to 45 percent Dudley soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Stickney soil is very dark gray loam about 6 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is very dark gray and grayish brown clay loam about 26 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray and pale yellow, calcareous loam.

Typically, the surface layer of the Dudley soil is dark gray silt loam about 6 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is dark grayish brown, very firm clay loam about 20 inches thick. In the lower part it is calcareous and has nests of salts. The underlying material to a depth of 60 inches is grayish brown, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Clarno, Houdek, Hoven, Jerauld, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The well drained Clarno and Houdek soils are on the higher parts of the landscape. They do not have a sodium affected subsoil. The poorly drained Hoven and Tetonka soils are in depressions. Jerauld soils have visible salts within a depth of 16 inches. They are in small pits and depressions.

Organic matter content is moderate and fertility medium in the Stickney and Dudley soils. Both soils have a sodium affected subsoil that restricts root penetration. Tilth is good in the Stickney soil and poor in the Dudley soil. Permeability is slow in both soils. Available water capacity is high. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay, but the dense claypan subsoil in the Dudley soil and the sodium in both soils adversely affect crop growth by restricting root penetration and the rate of water intake. Examples of suitable pasture plants are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Measures that conserve moisture, increase the rate of water intake, and improve the tilth of the Dudley soil are the main management needs. Leaving crop residue on the surface and including grasses and legumes in the cropping system are examples. Chiseling and subsoiling also improve tilth and increase the rate of water intake.

These soils are suited to range (fig. 9). The native vegetation dominantly is green needlegrass and western wheatgrass. Bluestems are common on the Stickney soil. Overused areas are dominated by western wheatgrass and blue grama.

These soils are suited to windbreaks and environmental plantings, but the claypan subsoil in the Dudley soil is a limitation. Except for the species that require an abundant supply of moisture, all climatically suited trees and shrubs grow well on the Stickney soil. Optimum growth and survival are unlikely on the Dudley soil.

The Stickney soil is in capability unit IIIs-1, Clayey range site; the Dudley soil is in capability unit IVs-2, Claypan range site.

Te—Tetonka silt loam. This deep, poorly drained, level soil is in depressions in the uplands. It is ponded during wet periods. Areas are 5 to 15 acres in size and are oval.

Typically, the surface layer is dark gray and dark grayish brown silt loam about 16 inches thick. The subsurface layer is light gray silt loam about 7 inches

Figure 9.—An area of the Stickney-Dudley complex used for range.

thick. The subsoil is dark gray and gray silty clay loam about 28 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous silty clay loam.

Included with this soil in mapping are small areas of Chancellor, Crossplain, and Hoven soils. These soils make up less than 10 percent of any one mapped area. The somewhat poorly drained Chancellor and Crossplain soils are in shallow drainageways. Hoven soils have a sodium affected subsoil. They are in positions on the landscape similar to those of the Tetonka soil.

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

Most of the acreage supports native grasses. This soil is suited to range. The native vegetation dominantly is sedges, reedgrass, prairie cordgrass, and western wheatgrass. Overused areas are dominated by foxtail barley, spikesedge, and rushes.

This soil is suited to cultivated crops, but the wetness is a limitation. The best suited crops are those that mature late in the growing season. Measures that improve drainage are needed. In undrained areas, crops are likely to drown out and tillage usually is delayed for long periods.

This soil is suited to tame pasture and hay but generally is unsuited to windbreaks and environmental plantings. Only the water-tolerant pasture plants grow well in undrained areas. Garrison creeping foxtail and reed canarygrass are the best suited species. All climatically suited pasture plants grow well in drained areas.

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

Wo—Worthing silty clay loam. This deep, poorly drained, level soil is in depressions in the uplands. It is ponded during wet periods. Areas are 5 to 35 acres in size and generally are oval.

Typically, the surface layer is very dark gray silty clay loam about 9 inches thick. The subsoil is about 38 inches of very dark gray, mottled, firm silty clay loam and

Figure 10.—An area of Worthing silty clay loam, ponded, used as wildlife habitat.

dark gray and gray, mottled, firm silty clay. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray, mottled, calcareous silty clay. In places the soil is calcareous throughout.

Included with this soil in mapping are small areas of Hoven soils. These soils make up less than 10 percent of any one mapped area. They have a sodium affected subsoil. They are in positions on the landscape similar to those of the Worthing soil.

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

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

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings. Because the soil is frequently ponded, the number of suitable crops is severely limited.

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

Wp—Worthing silty clay loam, ponded. This deep, very poorly drained, level soil is in depressions in the uplands. It is ponded most of the year (fig. 10). Areas are 5 to 100 acres in size and generally are oval.

Typically, the surface layer is very dark gray silty clay loam about 9 inches thick. The subsoil is about 38 inches of very dark gray, mottled, firm silty clay loam and dark gray and gray, mottled, firm silty clay. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray, mottled, calcareous silty clay.

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

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

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

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

Prime Farmland

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

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

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

About 108,681 acres in Miner County, or 27 percent of the total land area, meets the requirements for prime farmland. About 33,060 additional acres would meet the requirements if drained. Most of the acreage of these soils is cropland. The main crops are corn, small grain, and alfalfa.

The map units in Miner County that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a high water table or susceptibility to flooding, qualify for prime farmland only in areas where these limitations are overcome by such measures as a drainage system or flood control. In table 5, the need for measures that overcome the limitations, if any, are shown in parentheses after the map unit name. Onsite evaluation is needed to determine whether or not the limitations have been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

Dale E. Johnson, district conservationist, Soil Conservation Service, helped write this section.

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

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

About 73 percent of the acreage in Miner County is used for cultivated crops or for tame pasture and hay (*3*). The major crops are corn, oats, spring wheat, and alfalfa. Barley, grain sorghum, and sunflowers also are grown. Alfalfa is harvested mainly for hay, corn is harvested for both silage and grain, and oats is grown as a cash crop and as livestock feed.

The potential of the soils in Miner County for increased crop production is good. About 20,990 acres of potentially good cropland is used as range, 13,392 acres as pasture, and 7,050 acres as tame hayland (*9*). 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. The paragraphs that follow describe the management needed on the cropland in the county.

Water erosion reduces productivity and results in sedimentation. It is a hazard on Clarno, Egan, Ethan, Houdek, and other soils if the slope is more than 2 percent. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as Ethan soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Delmont and Enet soils. When erosion occurs, sediment rich in nutrients enters streams and lakes. Measures that control erosion minimize the pollution of streams and lakes by sediment and preserve water quality for fish and wildlife, recreation, and municipal use. They also reduce the amount of fertilizer needed in cropped areas by helping to prevent the removal of plant nutrients.

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

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

Terraces and diversions reduce the length of slopes and the runoff rate and thus help to control erosion. In many areas, however, the soils are poorly suited to terraces and diversions because of short, irregular slopes. In some soils, such as Ethan, an unfavorable subsoil would be exposed in terrace channels.

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

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

Soil drainage is the major management concern on the somewhat poorly drained Lamo and poorly drained Arlo, Baltic, Clamo, and Tetonka soils. Unless these soils are artificially drained, the wetness commonly retards plant growth. Open ditches can remove the excess water if a drainage outlet is available. Controlling the runoff from the adjacent slopes also helps to reduce the wetness of these soils.

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

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

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

Field crops suited to the soils and climate of the survey area include small grain and row crops. Spring wheat and oats are the main small grain crops. Barley and rye are grown on a lesser acreage. The main row crop is corn, some of which is harvested for silage. The acreage planted to sunflowers is increasing.

All commonly grown and climatically suited crops are suited to the deep, well drained or moderately well drained soils, such as Bonilla, Clarno, Davis, Egan, and Trent soils. Delmont and Enet soils are better suited to early maturing small grain than to the deeper rooted crops, such as corn and alfalfa, because the porous underlying material limits the available water capacity and the depth to which roots can develop.

Pasture plants best suited to the climate and to most of the soils in the survey area include alfalfa, intermediate wheatgrass, and smooth bromegrass. Crested wheatgrass is well suited to Delmont, Enet, and other soils that tend to be droughty. Bunch grasses, such as crested wheatgrass, should not be planted in areas where the slope is more than 6 percent because erosion is a hazard. Pubescent wheatgrass is suited to Dudley and other soils that have a dense claypan subsoil. The choice of pasture plants is limited to water-tolerant species, such as Garrison creeping foxtail and reed canarygrass, on the poorly drained Tetonka and Worthing soils.

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

Yields Per Acre

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

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

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties;

appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

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

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

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*7*). These levels are defined in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

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

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 6.

Rangeland

Dale E. Johnson, district conservationist, Soil Conservation Service, helped write this section.

About 26 percent of the acreage of Miner County is rangeland (*3*). About 70 percent of the farm income is derived from the sale of livestock, principally cattle. Cow-calf-steer enterprises are dominant throughout the county. The average size of farms or ranches is about 599 acres.

The rangeland occurs as scattered tracts throughout the county. The greatest concentration is in the Bon-Clarno, Arlo-Baltic, and Stickney-Dudley-Jerauld associations, which are described under the heading "General Soil Map Units." The soils used as rangeland generally are channeled, wet, or have a dense, sodium affected subsoil near the surface.

On many farms the forage produced on rangeland is supplemented by crop aftermath. In winter it is supplemented by protein concentrate. On some ranches the market weight of calves and yearlings is increased by creep feeding.

In areas that have similar climate and topography, differences in the kind and amount of vegetation

produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for nearly every soil, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 7 follows.

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

Most of the rangeland in Miner County is in Claypan and Silty range sites. The rest is in Clayey, Closed Depression, Saline Lowland, Shallow Marsh, Shallow to Gravel, Overflow, Subirrigated, Thin Claypan, and Wet Meadow range sites. Descriptions and interpretations of each of these range sites are in the Technical Guide, which is available in the local office of the Soil Conservation Service.

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

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

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The native vegetation in many parts of the county has been greatly depleted by continued excessive use. Much of the acreage that was once mixed prairie is now covered with short grasses and weeds. The amount of forage produced may be less than half of that originally produced. The productivity of rangeland can be increased by applying management that is effective on specific soils and range sites.

An adequate plant cover and ground mulch help to control erosion and increase the moisture supply by reducing the runoff rate. If the range is overgrazed, the more desirable tall grasses lose vigor and are replaced by less productive short grasses. Measures that prevent overgrazing help to keep the range in good condition. Crossfencing and properly distributed watering and salting facilities help to obtain a uniform distribution of grazing. Deferred grazing helps to prevent surface compaction on soils that tend to be wet for long periods. Examples are Arlo, Baltic, Hoven, Tetonka, and Worthing soils.

Native Woods, Windbreaks, and Environmental Plantings

Dale E. Johnson, district conservationist, Soil Conservation Service, helped write this section.

Native trees and shrubs grow on about 800 acres in Miner County. They generally grow as clumps and thickets adjacent to drainageways and sloughs. The early settlers used the native trees and shrubs as fuel and as a food supply. Today, the trees and shrubs are used mainly for wildlife habitat.

Scattered individual plants or clumps of American elm, American plum, boxelder, bur oak, common chokecherry, hackberry, false indigo, green ash, western snowberry, and wild rose are common on the Ethan and Clarno soils along drainageways. Willow and cottonwood are common on the margins of some sloughs and on Bon, Clamo, and Lamo soils along flood plains or drainage channels.

Windbreaks have been planted since the days of the early settlers. The early plantings were made mainly to protect farmsteads and livestock. These kinds of windbreaks are still needed. In recent years field windbreaks have been planted to help control wind erosion. They are still needed in many areas.

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

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

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

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

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

The effectiveness of many of the older windbreaks can be improved by planting ponderosa pine, eastern redcedar, or Rocky Mountain juniper between the existing rows. Also, additional trees can be planted on the edges of the existing belts.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Wildlife Habitat

Connie M. Vicuna, biologist, Soil Conservation Service, helped write this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants. The elements used to develop wildlife habitat are crops, forbs and grasses, shrubs, woods, and wetlands and other water sources.

The suitability of soils for the development of specific kinds of wildlife habitat can be determined from various soil interpretations. The soil suitability rating for crop production is an indicator of the capacity of a soil to produce food plots or to support domestic grasses and legumes. Pasture suitability ratings are useful in planning dense ground cover. Native plantings in areas of range should be planned according to range site information. Recommendations for establishing woody cover can be determined from table 8 or the appropriate windbreak suitability group. The suitability for establishing wetland food and cover is determined by the natural drainage. Permeability, depth to bedrock, and slope determine the suitability for the construction of dams and levees. Additional interpretations for the various soils can be obtained from the Technical Guide, which is available at the local office of the Soil Conservation Service.

The county has several public wildlife management areas, mainly in the southwestern quarter. Wildlife is more abundant in the western half of the county than in the eastern half because the extent of undisturbed cover is greater and the landscape is more diverse.

The most abundant wildlife species in the county are those that are suited to agricultural uses. Deer, gray partridge, pheasants, cottontails, and jackrabbits are throughout the county. The coyote population is growing in the northwestern quarter of the county. Predators, including mink, fox, and raccoon, are especially abundant along the drainageways. Meadowlarks, bobolinks, marsh hawks, godwits, and other grassland and cropland birds are common throughout the county. The county is located on a spring migration route for waterfowl. In years of abundant precipitation, waterfowl production is considerable around the shallow wetlands.

Woody cover is limited to windbreaks and to wooded areas along Rock, Redstone, and Wolf Creeks, the West and East Forks of the Vermillion River, and the Little Vermillion River.

Soil associations generally can be used to make interpretations for wildlife habitat. In the following paragraphs the seven soil associations in Miner County, which are described under the heading "General Soil Map Units," are grouped into three wildlife areas that differ from one another in the kind and abundance of wildlife and in the potential for producing habitat elements.

Wildlife Area 1 consists of the Egan-Huntimer-Trent, Clarno-Bonilla-Crossplain, and Clarno-Stickney associations. It makes up about 60 percent of the county. It is intensively used. About 90 to 95 percent of the acreage is cropland. The pheasant population is low because of a lack of undisturbed grassy cover. The lack of dense grassy cover also limits waterfowl production around wetlands, which are in areas of the Tetonka and Worthing soils in depressions and shallow drainageways. Deer use the Vermillion Hills, Silver Lake, and the large wetlands as wintering areas. The windbreaks in this wildlife area provide excellent cover for deer and support abundant bird populations.

This wildlife area is well suited to cropland and rangeland wildlife habitat and has potential for additional wetland wildlife habitat. Availability of the moisture needed for tree establishment and, in some soils, excess

sodium are the only limitations affecting the development of wildlife habitat.

Wildlife Area 2 consists of the Arlo-Baltic and Bon-Clarno associations. It makes up about 10 percent of the county. Tame pasture and hay are the primary uses of the Arlo-Baltic association. About 80 percent of the Bon-Clarno association is range.

The woody habitat of this wildlife area provides food and cover for squirrels and a variety of birds, abundant cover for predators, and winter cover for deer and other wildlife species. The part of the Arlo-Baltic association along the East Fork of the Vermillion River is on a major springtime flyway for geese and includes abundant wetland habitat. Mink, muskrat, and raccoons are common, especially in years of abundant precipitation.

Old Lake Carthage and New Lake Carthage are both dams developed on channels in areas of the Bon-Clarno association. Old Lake Carthage provides good wetland wildlife habitat. New Lake Carthage provides wetland wildlife habitat and deep water habitats that support bullheads, northern pike, bass, walleye, and channel catfish.

This wildlife area is suited to rangeland wildlife habitat. The Arlo-Baltic association is well suited to shallow wetland habitat. Natural woody cover is available in areas of these associations, and additional woody wildlife habitat can be developed.

Wildlife Area 3 consists of the Stickney-Dudley-Jerauld and Houdek-Dudley-Stickney associations. It makes up about 30 percent of the county. These soils have a sodium affected subsoil that restricts root penetration. About 65 to 70 percent of the area is cropland. Corn, small grain, alfalfa, and tame grasses are the major crops.

The range in this area provides abundant grassy cover for pheasant, gray partridge, and prairie chicken. Some deer inhabit this area. Shallow wetlands are abundant and include some saline wetlands.

This wildlife area is suited to shallow wetland, rangeland, and cropland wildlife habitat. The sodium affected subsoil in these soils is the major limitation affecting the development of woody wildlife habitat.

Engineering

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

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

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

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

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

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if

soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

Sanitary Facilities

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

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

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

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the

ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 5 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific

purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

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

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

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

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

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design

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

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

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

Soil Properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 16.

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

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

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 11). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

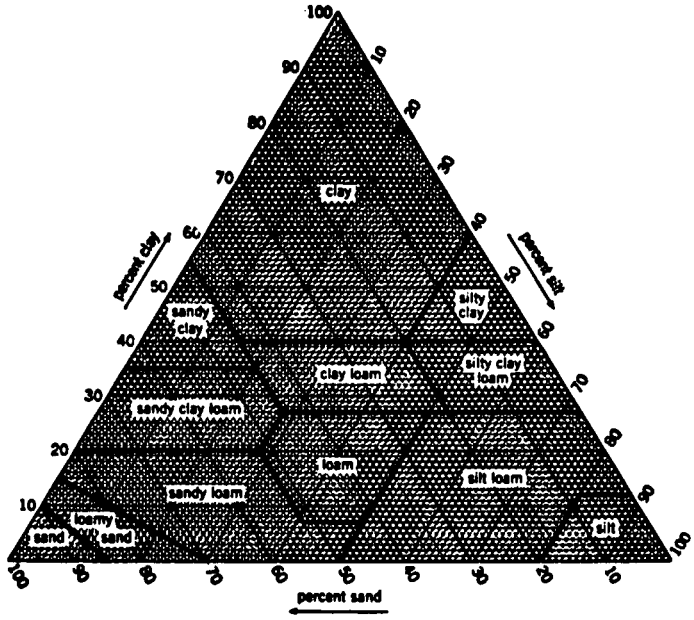

Figure 11.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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

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

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

group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 16.

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

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

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

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

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

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

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

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

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

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

In table 14, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

In table 15, some soils are assigned to two hydrologic groups. The first letter is for drained areas, and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months;

November-May, for example, means that flooding can occur during the period November through May.

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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

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

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

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

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

Engineering Index Test Data

Table 16 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the South Dakota Department of Transportation, Division of Highways.

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*8*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

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

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*6*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*8*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Arlo Series

The Arlo series consists of poorly drained soils that are moderately deep to sandy and gravelly material. These soils formed in glacial outwash on flood plains. Permeability is moderate in the loamy sediments and rapid in the underlying material. Slopes range from 0 to 2 percent.

Arlo soils commonly are near Baltic, Delmont, Enet, and Lamo soils. The nearby soils do not have a calcic horizon. Baltic soils are in positions on the landscape similar to those of the Arlo soils. Delmont, Enet, and Lamo soils are higher on the landscape than the Arlo

soils. Baltic and Lamo soils do not have sand and gravel within a depth of 40 inches. The somewhat excessively drained Delmont and well drained Enet soils do not have a water table within a depth of 5 feet.

Typical pedon of Arlo clay loam, 500 feet north and 1,740 feet west of the southeast corner of sec. 31, T. 108 N., R. 55 W.

A—0 to 7 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; clear smooth boundary.

Ak—7 to 18 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; patches of dark gray (10YR 4/1); weak fine granular structure; slightly hard, friable; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

ACk—18 to 25 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common coarse and fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Ck—25 to 36 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/4) and few fine prominent yellowish brown (10YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine iron and manganese oxide concretions; few medium accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

2C—36 to 60 inches; light brownish gray (2.5Y 6/2) stratified loamy sand, gravelly sand, and loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose; slight effervescence; mildly alkaline.

The depth to the sandy and gravelly underlying material ranges from 30 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 25 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 0 or 1. The Ck horizon has hue of 10YR or 2.5Y and value of 5 to 7 (4 to 6 moist). The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 4. It has thin layers of finer textured material in some pedons.

Baltic Series

The Baltic series consists of deep, poorly drained, slowly permeable soils formed in calcareous, clayey and silty alluvium on flood plains and in depressions on uplands. Slopes are 0 to 1 percent.

Baltic soils are similar to Clamo and Worthing soils and commonly are near Arlo, Chancellor, and Crossplain soils. Arlo soils have a calcic horizon and are 30 to 40 inches deep to sandy and gravelly material. They are in positions on the landscape similar to those of the Baltic soils. The somewhat poorly drained Chancellor and Crossplain soils are in shallow drainageways. Clamo soils are more than 14 inches deep to carbonates. Worthing soils have an argillic horizon.

Typical pedon of Baltic silty clay loam, 633 feet south and 750 feet east of the northwest corner of sec. 2, T. 108 N., R. 55 W.

Ap—0 to 6 inches; dark gray (N 4/0) silty clay loam, black (N 2/0) moist; moderate fine and medium granular structure; slightly hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—6 to 15 inches; dark gray (N 4/0) silty clay loam, black (N 2/0) moist; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

Bg1—15 to 34 inches; dark gray (N 4/0) silty clay, black (N 2/0) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

Bg2—34 to 42 inches; dark gray (N 4/0) silty clay, black (N 2/0) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, sticky and plastic; few fine accumulations of carbonate and salts; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg1—42 to 57 inches; gray (5Y 5/1) silty clay, black (N 2/0) moist; few fine prominent light olive brown (2.5Y 5/4) mottles; moderate medium prismatic structure parting to moderate fine and medium blocky; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg2—57 to 60 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; few fine prominent olive (5Y 4/4) mottles; moderate medium prismatic structure parting to moderate fine and medium blocky; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline.

The thickness of the solum and the thickness of the mollic epipedon range from 30 to 50 inches.

The A horizon is neutral in hue or has hue of 10YR or 2.5Y. It has value of 3 or 4 (2 or 3 moist) and chroma of 1 or less. The B horizon is neutral in hue or has hue of 10YR to 5Y. It has value of 4 or 5 (2 or 3 moist) and chroma of 0 or 1. It is silty clay or silty clay loam.

Bon Series

The Bon series consists of deep, moderately well drained and well drained soils formed in loamy and silty alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Bon soils are similar to Davis soils and commonly are near Clamo, Delmont, Enet, and Lamo soils. The poorly drained Clamo and somewhat poorly drained Lamo soils are slightly lower on the flood plains than the Bon soils. Davis soils are deeper to free carbonates than the Bon soils. Delmont and Enet soils are underlain by gravelly material. They are on terraces.

Typical pedon of Bon loam, 225 feet south and 418 feet east of the northwest corner of sec. 34, T. 108 N., R. 58 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, friable; neutral; clear smooth boundary.

A1—7 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable; neutral; clear wavy boundary.

A2—10 to 27 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; common fine accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

A3—27 to 31 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; common fine and medium accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

A4—31 to 40 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak fine granular; slightly hard, friable; common fine threads of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C1—40 to 55 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, friable; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C2—55 to 60 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; many fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; slightly hard, friable; many fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 15 inches. The thickness of the mollic epipedon ranges from 20 to more than 60 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. The C horizon has value of 3 to 6 (2 to 4 moist) and chroma of 1 to 3. It dominantly is loam but in some pedons is stratified loam, silt loam, fine sandy loam, and clay loam.

Bonilla Series

The Bonilla series consists of deep, moderately well drained soils formed in loamy alluvium over loamy glacial till. These soils are in swales on uplands. Permeability is moderate in the solum and moderately slow in the underlying material. Slopes range from 0 to 6 percent.

Bonilla soils are similar to Davis and Trent soils and commonly are near Clarno and Crossplain soils. The well drained Clarno soils are on the higher parts of the landscape. They have a mollic epipedon that is less than 20 inches thick. The somewhat poorly drained Crossplain soils are slightly lower on the landscape than the Bonilla soils. Davis soils are well drained. The subsoil of Trent soils contains less sand than that of the Bonilla soils.

Typical pedon of Bonilla loam, in an area of Clarno-Bonilla loams, 0 to 3 percent slopes, 2,055 feet east and 224 feet south of the northwest corner of sec. 11, T. 107 N., R. 55 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A—9 to 13 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; medium acid; few pebbles; clear wavy boundary.

Bw1—13 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable; few pebbles; slightly acid; gradual wavy boundary.

Bw2—17 to 27 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; slightly hard, friable; few pebbles; neutral; clear wavy boundary.

BCk—27 to 37 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few pebbles; few dark stains (iron and manganese oxide); common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

Ck—37 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; few fine prominent yellowish brown (10YR 5/8) mottles;

massive; hard, friable, slightly sticky and slightly plastic; few pebbles; few fine dark stains (iron and manganese oxide); common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 40 inches. The thickness of the mollic epipedon and the depth to free carbonates range from 23 to 33 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is 7 to 15 inches thick. The B horizon has value of 3 or 4 (2 or 3 moist). In some pedons it is clay loam. The C horizon is loam or clay loam.

Chancellor Series

The Chancellor series consists of deep, somewhat poorly drained soils formed in silty and clayey alluvium in swales and shallow drainageways on uplands. Permeability is slow. Slopes are 0 to 1 percent.

Chancellor soils are similar to Crossplain soils and commonly are near Baltic, Egan, Tetonka, and Trent soils. The poorly drained Baltic soils are in depressions. They are not so deep to free carbonates as the Chancellor soils. Crossplain soils contain more sand throughout than the Chancellor soils. The well drained Egan soils are higher on the landscape than the Chancellor soils. The poorly drained Tetonka soils are in depressions. The moderately well drained Trent soils are in positions on the landscape similar to those of the Chancellor soils.

Typical pedon of Chancellor silty clay loam, in an area of Chancellor-Tetonka complex, 955 feet south and 420 feet west of the northeast corner of sec. 25, T. 108 N., R. 55 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A—7 to 14 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable, sticky and plastic; slightly acid; clear smooth boundary.

Bt1—14 to 27 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate coarse prismatic structure parting to moderate fine blocky; hard, very firm, sticky and plastic; neutral; clear smooth boundary.

Bt2—27 to 31 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; common fine faint dark brown (10YR 4/3) mottles; moderate medium prismatic structure parting to moderate fine blocky; hard, very firm, sticky and plastic; black (10YR 2/1) coatings on faces of peds; mildly alkaline; clear smooth boundary.

BCkg—31 to 43 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very firm, sticky and plastic; few fine concretions (iron and manganese oxide); many fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Ckg—43 to 49 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; many medium distinct yellowish brown (10YR 5/6) and light gray (N 6/0) mottles; moderate medium blocky structure; hard, firm, sticky and plastic; common medium concretions (iron and manganese oxide); many fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Cyg—49 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; many fine faint gray (10YR 5/1), many fine distinct yellowish brown (10YR 5/4), and many fine prominent strong brown (7.5YR 5/6) mottles; massive; hard, firm, sticky and plastic; few fine nests of gypsum and other salts; common fine concretions (iron and manganese oxide); common fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 44 inches. The thickness of the mollic epipedon ranges from 24 to 35 inches.

The A horizon has hue of 2.5Y or 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 1. The B horizon has hue of 2.5Y or 10YR. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (5 or 6 moist), and chroma of 2 or 3.

Clamo Series

The Clamo series consists of deep, poorly drained soils formed in alluvium on flood plains. Permeability is slow. Slopes are 0 to 1 percent.

Clamo soils are similar to Baltic soils and commonly are near Bon and Lamo soils. Baltic soils have free carbonates at or near the surface. The moderately well drained Bon soils are on the high parts of the flood plains. Lamo soils contain less clay than the Clamo soils. They are in positions on the landscape similar to those of the Clamo soils.

Typical pedon of Clamo silty clay loam, 1,050 feet west and 2,528 feet north of the southeast corner of sec. 33, T. 108 N., R. 57 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; neutral; abrupt smooth boundary.
A—7 to 14 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate very fine and fine blocky; slightly hard, friable, sticky and plastic; neutral; clear wavy boundary.
Bkg—14 to 29 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; weak medium and coarse prismatic structure parting to moderate fine blocky; hard, firm, sticky and plastic; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.
BCkg—29 to 42 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; weak medium and coarse prismatic structure parting to moderate fine and medium blocky; hard, firm, sticky and plastic; many fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.
Ckg—42 to 60 inches; gray (5Y 5/1) stratified silt loam and sandy clay loam, dark gray (5Y 4/1) moist; massive; hard, friable; common fine dark concretions (iron and manganese oxide); many fine and medium accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 48 inches. The depth to free carbonates ranges from 14 to 30 inches. The thickness of the mollic epipedon ranges from 24 to 48 inches.

The A horizon has hue of 10YR, 2.5Y, or 5Y and value of 3 or 4 (2 or 3 moist). The B horizon has hue of 2.5Y or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay loam or silty clay. In some pedons the C horizon is not stratified.

Clarno Series

The Clarno series consists of deep, well drained and moderately well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 15 percent.

Clarno soils are similar to Egan and Houdek soils and commonly are near Bonilla, Crossplain, Egan, Ethan, and Stickney soils. Bonilla soils have a mollic epipedon that is more than 20 inches thick. They are in swales. The somewhat poorly drained Crossplain soils are in drainageways and swales. Egan soils contain more silt and less sand in the solum than the Clarno soils. Ethan soils have free carbonates at or near the surface. They are on knolls and the more sloping parts of the landscape. Houdek soils have an argillic horizon. Stickney soils have a natric horizon. They are on the less sloping parts of the landscape.

Typical pedon of Clarno loam, in an area of Clarno-Ethan complex, 2 to 6 percent slopes, 1,056 feet west and 1,954 feet north of the southeast corner of sec. 23, T. 107 N., R. 55 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; few pebbles; slightly acid; abrupt smooth boundary.
Bw1—6 to 10 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few pebbles; neutral; clear wavy boundary.
Bw2—10 to 15 inches; brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; few pebbles; neutral; clear wavy boundary.
BCk—15 to 28 inches; light yellowish brown (10YR 6/4) clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few pebbles; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.
Ck—28 to 43 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; common fine distinct light gray (10YR 7/1) and yellowish brown (10YR 5/6) mottles; weak coarse and medium subangular blocky structure; slightly hard, friable; few pebbles; common fine dark stains; common fine accumulations of carbonate; strong effervescence; moderately alkaline; diffuse wavy boundary.
C—43 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common fine prominent strong brown (7.5YR 5/6) and common fine distinct gray (N 5/0) mottles; weak coarse and medium subangular blocky structure; slightly hard, firm, slightly sticky and plastic; few pebbles; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 41 inches. The depth to free carbonates ranges from 15 to 25 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. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 or 3. It is loam or clay loam. The C horizon also is loam or clay loam.

Crossplain Series

The Crossplain series consists of deep, somewhat poorly drained soils formed in a thin mantle of local loamy alluvium and in the underlying loamy glacial till. These soils are in swales and shallow drainageways on uplands. Permeability is slow. Slopes range from 0 to 2 percent.

Crossplain soils are similar to Chancellor soils and commonly are near Baltic, Bonilla, Clarno, and Tetonka soils. The poorly drained Baltic soils are on flood plains and in depressions on uplands. The moderately well drained Bonilla soils are in swales on uplands. They contain less clay in the subsoil than the Crossplain soils. Chancellor soils contain less sand in the subsoil than the Crossplain soils. The well drained and moderately well drained Clarno soils are higher on the landscape than the Crossplain soils. The poorly drained Tetonka and Worthing soils are in the lower parts of drainageways and in depressions.

Typical pedon of Crossplain loam, in an area of Clarno-Crossplain loams, 0 to 2 percent slopes, 430 feet south and 2,615 feet east of the northwest corner of sec. 35, T. 105 N., R. 58 W.

Ap—0 to 11 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; few pebbles; neutral; abrupt smooth boundary.

Bt—11 to 27 inches; dark gray (5Y 4/1) clay loam, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to moderate fine blocky; hard, firm, sticky and plastic; black (5Y 2/1) coatings on faces of peds; few pebbles; neutral; gradual wavy boundary.

Btg—27 to 38 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; common fine distinct olive (5Y 5/4) mottles; moderate coarse prismatic structure parting to moderate medium blocky; hard, firm, sticky and plastic; very dark gray (5Y 3/1) coatings on faces of peds; few pebbles; neutral; clear wavy boundary.

BCkg—38 to 44 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; common fine faint olive (5Y 5/4) mottles; moderate medium blocky structure; hard, firm, sticky and plastic; few pebbles; olive gray (5Y 4/2) coatings on faces of peds; common fine dark concretions (iron and manganese oxide); few fine accumulations of gypsum and other salts; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

Cg—44 to 53 inches; light olive gray (5Y 6/2) loam, olive gray (5Y 5/2) moist; common fine distinct olive (5Y 5/6 and 5Y 5/4) mottles; massive; hard, friable; few pebbles; common fine dark concretions (iron and manganese oxide); slight effervescence; mildly alkaline; clear wavy boundary.

Cyg—53 to 60 inches; pale olive (5Y 6/3) loam, olive (5Y 5/3) moist; common fine distinct olive (5Y 5/6) and common coarse distinct gray (5Y 6/1) mottles; massive; hard, friable; few pebbles; many fine accumulations of gypsum; common medium dark concretions (iron and manganese oxide); many fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 44 inches. The depth to free carbonates ranges from 21 to 38 inches. The thickness of the mollic epipedon ranges from 21 to 33 inches.

The A horizon has value of 3 or 4 (2 moist) and chroma of 1. The Btg horizon has hue of 2.5Y or 5Y and value of 3 to 5 (2 to 4 moist). It is clay loam or clay. The C horizon has hue of 2.5Y or 5Y, value of 6 (4 or 5 moist), and chroma of 1 to 3. It is loam or clay loam.

Davis Series

The Davis series consists of deep, well drained soils formed in loamy alluvium on foot slopes and fans in the uplands. Permeability is moderate. Slopes range from 1 to 4 percent.

Davis soils are similar to Bon and Bonilla soils and commonly are near Clarno and Ethan soils. Bon soils are not so deep to free carbonates as the Davis soils. They are on flood plains. The moderately well drained Bonilla soils are in swales on uplands. Clarno and Ethan soils have a mollic epipedon that is less than 20 inches thick. They are higher on the landscape than the Davis soils.

Typical pedon of Davis loam, 1 to 4 percent slopes, 1,226 feet east and 241 feet north of the southwest corner of sec. 35, T. 108 N., R. 55 W.

A—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

BA—6 to 16 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

Bw1—16 to 29 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

Bw2—29 to 40 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

BC—40 to 50 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium

subangular blocky structure; slightly hard, friable; mildly alkaline; gradual wavy boundary.
Ck—50 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; common fine faint brown (10YR 4/3) mottles; massive; slightly hard, friable; common fine accumulations of carbonate; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 50 inches. The depth to free carbonates ranges from 29 to 55 inches. The thickness of the mollic epipedon ranges from 29 to 49 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 to 3. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 3 or 4. It dominantly is loam or clay loam, but in some pedons it has thin layers of sand.

Delmont Series

The Delmont series consists of somewhat excessively drained soils that are shallow to gravelly sand. These soils formed in loamy alluvium. They are on terraces. Permeability is moderate in the solum and rapid in the underlying material. Slopes range from 0 to 4 percent.

Delmont soils are similar to Enet soils and commonly are near Arlo and Enet soils. The poorly drained Arlo soils are on flood plains. The well drained Enet soils are more than 20 inches deep to gravelly material.

Typical pedon of Delmont loam, in an area of Enet-Delmont loams, 0 to 4 percent slopes, 370 feet south and 2,203 feet east of the northwest corner of sec. 1, T. 108 N., R. 56 W.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable; few pebbles; neutral; clear smooth boundary.
Bw1—6 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few pebbles; neutral; clear smooth boundary.
Bw2—12 to 16 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common pebbles; mildly alkaline; clear wavy boundary.
2Ck—16 to 48 inches; multicolored gravelly sand; single grain; loose; carbonates on the underside of pebbles; violent effervescence; moderately alkaline; clear wavy boundary.
2C—48 to 60 inches; multicolored gravelly sand; single grain; loose; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 14 to 18 inches and corresponds to the depth to the gravelly underlying material. The thickness of the mollic epipedon ranges from 10 to 18 inches.

The A horizon has value of 3 or 4 (2 moist) and chroma of 1 or 2. The B horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. The 2C horizon is multicolored gravelly sand or gravelly loamy sand.

Dudley Series

The Dudley series consists of deep, moderately well drained soils formed in glacial till on uplands. Permeability is slow. Slopes range from 0 to 6 percent.

Dudley soils commonly are near Durrstein, Houdek, Jerauld, Stickney, and Tetonka soils. Durrstein and Jerauld soils have visible salts within a depth of 16 inches. The poorly drained Durrstein soils are on flood plains. The moderately well drained Jerauld soils are in small pits and depressions. The well drained Houdek soils are on rises. They do not have a natric horizon. Stickney soils do not have columnar structure in the Bt horizon. They are on the higher parts of the landscape. The poorly drained Tetonka soils are in depressions.

Typical pedon of Dudley silt loam, in an area of Stickney-Dudley complex, 2,190 feet west and 195 feet north of the southeast corner of sec. 6, T. 108 N., R. 57 W.

A—0 to 6 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak thin platy structure parting to weak fine granular; soft, very friable; few pebbles; slightly acid; clear wavy boundary.
E—6 to 9 inches; gray (10YR 5/1) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak fine granular; soft, very friable; few pebbles; neutral; abrupt smooth boundary.
Bt—9 to 17 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to moderate medium blocky; very hard, very firm, sticky and plastic; dark gray (10YR 4/1) coatings on the tops of columnar peds; shiny films on vertical faces of peds; few pebbles; neutral; clear wavy boundary.
Btz—17 to 22 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium blocky; very hard, very firm, slightly sticky and plastic; few pebbles; few accumulations of gypsum and other salts; mildly alkaline; clear wavy boundary.
BCz—22 to 29 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, very firm, sticky and plastic; few pebbles; few accumulations

of gypsum and other salts; mildly alkaline; clear wavy boundary.

Ckz—29 to 47 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium blocky; hard, firm, slightly sticky and plastic; few pebbles; many fine dark concretions (iron and manganese oxide); few fine accumulations of gypsum and other salts; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—47 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common medium distinct light olive brown (2.5Y 5/4) mottles; massive; hard, firm, slightly sticky and plastic; few pebbles; many large dark concretions (iron and manganese oxide); few fine accumulations of gypsum and other salts; many large accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 23 to 39 inches. The depth to free carbonates ranges from 18 to 32 inches. The depth to visible salts ranges from 16 to 23 inches. The thickness of the mollic epipedon ranges from 21 to 38 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is silt loam but in some pedons is loam. The E horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is 1 to 3 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is clay loam or clay. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Durrstein Series

The Durrstein series consists of deep, poorly drained soils formed in clayey and loamy alluvium on flood plains. Permeability is very slow. Slopes range from 0 to 2 percent.

Durrstein soils are similar to Hoven soils and commonly are near Dudley, Jerauld, and Stickney soils. The moderately well drained Dudley, Jerauld, and Stickney soils are on uplands. Also, Dudley and Stickney soils do not have visible salts within a depth of 16 inches. Hoven soils are in depressions in the uplands. They are deeper to salts than the Durrstein soils.

Typical pedon of Durrstein silt loam, 588 feet north and 1,815 feet west of the southeast corner of sec. 20, T. 108 N., R. 57 W.

E—0 to 2 inches; light gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, friable; neutral; abrupt smooth boundary.

Bt—2 to 7 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium columnar structure parting to strong fine blocky; very hard, very firm; few pebbles; light gray (10YR 6/1) coatings on the tops of columnar peds; few fine dark concretions (iron and manganese oxide); mildly alkaline; clear wavy boundary.

Btz—7 to 17 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, very firm; few pebbles; common fine accumulations of salts; mildly alkaline; clear wavy boundary.

BCz—17 to 33 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm; few pebbles; few fine accumulations of carbonate; common fine accumulations of salts; moderately alkaline; clear irregular boundary.

Ck—33 to 47 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; massive; very hard, very firm; few pebbles; strongly alkaline; violent effervescence; abrupt wavy boundary.

C—47 to 60 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; many medium distinct yellowish brown (10YR 5/4) and common medium prominent yellowish brown (10YR 5/8) mottles; massive; very hard, firm, sticky and plastic; few pebbles; few fine dark concretions (iron and manganese oxide); few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to visible salts ranges from 5 to 15 inches.

The E horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It is 1 to 3 inches thick. The Bt horizon has hue of 10YR or 2.5Y and value of 4 or 5 (2 or 3 moist). It is silty clay, clay, or clay loam. The C horizon has hue of 2.5Y or 5Y and value of 5 to 7 (3 to 6 moist). In some pedons sand and gravel are below a depth of 40 inches.

Egan Series

The Egan series consists of deep, well drained soils formed in silty sediments over loamy glacial till. These soils are on uplands. Permeability is moderate in the solum and moderately slow in the underlying material. Slopes range from 1 to 7 percent.

Egan soils are similar to Clarno and Huntimer soils and commonly are near Chancellor, Clarno, Ethan, Huntimer, and Trent soils. The somewhat poorly drained Chancellor soils are in shallow drainageways. Clarno soils contain more sand and less silt in the solum than the Egan soils. Ethan soils have free carbonates at or near the surface. They are on knolls and the more sloping parts of the landscape. Huntimer soils contain more clay in the

subsoil than the Egan soils. Trent soils have a mollic epipedon that is more than 20 inches thick. They are in swales.

Typical pedon of Egan silty clay loam, in an area of Egan-Trent silty clay loams, 1 to 4 percent slopes, 350 feet north and 2,503 feet west of the southeast corner of sec. 36, T. 108 N., R. 55 W.

A1—0 to 3 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, sticky and slightly plastic; neutral; abrupt smooth boundary.

A2—3 to 9 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; slightly acid; clear wavy boundary.

Bw—9 to 22 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, sticky and plastic; neutral; gradual wavy boundary.

BCk—22 to 30 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, sticky and plastic; common medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Ck—30 to 38 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, sticky and plastic; many medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

2C—38 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; few medium prominent yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, slightly sticky and plastic; many fine dark stains (iron and manganese oxide); strong effervescence; moderately alkaline.

The thickness of the solum and the depth to clay loam glacial till range from 24 to 38 inches. The depth to free carbonates ranges from 20 to 25 inches. The mollic epipedon is 9 to 11 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 to 4. The 2C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4.

Enet Series

The Enet series consists of well drained soils that are moderately deep to gravelly sandy loam. These soils formed in loamy alluvium on terraces. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 4 percent.

These soils contain more silt and clay in the underlying material than is definitive for the Enet series. This difference, however, does not significantly alter the usefulness or behavior of the soils.

Enet soils are similar to Delmont soils and commonly are near Arlo, Bon, and Delmont soils. The poorly drained Arlo and moderately well drained Bon soils are on flood plains. The somewhat excessively drained Delmont soils are 14 to 18 inches deep to gravelly material.

Typical pedon of Enet loam, in an area of Enet-Delmont loams, 0 to 4 percent slopes, 1,185 feet south and 2,185 feet west of the northeast corner of sec. 2, T. 106 N., R. 58 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; very weak fine granular structure; soft, very friable; few small pebbles; neutral; clear smooth boundary.

Bw1—6 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; few small pebbles; neutral; clear wavy boundary

Bw2—16 to 21 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; few small pebbles; neutral; clear wavy boundary.

Ck—21 to 31 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; common coarse accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

2C—31 to 60 inches; multicolored gravelly sandy loam; single grain; loose; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 21 to 25 inches. The depth to free carbonates and the thickness of the mollic epipedon commonly correspond to the thickness of the solum.

The A horizon has value of 3 or 4 (2 moist) and chroma of 1 or 2. The B horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is loam or clay loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Ethan Series

The Ethan series consists of deep, well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the solum and moderately slow in the underlying material. Slopes range from 2 to 15 percent.

Ethan soils commonly are near Clarno and Egan soils. The nearby soils are deeper to carbonates than the Ethan soils. They are on the smoother parts of the landscape.

Typical pedon of Ethan clay loam, in an area of Clarno-Ethan complex, 2 to 6 percent slopes, 1,095 feet west and 2,105 feet north of the southeast corner of sec. 23, T. 107 N., R. 55 W.

Ap—0 to 8 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; few pebbles; violent effervescence; mildly alkaline; abrupt smooth boundary.

Bk—8 to 18 inches; light yellowish brown (10YR 6/4) clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common fine and medium accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

Ck—18 to 29 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct gray (10YR 6/1) mottles; weak coarse subangular blocky structure; hard, friable; few pebbles; common medium and fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—29 to 60 inches; pale yellow (5Y 7/3) clay loam, olive (5Y 4/4) moist; common medium prominent brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few pebbles; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 28 inches. The depth to free carbonates is 0 to 5 inches. The mollic epipedon is 7 to 10 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It dominantly is clay loam but is loam in some pedons. The B horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam or clay loam.

Houdek Series

The Houdek series consists of deep, well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 6 percent.

Houdek soils are similar to Clarno soils and commonly are near Dudley, Hoven, and Tetonka soils. Clarno soils do not have an argillic horizon. The moderately well drained Dudley and poorly drained Hoven soils have a natric horizon. Dudley soils are in slight depressions. Hoven soils and the poorly drained Tetonka soils are in depressions.

Typical pedon of Houdek loam, in an area of Houdek-Dudley-Tetonka complex, 0 to 6 percent slopes, 1,455 feet west and 470 feet north of the southeast corner of sec. 9, T. 106 N., R. 56 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; few pebbles; neutral; clear smooth boundary.

Bt1—6 to 9 inches; dark brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few pebbles; neutral; clear wavy boundary.

Bt2—9 to 16 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few pebbles; neutral; clear wavy boundary.

BCk—16 to 27 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; common fine prominent yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few pebbles; many medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—27 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; many fine prominent yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few pebbles; many fine dark stains (iron and manganese oxide); common medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 33 inches. The depth to free carbonates ranges from 14 to 22 inches. The thickness of the mollic epipedon ranges from 14 to 20 inches.

The A horizon has value of 3 to 5 (2 or 3 moist). The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Hoven Series

The Hoven series consists of deep, poorly drained soils formed in clayey and loamy alluvium in depressions on uplands. Permeability is very slow. Slopes are 0 to 1 percent.

Hoven soils are similar to Durrstein soils and commonly are near Dudley, Houdek, and Stickney soils. The moderately well drained Dudley and Stickney soils are higher on the landscape than the Hoven soils. Durrstein soils have visible salts within a depth of 15 inches. They are on flood plains. The well drained Houdek soils are on uplands.

Typical pedon of Hoven silt loam, 2,330 feet south and 196 feet east of the northwest corner of sec. 31, T. 107 N., R. 58 W.

A—0 to 4 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; few pebbles; neutral; abrupt smooth boundary.

E—4 to 5 inches; light gray (10YR 6/1) silty clay loam, very dark gray (10YR 3/1) moist; weak thin platy structure; soft, very friable; few pebbles; neutral; abrupt wavy boundary.

Bt1—5 to 9 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate coarse columnar structure parting to strong medium blocky; very hard, very firm, sticky and plastic; light gray (10YR 6/1) coatings on the tops of columns; mildly alkaline; clear wavy boundary.

Bt2—9 to 21 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; weak coarse prismatic structure parting to strong medium blocky; very hard, very firm, sticky and plastic; few pebbles; mildly alkaline; gradual wavy boundary.

BCk—21 to 37 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; common fine distinct olive brown (2.5Y 4/4) and few fine faint dark gray (N 4/0) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; few pebbles; few fine concretions (iron and manganese oxide); common fine and coarse accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Ckz—37 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common medium distinct dark gray (N 4/0) and few fine distinct dark yellowish brown (10YR 4/6) mottles; massive; hard, very firm, slightly sticky and slightly plastic; few pebbles; few fine concretions (iron and manganese oxide); many fine accumulations of carbonate; common fine accumulations of salts; strong effervescence; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; light gray (5Y 6/1) clay loam, gray (5Y 5/1) moist; many medium distinct dark gray (N 4/0) and olive (2.5Y 4/4) mottles; massive; hard, very firm, sticky and slightly plastic; few pebbles; few fine concretions (iron and manganese oxide); few medium accumulations of gypsum and other salts; few medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 40 inches. The depth to free carbonates ranges from 20 to 30 inches. The depth to visible salts ranges from 30 to 40 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. Some pedons do not have an A horizon. The E horizon has value of 5 to 7 (2 to 4 moist) and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay loam, silty clay, clay loam, or clay. The C horizon has hue of 2.5Y or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 to 3. It is clay loam, silty clay loam, or silty clay.

Huntimer Series

The Huntimer series consists of deep, well drained soils formed in clayey and silty lacustrine material on uplands. Permeability is moderately slow. Slopes range from 0 to 6 percent.

Huntimer soils are similar to Egan soils and commonly are near Chancellor, Egan, and Trent soils. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. Egan soils contain less clay in the subsoil than the Huntimer soils. The moderately well drained Trent soils are in swales. They have a mollic epipedon that is more than 20 inches thick.

Typical pedon of Huntimer silty clay loam, 0 to 2 percent slopes, 2,300 feet south and 1,320 feet west of the northeast corner of sec. 13, T. 108 N., R. 55 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, sticky and slightly plastic; slightly acid; abrupt smooth boundary.

Bw1—10 to 14 inches; grayish brown (10YR 5/2) silty clay, brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak fine and medium subangular blocky; hard, firm, sticky and plastic; black (10YR 2/1) coatings on faces of peds; slightly acid; clear wavy boundary.

Bw2—14 to 22 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; clear wavy boundary.

BCk—22 to 31 inches; pale yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—31 to 60 inches; light gray (2.5Y 7/2) silty clay loam, light olive brown (2.5Y 5/4) moist; many fine distinct light brownish gray (2.5Y 6/2) mottles; weak coarse subangular blocky structure; slightly hard, friable, sticky and plastic; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 35 inches. The depth to free carbonates ranges from 16 to 22 inches. The thickness of the mollic epipedon ranges from 10 to 16 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has value of 4 or 5 (2 to 4 moist) and chroma of 1 to 3. It is silty clay or silty clay loam. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. It dominantly is silty clay loam or silt loam but in some pedons has thin layers of fine sand.

Jerauld Series

The Jerauld series consists of deep, moderately well drained soils formed in glacial till on uplands. Permeability is very slow. Slopes range from 0 to 2 percent.

Jerauld soils commonly are near Dudley, Durrstein, and Stickney soils. Dudley and Stickney soils do not have visible salts within a depth of 16 inches. They are slightly higher on the landscape than the Jerauld soils. The poorly drained Durrstein soils are on flood plains.

Typical pedon of Jerauld silt loam, in an area of Dudley-Jerauld silt loams, 1,280 feet west and 255 feet south of the northeast corner of sec. 19, T. 108 N., R. 58 W.

E—0 to 2 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; few pebbles; neutral; abrupt smooth boundary.

Bt—2 to 14 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium columnar structure parting to moderate fine and medium subangular blocky; very hard, very firm, sticky and plastic; few pebbles; gray (10YR 6/1) coatings on the tops of columnar peds; neutral; clear wavy boundary.

BCkz—14 to 24 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium blocky structure parting to moderate fine blocky; very hard, very firm, slightly sticky and slightly plastic; few pebbles; few fine dark concretions (iron and manganese oxide); common fine accumulations of salts and carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Ckz—24 to 44 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few pebbles; few fine accumulations of gypsum and other salts; few fine dark concretions (iron and manganese oxide); few medium accumulations of carbonate; strong effervescence; moderately alkaline; diffuse wavy boundary.

C—44 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; many coarse distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of gypsum and other salts; many fine dark concretions (iron and manganese oxide); strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 26 inches. The depth to free carbonates and visible salts ranges from 6 to 16 inches.

The E horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is 1 to 3 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay or clay loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 4.

Lamo Series

The Lamo series consists of deep, somewhat poorly drained soils formed in calcareous, silty alluvium on flood plains. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Lamo soils commonly are near Arlo, Bon, and Clamo soils. The poorly drained Arlo and Clamo soils are in positions on the landscape similar to those of the Lamo soils. Arlo soils are underlain by sandy and gravelly material. Clamo soils contain more clay throughout than the Lamo soils. The moderately well drained Bon soils are higher on the flood plain than the Lamo soils.

Typical pedon of Lamo silty clay loam, 840 feet east and 970 feet north of the southwest corner of sec. 36, T. 108 N., R. 55 W.

A1—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine and medium granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

A2—7 to 21 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium and fine subangular blocky structure parting to weak medium and fine granular; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

AC—21 to 27 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; violent

effervescence; moderately alkaline; clear wavy boundary.
Ck—27 to 47 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.
Ckg—47 to 60 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; few fine prominent olive (5Y 4/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum and the thickness of the mollic epipedon range from 24 to 30 inches. The depth to free carbonates ranges from 0 to 8 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2.

Stickney Series

The Stickney series consists of deep, moderately well drained soils formed in loamy glacial till on uplands. Permeability is slow. Slopes range from 0 to 6 percent.

Stickney soils commonly are near Clarno, Dudley, Durrstein, and Jerauld soils. Clarno soils do not have a natric horizon. Dudley soils have columnar structure in the Bt1 horizon. Clarno and Dudley soils are in positions on the landscape similar to those of the Stickney soils. Durrstein and Jerauld soils have visible salts within a depth of 16 inches. The poorly drained Durrstein soils are on flood plains. The moderately well drained Jerauld soils are in small pits and depressions.

Typical pedon of Stickney loam, in an area of Clarno-Stickney-Tetonka complex, 0 to 2 percent slopes, 1,890 feet north and 525 feet east of the southwest corner of sec. 31, T. 107 N., R. 58 W.

A—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable; few pebbles; slightly acid; clear smooth boundary.
E—6 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure parting to weak medium granular; slightly hard, friable; few pebbles; slightly acid; clear wavy boundary.
Bt1—10 to 12 inches; very dark gray (10YR 3/1) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine blocky; hard, friable, sticky and plastic; few pebbles; grayish brown (10YR 5/2) coatings on faces of peds; slightly acid; clear wavy boundary.
Bt2—12 to 28 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; few pebbles; neutral; clear wavy boundary.
BCk—28 to 36 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; few pebbles; many fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.
Ck—36 to 43 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; hard, friable; few pebbles; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.
C—43 to 60 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable; few pebbles; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 46 inches. The depth to free carbonates ranges from 20 to 36 inches. The thickness of the mollic epipedon ranges from 21 to 36 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. The B horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 or 2. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam or clay loam. In some pedons it has visible salts.

Tetonka Series

The Tetonka series consists of deep, poorly drained soils formed in local alluvium in depressions on uplands. Permeability is slow. Slopes are 0 to 1 percent.

Tetonka soils are similar to Worthing soils and commonly are near Chancellor, Clarno, Crossplain, Dudley, Houdek, and Stickney soils. The somewhat poorly drained Chancellor and Crossplain soils are in swales and shallow drainageways. The well drained Clarno and Houdek and moderately well drained Dudley and Stickney soils are higher on the landscape than the Tetonka soils. Worthing soils do not have an E horizon.

Typical pedon of Tetonka silt loam, 2,350 feet south and 2,083 feet east of the northwest corner of sec. 22, T. 108 N., R. 55 W.

A1—0 to 6 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak thin platy structure parting to moderate fine granular; slightly hard, friable; few pebbles; slightly acid; clear wavy boundary.

A2—6 to 16 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak thin platy structure parting to moderate fine granular; slightly hard, friable; slightly acid; few pebbles; clear wavy boundary.

E—16 to 23 inches; light gray (10YR 7/1) silt loam, dark gray (10YR 4/1) moist; weak medium platy structure; slightly hard, friable; few pebbles; slightly acid; clear wavy boundary.

Bt—23 to 37 inches; dark gray (5Y 4/1) silty clay loam, black (5Y 2/1) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; few pebbles; neutral; gradual wavy boundary.

Btg—37 to 51 inches; gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; many medium distinct olive (5Y 5/3) mottles; weak medium prismatic structure parting to moderate medium blocky; hard, firm, sticky and plastic; few pebbles; very dark gray (5Y 3/1) coatings on faces of peds; many fine dark concretions (iron and manganese oxide); neutral; gradual wavy boundary.

Ckg—51 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; many medium distinct olive (5Y 5/4) mottles; massive; hard, firm, sticky and plastic; few pebbles; many fine dark concretions (iron and manganese oxide); few fine accumulations of carbonate; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 45 to 60 inches. The depth to free carbonates ranges from 36 to 60 inches. The thickness of the mollic epipedon ranges from 28 to 49 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The E horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. The Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 or 2. It is silty clay or silty clay loam. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 1 or 2.

Trent Series

The Trent series consists of deep, moderately well drained soils formed in silty alluvium in swales on uplands. Permeability is moderate. Slopes range from 1 to 4 percent.

Trent soils are similar to Bonilla soils and commonly are near Chancellor, Egan, and Huntimer soils. The subsoil of Bonilla soils contains more sand and less silt than that of the Trent soils. The somewhat poorly drained Chancellor soils are slightly lower on the landscape than the Trent soils. Egan and Huntimer soils have a mollic epipedon that is less than 20 inches thick. They are higher on the landscape than the Trent soils.

Typical pedon of Trent silty clay loam, in an area of Egan-Trent silty clay loams, 1 to 4 percent slopes, 160 feet north and 2,520 feet west of the southeast corner of sec. 36, T. 108 N., R. 55 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; medium acid; clear smooth boundary.

A—7 to 11 inches; dark gray (10YR 4/1) silty clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable; medium acid; clear smooth boundary.

Bw1—11 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine prismatic structure parting to weak medium subangular blocky; slightly hard, friable, sticky and plastic; slightly acid; clear smooth boundary.

Bw2—15 to 31 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, sticky and plastic; neutral; gradual wavy boundary.

BCk—31 to 38 inches; light yellowish brown (10YR 6/4) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, friable; few fine accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

Ck—38 to 51 inches; light yellowish brown (10YR 6/4) silt loam, brown (10YR 5/3) moist; common fine distinct yellowish brown (10YR 5/6) and common fine faint pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; slightly hard, friable; few fine dark concretions (iron and manganese oxide); many fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—51 to 60 inches; pale brown (10YR 6/3) and very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) and pale brown (10YR 6/3) moist; many medium distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable; many fine dark concretions (iron and manganese oxide); strong effervescence; moderately alkaline.

The thickness of the solum ranges from 38 to 49 inches. The depth to free carbonates ranges from 31 to 60 inches. The thickness of the mollic epipedon ranges from 28 to 39 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has value of 3 to 5 (2 to 4 moist) and chroma of 2 to 4. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Worthing Series

The Worthing series consists of deep, poorly drained and very poorly drained soils formed in alluvium in depressions on uplands. Permeability is slow. Slopes are 0 to 1 percent.

Worthing soils are similar to Baltic and Tetonka soils and commonly are near Chancellor and Crossplain soils. Baltic soils have free carbonates at the surface. The somewhat poorly drained Chancellor and Crossplain soils are in swales and shallow drainageways. Tetonka soils have an E horizon.

Typical pedon of Worthing silty clay loam, 830 feet west and 100 feet south of the northeast corner of sec. 26, T. 107 N., R. 55 W.

A—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; few pebbles; slightly acid; clear wavy boundary.

Bt1—9 to 19 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; common fine distinct dark yellowish brown (10YR 4/6) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, slightly sticky and slightly plastic; few pebbles; neutral; clear wavy boundary.

Bt2—19 to 27 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure parting to strong fine blocky; hard, firm, sticky and plastic; few pebbles; neutral; clear wavy boundary.

Bt3—27 to 36 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; common fine distinct grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to strong fine and medium blocky; hard, firm, sticky and plastic; few pebbles; neutral; gradual wavy boundary.

BCkg—36 to 47 inches; gray (N 5/0) silty clay, dark gray (N 4/0) moist; common medium faint grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate fine and medium blocky; hard, firm, sticky and plastic; few pebbles; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Ckg—47 to 60 inches; gray (N 5/0) silty clay, dark gray (5Y 4/1) moist; common fine distinct light olive brown (2.5Y 5/4) mottles; massive; hard, firm, sticky and plastic; few pebbles; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 50 inches. The depth to free carbonates ranges from 36 to 50 inches. The thickness of the mollic epipedon ranges from 36 to 48 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1. The C horizon is neutral in hue or has hue of 2.5Y or 5Y. It has value of 4 to 6 (3 to 5 moist) and chroma of 2 or less. It is silty clay, clay, or silty clay loam.

Formation of the Soils

Soil forms when chemical and physical processes act on geologically deposited or accumulated material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil having genetically related horizons. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in Miner County.

Climate

Climate directly influences the rate of chemical and physical weathering. Miner County has a continental climate marked by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. The precipitation is sufficient to leach carbonates in most soils to an average depth of about 16 inches. The climate is generally uniform throughout the county and thus as a separate factor does not differentiate the soils within the county. Additional climatic data are given under the heading "General Nature of the County."

Plant and Animal Life

Plants, animals, insects, earthworms, bacteria, and fungi have an important effect on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In Miner County the tall and mid prairie grasses have had more influence than other living organisms on soil formation. As a result of these grasses, the surface layer of many soils has a moderate or high content of organic matter. Bonilla soils are an example.

Earthworms, insects, and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose plant residue, thus releasing plant nutrients.

Parent Material

The soils in Miner County formed in glacial material derived from preglacial formations of granite, gneiss, limestone, sandstone, and shale. The glacier ground up and mixed these materials as it transported them. It then redeposited them as it melted. Some deposits consist of material sorted either by water as the material was deposited or by wind and water after it was deposited; others consist of unsorted material, or glacial till.

The glacial till in Miner County generally is loamy or silty. The silty glacial till is only in areas on the Coteau des Prairies, in the northeast corner of the county. The loamy glacial till is on the James River Lowlands, which occupy the rest of the county.

The silty glacial till was deposited on glacial ice and then reworked by water as the glacier melted. Huntimer soils formed in silty glaciolacustrine deposits. Egan soils formed in a thin mantle of silty glacial till over loamy glacial till. Loamy glacial till is a mixture of clay, silt, sand, and gravel that contains few to many cobblestones and boulders. The content of pebbles and cobblestones is higher than that in the silty glacial till. The proportion of each kind of material is determined by the kind of material picked up by the glacier. Among the soils that formed in loamy glacial till are Clarno, Ethan, and Houdek.

Glacial outwash is sandy, gravelly, and loamy material deposited by glacial melt water. Delmont and Enet soils formed in loamy material underlain by sand and gravel within a depth of 40 inches. They generally are on terraces along the West Fork of the Vermillion River and the Little Vermillion River.

Bonilla, Davis, and Tetonka are examples of soils that formed partly or entirely in local alluvium washed in from adjacent sloping upland soils. Bon, Clamo, and Lamo soils formed in alluvium deposited by streams.

Relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the steeper soils, such as Ethan soils, much of the rainfall runs off the surface. Because of the excessive runoff, a limited amount of moisture penetrates the surface. Much of the surface soil is lost through erosion. As a result, these soils have a thin surface layer and are calcareous at or near the surface. Runoff is slower on Clarno and Houdek soils than on the Ethan soils. As a result, more moisture penetrates the surface and the layers in which organic matter accumulates are thicker. Also, calcium carbonate is leached to a depth of more than 14 inches.

Bonilla and Trent soils are in swales that receive extra moisture in the form of runoff from adjacent soils. The layers in which organic matter accumulates are thicker than those in the Clarno and Houdek soils. Also, calcium carbonate is leached to a greater depth. The seasonal high water table in Durrstein and other soils that are in areas where drainage is impeded favors the concentration of salts.

Time

The length of time that the climate, plant and animal life, and relief have affected the parent material helps to determine the kind of soil that forms. All of the soils in Miner County are young. The youngest are those on active flood plains, such as Bon soils.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vols., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Baumberger, Rodney. 1977. South Dakota rangeland resources. Old West Reg. Comm., 150 pp., illus.

(4) Flint, Richard Foster. 1955. Pleistocene geology of eastern South Dakota. U.S. Geol. Surv., Prof. Pap. 262, 173 pp., illus.

(5) South Dakota Crop and Livestock Reporting Service. 1968. Miner County agriculture. 62 pp., illus.

(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(7) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(8) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(9) United States Department of Agriculture. 1976. South Dakota land use—1975 estimates. Soil Conserv. Serv., 65 pp., illus.

(10) United States Department of Commerce, Bureau of the Census. 1979. 1978 census of agriculture. Vol. 1, Part 41, illus.

Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour farming. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

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 they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

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.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water through cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing

crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes recognized in this survey area are as follows:

	Percent
Level	0 to 1
Nearly level or gently undulating	0 to 2
Nearly level or gently undulating	0 to 3
Gently sloping or undulating	2 to 6
Moderately sloping	6 to 9
Strongly sloping or rolling	9 to 15

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the

underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded and 6 to 15 inches (15 to 38 centimeters) in length if flat.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. Includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-79 at Howard, S. Dak.]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	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----	22.4	1.5	12.0	47	-29	0	0.43	0.10	0.69	1	4.6
February---	30.5	8.9	19.7	56	-27	15	.70	.21	1.09	2	6.1
March------	41.6	20.1	30.9	73	-10	74	1.22	.51	1.83	4	6.7
April------	59.4	34.1	46.8	87	13	239	2.21	1.13	3.15	5	1.5
May--------	72.0	45.3	58.7	92	24	580	3.05	1.48	4.40	7	.0
June-------	81.1	55.3	68.2	99	37	846	3.68	2.16	5.02	8	.0
July-------	87.7	60.6	74.2	104	43	1,060	2.57	1.29	3.67	5	.0
August-----	86.0	58.6	72.3	102	42	1,001	2.53	1.53	3.42	5	.0
September--	75.2	48.0	61.6	98	27	648	2.06	.92	3.02	5	.0
October----	62.7	37.2	50.0	85	14	331	1.41	.36	2.26	3	.4
November---	43.6	22.7	33.2	71	-5	27	.85	.20	1.36	2	2.7
December---	29.1	9.5	19.3	54	-22	8	.61	.22	.92	2	5.8
Yearly:											
Average--	57.6	33.5	45.6	---	---	---	---	---	---	---	---
Extreme--	---	---	---	105	-29	---	---	---	---	---	---
Total----	---	---	---	---	---	4,829	21.32	17.51	24.93	49	27.8

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-79 at Howard, S. Dak.]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 5	May 19	May 24
2 years in 10 later than--	April 29	May 13	May 19
5 years in 10 later than--	April 19	May 1	May 10
First freezing temperature in fall:			
1 year in 10 earlier than--	September 28	September 21	September 11
2 years in 10 earlier than--	October 4	September 26	September 16
5 years in 10 earlier than--	October 16	October 7	September 27

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-79 at Howard, S. Dak.]

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	156	136	119
8 years in 10	164	143	126
5 years in 10	180	158	139
2 years in 10	195	172	152
1 year in 10	203	180	159

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ar	Arlo clay loam	4,560	1.2
Ba	Baltic silty clay loam	1,865	0.5
Bn	Bon loam	4,395	1.2
Bo	Bon loam, channeled	5,795	1.6
Ca	Chancellor-Tetonka complex	735	0.2
Cc	Clamo silty clay loam	815	0.2
CfA	Clarno-Bonilla loams, 0 to 3 percent slopes	38,560	10.6
CfB	Clarno-Bonilla loams, 1 to 6 percent slopes	38,715	10.7
CgA	Clarno-Crossplain loams, 0 to 2 percent slopes	28,980	7.9
CkB	Clarno-Ethan complex, 2 to 6 percent slopes	23,586	6.4
CnA	Clarno-Stickney-Tetonka complex, 0 to 2 percent slopes	25,850	7.1
CnB	Clarno-Stickney-Tetonka complex, 0 to 6 percent slopes	29,640	8.1
Ct	Crossplain-Tetonka complex	23,360	6.4
Da	Davis loam, 1 to 4 percent slopes	710	0.2
Do	Dudley-Jerauld silt loams	8,570	2.3
Du	Durrstein silt loam	4,185	1.1
EbB	Egan-Trent silty clay loams, 1 to 4 percent slopes	1,765	0.5
EdA	Enet-Delmont loams, 0 to 4 percent slopes	9,675	2.6
EgC	Ethan-Clarno complex, 6 to 9 percent slopes	4,460	1.2
EgD	Ethan-Clarno complex, 9 to 15 percent slopes	1,015	0.3
EmB	Ethan-Egan complex, 3 to 7 percent slopes	535	0.1
HdA	Houdek-Dudley complex, 0 to 2 percent slopes	19,540	5.3
HdB	Houdek-Dudley complex, 2 to 6 percent slopes	11,065	3.0
HgA	Houdek-Dudley-Tetonka complex, 0 to 3 percent slopes	15,235	4.2
HgB	Houdek-Dudley-Tetonka complex, 0 to 6 percent slopes	31,240	8.5
Ho	Hoven silt loam	1,705	0.5
HuA	Huntimer silty clay loam, 0 to 2 percent slopes	760	0.2
HxB	Huntimer-Egan silty clay loams, 2 to 6 percent slopes	900	0.2
La	Lamo silty clay loam	3,265	0.9
Sd	Stickney-Dudley complex	9,060	2.5
Te	Tetonka silt loam	4,075	1.1
Wo	Worthing silty clay loam	6,875	1.9
Wp	Worthing silty clay loam, ponded	3,200	0.9
	Water	1,408	0.4
	Total	366,099	100.0

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
Ar	Arlo clay loam (where drained and protected from flooding)
Bn	Bon loam
Cc	Clamo silty clay loam (where drained)
CfA	Clarno-Bonilla loams, 0 to 3 percent slopes
CfB	Clarno-Bonilla loams, 1 to 6 percent slopes
CgA	Clarno-Crossplain loams, 0 to 2 percent slopes (where drained and protected from flooding)
CkB	Clarno-Ethan complex, 2 to 6 percent slopes
Da	Davis loam, 1 to 4 percent slopes
EbB	Egan-Trent silty clay loams, 1 to 4 percent slopes
HuA	Huntimer silty clay loam, 0 to 2 percent slopes
HxB	Huntimer-Egan silty clay loams, 2 to 6 percent slopes
La	Lamo silty clay loam (where drained)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Oats	Spring wheat	Grain sorghum	Barley	Alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Bu	Bu	Tons	AUM*
Ar Arlo	IIIw-3	60	61	20	63	57	3.0	5.0
Ba Baltic	Vw-2	---	---	---	---	---	---	---
Bn Bon	IIc-3	81	72	30	75	---	3.3	5.5
Bo Bon	VIw-1	---	---	---	---	---	3.3	5.5
Ca		57	53	17	58	52	3.1	5.1
Chancellor	IIw-2							
Tetonka	IIw-1							
Cc Clamo	IIw-2	61	60	20	63	56	2.8	4.7
CfA		72	73	30	70	72	2.9	4.7
Clarno	IIc-2							
Bonilla	IIc-3							
CfB		67	72	28	73	68	2.7	4.7
Clarno	IIe-2							
Bonilla	IIc-3							
CgA		64	69	25	67	66	3.3	5.5
Clarno	IIc-2							
Crossplain	IIw-1							
CkB		63	67	26	65	65	2.6	4.4
Clarno	IIe-2							
Ethan	IIIe-12							
CnA		58	55	21	60	53	2.9	4.7
Clarno	IIc-2							
Stickney	IIIs-1							
Tetonka	IIw-1							
CnB		53	50	19	52	51	2.7	4.5
Clarno	IIe-2							
Stickney	IIIe-3							
Tetonka	IIw-1							
Ct		57	53	17	58	52	3.1	5.1
Crossplain	IIw-2							
Tetonka	IIw-1							
Da Davis	IIe-3	70	72	28	68	68	2.9	4.8
Do		---	38	12	30	40	1.4	2.2
Dudley	IVs-2							
Jerauld	VIs-1							
Du Durrstein	VIw-4	---	---	---	---	---	---	---
EbB		76	76	30	73	72	2.9	4.7
Egan	IIe-3							
Trent	I-3							

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Oats	Spring wheat	Grain sorghum	Barley	Alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Bu	Bu	Tons	AUM*
EdA---		45	49	18	43	50	1.7	2.9
Enet---	IIIs-2							
Delmont---	IVs-1							
EgC---		49	48	13	46	49	2.3	3.7
Ethan---	IVe-3							
Clarno---	IIIe-2							
EgD---		---	---	---	---	---	2.2	3.5
Ethan---	VIe-3							
Clarno---	IVe-1							
EmB---		55	62	23	54	60	2.6	4.4
Ethan---	IIIe-6							
Egan---	IIe-3							
HdA---		50	46	16	47	48	2.1	3.6
Houdek---	IIc-2							
Dudley---	IVs-2							
HdB---		47	42	15	45	47	2.1	3.4
Houdek---	IIe-2							
Dudley---	IVs-3							
HgA---		41	41	14	35	43	2.2	3.7
Houdek---	IIc-2							
Dudley---	IVs-2							
Tetonka---	IIw-1							
HgB---		38	40	14	33	42	2.1	3.5
Houdek---	IIe-2							
Dudley---	IVs-3							
Tetonka---	IIw-1							
Ho---	VIs-1	---	---	---	---	---	---	---
Hoven								
HuA---	IIs-2	72	67	26	67	65	3.0	5.0
Huntimer								
HxB---	IIe-3	66	65	26	65	65	2.7	4.7
Huntimer-Egan								
La---	IIw-2	69	69	24	66	66	3.2	5.1
Lamo								
Sd---		44	45	15	39	46	2.0	3.4
Stickney---	IIIs-1							
Dudley---	IVs-2							
Te---	IVw-2	---	---	---	---	---	---	---
Tetonka								
Wo---	Vw-2	---	---	---	---	---	---	---
Worthing								
Wp---	VIIIw-1	---	---	---	---	---	---	---
Worthing								

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Ar—Arlo	Subirrigated	4,500	4,500	3,600
Ba—Baltic	Shallow Marsh	7,400	6,700	5,400
Bo—Bon	Overflow	4,500	4,000	2,800
Bs*:				
Bon, frequently flooded	Subirrigated	4,900	4,400	3,500
Bon, rarely flooded	Overflow	4,200	3,800	3,000
Ch*:				
Chancellor	Overflow	4,800	4,200	2,900
Tetonka	Wet Meadow	4,800	4,200	2,900
Co—Clamo	Overflow	4,300	3,800	2,600
CrA*:				
Clamo	Silty	3,600	3,000	2,100
Worilla	Overflow	4,400	4,000	2,800
CrB*:				
Clamo	Silty	3,600	3,000	2,100
Worilla	Overflow	4,400	4,000	2,800
DgA*:				
Clamo	Silty	3,600	3,000	2,100
Crossplain	Overflow	4,300	3,600	2,600
DrB*:				
Clamo	Silty	3,600	3,000	2,100
Ethan	Silty	3,300	2,800	2,000
DsA*, DsB*:				
Clamo	Silty	3,600	3,000	2,100
Stickney	Clayey	3,400	2,800	2,000
Tetonka	Wet Meadow	4,800	4,200	2,900
Dt*:				
Crossplain	Overflow	4,300	3,600	2,600
Tetonka	Wet Meadow	4,800	4,200	2,900
Du—Tonka	Silty	3,800	3,200	2,300
Ju*:				
Dudley	Claypan	2,800	2,300	1,600
Jerauld	Thin Claypan	1,900	1,600	1,100
Du—Durratein	Saline Lowland	3,600	3,400	2,700

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
EbB*:				
Egan	Silty	3,800	3,200	2,300
Trent	Silty	4,800	4,000	2,800
EdA*:				
Enet	Silty	3,100	2,600	1,800
Delmont	Shallow to Gravel	2,500	2,100	1,300
EgC*:				
Ethan	Silty	3,300	2,800	2,000
Clarno	Silty	3,300	2,800	2,000
EgD*:				
Ethan	Silty	3,100	2,600	1,800
Clarno	Silty	3,300	2,800	2,000
EmB*:				
Ethan	Silty	3,300	2,800	2,000
Egan	Silty	3,800	3,200	2,300
HdA*, HdB*:				
Houdek	Silty	3,500	2,900	2,000
Dudley	Claypan	2,800	2,300	1,600
HgA*, HgB*:				
Houdek	Silty	3,500	2,900	2,000
Dudley	Claypan	2,800	2,300	1,600
Tetonka	Wet Meadow	4,800	4,200	2,900
Ho	Closed Depression	3,900	3,500	2,500
Hoven				
HuA	Silty	3,800	3,200	2,300
Huntimer				
HxB*:				
Huntimer	Silty	3,800	3,200	2,300
Egan	Silty	3,800	3,200	2,300
La	Subirrigated	6,600	6,000	4,800
Lamo				
Sd*:				
Stickney	Clayey	3,400	2,800	2,000
Dudley	Claypan	2,800	2,300	1,600
Te	Wet Meadow	4,800	4,200	2,900
Tetonka				
Wo	Shallow Marsh	6,800	6,200	5,000
Worthing				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ar---------- Arlo	Siberian peashrub	Common chokecherry, Tatarian honeysuckle.	Green ash, ponderosa pine, blue spruce, hackberry, Manchurian crabapple, eastern redcedar.	Golden willow, honeylocust.	Eastern cottonwood.
Ba. Baltic					
Bn, Bo*---------- Bon	Lilac----------	Siberian peashrub, American plum, Tatarian honeysuckle.	Hackberry, green ash, blue spruce, ponderosa pine, Russian mulberry, eastern redcedar.	Honeylocust-------	Eastern cottonwood.
Ca*: Chancellor-------	Lilac----------	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, eastern redcedar.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
Tetonka----------	Lilac----------	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, eastern redcedar.	Golden willow, green ash, silver maple, honeylocust.	Eastern cottonwood.
Cc---------- Clamo	Lilac----------	Common chokecherry, Tatarian honeysuckle, Siberian peashrub.	Green ash, ponderosa pine, hackberry, eastern redcedar.	Silver maple, golden willow, honeylocust.	Eastern cottonwood.
CfA*, CfB*: Clarno----------	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, green ash, hackberry, Russian-olive, bur oak, honeylocust.	Siberian elm------	---
Bonilla----------	Lilac----------	Common chokecherry, Siberian peashrub, Tatarian honeysuckle.	Ponderosa pine, blue spruce, green ash, hackberry, Russian mulberry, eastern redcedar.	Honeylocust-------	Eastern cottonwood.
CgA*: Clarno----------	Tatarian honeysuckle, lilac.	Eastern redcedar, Siberian peashrub, common chokecherry.	Honeylocust, green ash, hackberry, bur oak, ponderosa pine, Russian-olive.	Siberian elm------	---
Crossplain-------	Lilac----------	Siberian peashrub, Tatarian honeysuckle, common chokecherry.	Eastern redcedar, hackberry, ponderosa pine, green ash.	Honeylocust, golden willow, silver maple.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
CkB*:					
Clarno	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, green ash, hackberry, Russian-olive, bur oak, honeylocust.	Siberian elm	---
Ethan	Siberian peashrub, silver buffaloberry, lilac, skunkbush sumac.	Ponderosa pine, Russian-olive, hackberry, Rocky Mountain juniper, eastern redcedar.	Siberian elm, green ash, honeylocust.	---	---
CnA*, CnB*:					
Clarno	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, green ash, hackberry, Russian-olive, bur oak, honeylocust.	Siberian elm	---
Stickney	Skunkbush sumac, lilac.	Russian-olive, eastern redcedar, Manchurian crabapple, Rocky Mountain juniper, Tatarian honeysuckle, Siberian peashrub.	Green ash, hackberry, honeylocust.	Siberian elm	---
Tetonka	Lilac	Common chokecherry, Siberian peashrub, Tatarian honeysuckle.	Hackberry, green ash, ponderosa pine, eastern redcedar.	Golden willow, silver maple, honeylocust.	Eastern cottonwood.
Ct*:					
Crossplain	Lilac	Siberian peashrub, Tatarian honeysuckle, common chokecherry.	Eastern redcedar, hackberry, ponderosa pine, green ash.	Honeylocust, golden willow, silver maple.	Eastern cottonwood.
Tetonka	Lilac	Common chokecherry, Siberian peashrub, Tatarian honeysuckle.	Hackberry, green ash, ponderosa pine, eastern redcedar.	Golden willow, silver maple, honeylocust.	Eastern cottonwood.
Da Davis	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Honeylocust, ponderosa pine, bur oak, green ash, hackberry, Russian-olive.	Siberian elm	---
Do*:					
Dudley Jerauld.	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Du. Durrstein					
EbB*: Egan	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Trent	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, golden willow, green ash, hackberry.	Eastern cottonwood.
EdA*: Enet	Siberian peashrub, Peking cotoneaster, lilac.	Ponderosa pine, Manchurian crabapple, Russian-olive, eastern redcedar, bur oak, Rocky Mountain juniper.	Siberian elm, green ash, honeylocust.	---	---
Delmont	Lilac, Peking cotoneaster.	Bur oak, eastern redcedar, Rocky Mountain juniper, ponderosa pine, Manchurian crabapple, Siberian peashrub.	Siberian elm, honeylocust, green ash, Russian-olive.	---	---
EgC*, EgD*: Ethan	Siberian peashrub, silver buffaloberry, lilac, skunkbush sumac.	Ponderosa pine, Russian-olive, hackberry, Rocky Mountain juniper, eastern redcedar.	Siberian elm, green ash, honeylocust.	---	---
Clarno	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, green ash, hackberry, Russian-olive, bur oak, honeylocust.	Siberian elm------	---
EmB*: Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Egan	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
HdA*, HdB*: Houdek	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, green ash, hackberry, Russian-olive, bur oak, honeylocust.	Siberian elm	---
Dudley	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
HgA*, HgB*: Houdek	Tatarian honeysuckle, lilac.	Eastern redcedar, common chokecherry, Siberian peashrub.	Ponderosa pine, green ash, hackberry, Russian-olive, bur oak, honeylocust.	Siberian elm	---
Dudley	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Tetonka	Lilac	Common chokecherry, Siberian peashrub, Tatarian honeysuckle.	Hackberry, green ash, ponderosa pine, eastern redcedar.	Golden willow, silver maple, honeylocust.	Eastern cottonwood.
Ho. Hoven					
HuA Huntimer	---	American plum, Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, Russian-olive, eastern redcedar, blue spruce, bur oak.	Green ash, ponderosa pine, honeylocust.	---
HxB*: Huntimer	---	American plum, Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, Russian-olive, eastern redcedar, blue spruce, bur oak.	Green ash, ponderosa pine, honeylocust.	---
Egan	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
La Lamo	Lilac	Tatarian honeysuckle, common chokecherry, Siberian peashrub.	Eastern redcedar, ponderosa pine, hackberry, green ash, Manchurian crabapple.	Honeylocust, golden willow.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Sd*:					
Stickney	Skunkbush sumac, lilac.	Russian-olive, eastern redcedar, Manchurian crabapple, Rocky Mountain juniper, Tatarian honeysuckle, Siberian peashrub.	Green ash, hackberry, honeylocust.	Siberian elm	---
Dudley	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Te. Tetonka					
Wo. Worthing					
Wp. Worthing					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ar---------- Arlo	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.
Ba---------- Baltic	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.
Bn---------- Bon	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, frost action.
Bo*: Bon, frequently flooded---------	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.
Bon, rarely flooded---------	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, frost action.
Ca*: Chancellor-------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, wetness.
Tetonka----------	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Cc---------- Clamo	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.
CfA*: Clarno----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Bonilla----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
CfB*: Clarno----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Bonilla----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
CgA*: Clarno----------	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
CgA*: Crossplain	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.
CkB*: Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
CnA*: Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Stickney	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
CnB*: Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Stickney	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Ct*: Crossplain	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.
Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Da Davis	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Do*: Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Jerauld	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Du Durrstein	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, wetness.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
EbB*:					
Egan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Trent	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.
EdA*:					
Enet	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Delmont	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
EgC*:					
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
EgD*:					
Ethan	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
Clarno	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
EmB*:					
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Egan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
HdA*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
HdB*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
HgA*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
HgA*: Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
HgB*: Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Ho Hoven	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: ponding, low strength, shrink-swell.
HuA Huntimer	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
HxB*: Huntimer	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Egan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
La Lamo	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.
Sd*: Stickney	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Dudley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Te Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Wo Worthing	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: low strength, ponding, frost action.
Wp Worthing	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ar Arlo	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: too sandy, small stones, wetness.
Ba Baltic	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Bn Bon	Moderate: flooding, wetness, percs slowly.	Severe: seepage, flooding.	Severe: seepage, wetness.	Moderate: flooding, wetness.	Good.
Bo*: Bon, frequently flooded	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: wetness.
Bon, rarely flooded	Moderate: flooding, wetness, percs slowly.	Severe: seepage, flooding.	Severe: seepage, wetness.	Moderate: flooding, wetness.	Good.
Ca*: Chancellor	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
Cc Clamo	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
CfA*: Clarno	Severe: percs slowly.	Slight	Slight	Slight	Good.
Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
CfB*: Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CgA*:					
Clarno	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Slight	Fair: wetness.
Crossplain	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
CkB*:					
Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
CnA*:					
Clarno	Severe: percs slowly.	Slight	Slight	Slight	Good.
Stickney	Severe: percs slowly.	Slight	Severe: excess sodium, excess salt.	Slight	Poor: hard to pack, excess salt, excess sodium.
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
CnB*:					
Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Stickney	Severe: percs slowly.	Moderate: slope.	Severe: excess sodium, excess salt.	Slight	Poor: hard to pack, excess salt, excess sodium.
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
Ct*:					
Crossplain	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
Da Davis	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Do*:					
Dudley	Severe: percs slowly.	Slight	Severe: excess sodium.	Slight	Poor: hard to pack, excess sodium.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Do*:					
Jerauld	Severe: percs slowly.	Slight	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
Du Durrstein	Severe: flooding, percs slowly, wetness.	Slight	Severe: flooding, too clayey, wetness.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
EbB*:					
Egan	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
Trent	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
EdA*:					
Enet	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Delmont	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage, too sandy.
EgC*:					
Ethan	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
Clarno	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
EgD*:					
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Clarno	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
EmB*:					
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Egan	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
HdA*:					
Houdek	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Dudley	Severe: percs slowly.	Slight	Severe: excess sodium.	Slight	Poor: hard to pack, excess sodium.
HdB*:					
Houdek	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HdB*:					
Dudley	Severe: percs slowly.	Moderate: slope.	Severe: excess sodium.	Slight	Poor: hard to pack, excess sodium.
HgA*:					
Houdek	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Dudley	Severe: percs slowly.	Slight	Severe: excess sodium.	Slight	Poor: hard to pack, excess sodium.
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
HgB*:					
Houdek	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Dudley	Severe: percs slowly.	Moderate: slope.	Severe: excess sodium.	Slight	Poor: hard to pack, excess sodium.
Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
Ho Hoven	Severe: percs slowly, ponding.	Slight	Severe: too clayey, ponding, excess sodium.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
HuA Huntimer	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Poor: hard to pack.
HxB*:					
Huntimer	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
Egan	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
La Lamo	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack.
Sd*:					
Stickney	Severe: percs slowly.	Slight	Severe: excess sodium, excess salt.	Slight	Poor: hard to pack, excess salt, excess sodium.
Dudley	Severe: percs slowly.	Slight	Severe: excess sodium.	Slight	Poor: hard to pack, excess sodium.
Te Tetonka	Severe: percs slowly, ponding.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Wo---------- Worthing	Severe: percs slowly, ponding.	Slight----------	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Wp---------- Worthing	Severe: percs slowly, ponding.	Severe: ponding.	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable"]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ar Arlo	Poor: wetness.	Probable	Probable	Poor: area reclaim, wetness.
Ba Baltic	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Bn Bon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Bo*: Bon, frequently flooded	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Bon, rarely flooded	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ca*: Chancellor	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
Cc Clamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
CfA*, CfB*: Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bonilla	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
CgA*: Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Crossplain	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
CkB*: Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
CnA*, CnB*: Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CnA*, CnB*:				
Stickney	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
Ct*:				
Crossplain	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
Da	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Davis				
Do*:				
Dudley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Jerauld	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Du	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness, excess sodium.
Durrstein				
EbB*:				
Egan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Trent	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
EdA*:				
Enet	Good	Probable	Probable	Poor: small stones, area reclaim.
Delmont	Good	Probable	Probable	Poor: small stones, area reclaim.
EgC*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
EgD*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EmB*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
Egan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
HdA*, HdB*:				
Houdek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Dudley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
HgA*, HgB*:				
Houdek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Dudley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
Ho Hoven	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
HuA Huntimer	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
HxB*:				
Huntimer	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Egan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
La Lamo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Sd*:				
Stickney	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Dudley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Te Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
Wo Worthing	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wp Worthing	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ar Arlo	Severe: seepage.	Severe: wetness, seepage.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Wetness.
Ba Baltic	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Bn Bon	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Bo*: Bon, frequently flooded	Moderate: seepage.	Moderate: piping.	Flooding, frost action.	Wetness, flooding.	Wetness	Favorable.
Bon, rarely flooded	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Ca*: Chancellor	Slight	Severe: hard to pack.	Percs slowly, flooding, frost action.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Cc Clamo	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
CfA*: Clarno	Moderate: seepage.	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
Bonilla	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
CfB*: Clarno	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Bonilla	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
CgA*: Clarno	Moderate: seepage.	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
Crossplain	Slight	Severe: wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
CkB*: Clarno	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
CnA*: Clarno	Moderate: seepage.	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
CnA*:						
Stickney	Slight	Severe: hard to pack, excess salt, excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, erodes easily, percs slowly.
Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
CnB*:						
Clarno	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Stickney	Moderate: slope.	Severe: hard to pack, excess salt, excess sodium.	Deep to water	Percs slowly, excess sodium, slope.	Percs slowly, erodes easily.	Excess sodium, erodes easily, percs slowly.
Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Ct*:						
Crossplain	Slight	Severe: wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Da Davis	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Do*:						
Dudley	Slight	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
Jerauld	Slight	Severe: hard to pack, excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, droughty, erodes easily.
Du Durrstein	Slight	Severe: hard to pack, wetness, excess sodium.	Flooding, percs slowly, excess salt.	Wetness, excess sodium, percs slowly.	Wetness, percs slowly, erodes easily.	Excess sodium, excess salt, wetness.
EbB*:						
Egan	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Trent	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
EdA*:						
Enet	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
Delmont	Severe: seepage.	Severe: seepage.	Deep to water	Droughty	Too sandy	Droughty.
EgC*:						
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
EgC*:						
Clarno	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
EgD*:						
Ethan	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Clarno	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
EmB*:						
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Egan	Moderate: seepage, slope.	Moderate: piping, hard to pack.	Deep to water	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
HdA*:						
Houdek	Slight	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
Dudley	Slight	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
HdB*:						
Houdek	Moderate: slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Dudley	Moderate: slope.	Severe: excess sodium.	Deep to water	Percs slowly, slope, excess sodium.	Percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
HgA*:						
Houdek	Slight	Slight	Deep to water	Favorable	Erodes easily	Erodes easily.
Dudley	Slight	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
HgB*:						
Houdek	Moderate: slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Dudley	Slight	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Ho Hoven	Slight	Severe: hard to pack, ponding, excess sodium.	Percs slowly, ponding, excess salt.	Ponding, percs slowly, excess sodium.	Wetness, percs slowly.	Percs slowly, wetness, excess sodium.
HuA Huntimer	Slight	Severe: hard to pack.	Deep to water	Favorable	Favorable	Favorable.
HxB*:						
Huntimer	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope	Favorable	Favorable.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
HxB*: Fgan	Moderate: seepage, slope.	Moderate: piping, hard to pack.	Deep to water	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
La, Lamo	Slight	Moderate: piping, hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Favorable.
Sd*: Stickney	Slight	Severe: hard to pack, excess salt, excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, erodes easily, percs slowly.
Dudley	Slight	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, percs slowly, erodes easily.
Te, Tetonka	Slight	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Wo, Worthing	Slight	Severe: hard to pack, ponding.	Ponding, frost action, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly, erodes easily.	Wetness, percs slowly.
Wp, Worthing	Slight	Severe: hard to pack, ponding.	Percs slowly, ponding, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ar---------- Arlo	0-7	Clay loam---------	CL, ML, CH, MH	A-6, A-7	0-5	95-100	90-100	70-100	60-95	35-60	10-30
	7-36	Loam, clay loam	ML, CL	A-6, A-7	0-5	95-100	90-100	70-100	55-85	30-50	10-30
	36-60	Stratified loamy fine sand to very gravelly sand.	GM, SM, SM-SC, SP-SM	A-2, A-1, A-3	0-5	60-100	40-95	35-65	5-35	<35	NP-10
Ba---------- Baltic	0-15	Silty clay loam	CL, CH, MH	A-7	0	100	100	90-100	85-100	40-65	15-35
	15-42	Silty clay, clay, silty clay loam.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-70	20-40
	42-60	Silty clay, silty clay loam, clay loam.	CL, CH, MH, ML	A-6, A-7	0	100	95-100	80-100	65-100	35-70	15-35
Bn, Bo*---------- Bon	0-27	Loam----------	CL-ML, CL	A-4, A-6	0	100	95-100	80-95	55-85	25-40	5-15
	27-60	Stratified silty clay loam to fine sandy loam.	ML, SM, SC, CL	A-4, A-6, A-7	0	95-100	95-100	75-95	45-95	25-45	3-22
Ca*: Chancellor------	0-14	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	85-100	35-55	15-25
	14-31	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	31-60	Silty clay loam, clay loam, loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	85-100	70-100	35-55	15-25
Tetonka----------	0-16	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	16-23	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	30-50	10-25
	23-51	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	51-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
Cc---------- Clamo	0-7	Silty clay loam	CL, CH, MH, ML	A-7	0	100	95-100	90-100	85-100	45-75	20-40
	7-42	Silty clay, silty clay loam.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-80	20-45
	42-60	Stratified fine sandy loam to silty clay.	CL, CH	A-6, A-7	0	100	95-100	85-95	60-95	35-60	15-30
CfA*, CfB*: Clarno----------	0-6	Loam----------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-20
	6-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	28-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Bonilla----------	0-13	Loam----------	CL-ML, CL	A-4, A-6, A-7	0	100	95-100	75-100	50-90	25-45	5-20
	13-37	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-50	10-25
	37-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22
CgA*: Clarno----------	0-6	Loam----------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	3-18
	6-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	28-60	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 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CgA*:											
Crossplain------	0-11	Loam----------	CL, ML	A-6, A-7	0	100	100	90-100	60-85	30-50	10-20
	11-38	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-90	40-55	15-30
	38-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
CkB*:											
Clarno----------	0-6	Loam----------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-20
	6-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	28-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Ethan----------	0-8	Clay loam--------	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-18	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	18-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
CnA*, CnB*:											
Clarno----------	0-6	Loam----------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-20
	6-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	28-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Stickney--------	0-10	Loam----------	CL, ML	A-4, A-6, A-7	0	95-100	95-100	85-100	60-90	30-50	8-20
	10-28	Clay loam, silty clay loam, clay.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-95	40-60	14-34
	28-60	Clay loam, loam	CL, CH, MH, ML	A-6, A-7	0-5	95-100	90-100	80-100	55-90	35-60	10-35
Tetonka---------	0-16	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	16-23	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	30-50	10-25
	23-51	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	51-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
Ct*:											
Crossplain------	0-11	Loam----------	CL, ML	A-6, A-7	0	100	100	90-100	60-85	30-50	10-20
	11-38	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-90	40-55	15-30
	38-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
Tetonka---------	0-16	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	16-23	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	30-50	10-25
	23-51	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	51-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
Da---------- Davis	0-6	Loam----------	CL, ML	A-6, A-7, A-4	0	100	90-100	80-100	60-85	30-45	5-20
	6-40	Loam, silt loam, clay loam.	CL, ML	A-6, A-7	0	100	90-100	80-100	60-85	35-45	10-20
	40-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	55-90	30-45	10-20

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Do*:											
Dudley----------	0-9	Silt loam--------	CL, ML	A-4, A-6, A-7	0	95-100	95-100	90-100	65-90	35-45	10-20
	9-17	Clay loam, silty clay loam, clay.	CL, CH, MH	A-7	0	95-100	95-100	85-100	65-85	40-60	15-35
	17-29	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	65-85	35-60	15-35
	29-60	Loam, clay loam	CL, CH	A-6, A-7	0	95-100	90-100	80-100	55-80	30-60	11-35
Jerauld---------	0-2	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	60-100	25-40	5-15
	2-14	Silty clay, clay, clay loam.	CH, CL	A-7	0	95-100	95-100	90-100	55-95	45-70	20-40
	14-24	Silty clay, clay, clay loam.	CH, CL	A-7	0	95-100	95-100	90-100	55-95	45-70	20-40
	24-60	Silty clay, clay, clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	55-90	40-85	20-45
Du---------- Durrstein	0-2	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	3-15
	2-17	Silty clay, clay, clay loam.	CH, MH	A-7	0	95-100	95-100	85-100	65-95	50-85	20-50
	17-60	Silty clay, clay, clay loam.	CH, CL	A-7	0	95-100	95-100	85-100	60-95	40-75	15-50
EbB*:											
Egan----------	0-9	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	9-38	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	38-60	Clay loam, loam	CL, CH, ML, MH	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-25
Trent----------	0-11	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	100	95-100	90-100	35-55	10-30
	11-31	Silty clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	15-30
	31-60	Silt loam, silty clay loam.	CL	A-6, A-7, A-4	0	100	90-100	85-100	70-100	30-50	8-25
EdA*:											
Enet----------	0-6	Loam----------	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
	6-21	Loam, clay loam, sandy clay loam.	CL, ML, SC, SM	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	21-31	Loam, fine sandy loam, sandy clay loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	85-95	60-95	40-75	20-40	3-15
	31-60	Gravelly loamy sand, gravelly sandy loam.	SM, SM-SC	A-2, A-4	0	60-95	45-90	50-65	20-40	<30	3-10
Delmont---------	0-6	Loam----------	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	6-16	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
	16-60	Gravelly sand, gravelly loamy sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-80	15-50	3-30	<25	NP-5
EgC*, EgD*:											
Ethan----------	0-8	Clay loam--------	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-18	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	18-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Clarno----------	0-6	Loam----------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-20
	6-28	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	28-60	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 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EmB*:											
Ethan----------	0-8	Clay loam--------	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-18	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	18-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Egan----------	0-9	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	9-38	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	38-60	Clay loam, loam	CL, CH, ML, MH	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-25
HdA*, HdB*:											
Houdek----------	0-6	Loam----------	CL	A-4, A-6, A-7	0	95-100	95-100	85-100	60-85	30-45	8-20
	6-16	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-50	10-25
	16-27	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	30-50	10-25
	27-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	55-80	30-50	10-25
Dudley----------	0-9	Silt loam--------	CL, ML	A-4, A-6, A-7	0	95-100	95-100	90-100	65-90	35-45	10-20
	9-17	Clay loam, silty clay loam, clay.	CL, CH, MH	A-7	0	95-100	95-100	85-100	65-85	40-60	15-35
	17-29	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	65-85	35-60	15-35
	29-60	Loam, clay loam	CL, CH	A-6, A-7	0	95-100	90-100	80-100	55-80	30-60	11-35
HgA*, HgB*:											
Houdek----------	0-6	Loam----------	CL	A-4, A-6, A-7	0	95-100	95-100	85-100	60-85	30-45	8-20
	6-16	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-50	10-25
	16-27	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	30-50	10-25
	27-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	55-80	30-50	10-25
Dudley----------	0-9	Silt loam--------	CL, ML	A-4, A-6, A-7	0	95-100	95-100	90-100	65-90	35-45	10-20
	9-17	Clay loam, silty clay loam, clay.	CL, CH, MH	A-7	0	95-100	95-100	85-100	65-85	40-60	15-35
	17-29	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	65-85	35-60	15-35
	29-60	Loam, clay loam	CL, CH	A-6, A-7	0	95-100	90-100	80-100	55-80	30-60	11-35
Tetonka----------	0-16	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	16-23	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	30-50	10-25
	23-51	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	51-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
Ho---------- Hoven	0-5	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
	5-9	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	9-37	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	37-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45
HuA---------- Huntimer	0-10	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	45-65	15-35
	10-22	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	45-70	20-35
	22-31	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	40-65	15-30
	31-60	Silty clay loam, silt loam.	CL, CH, MH	A-6, A-7	0	100	95-100	95-100	85-100	35-55	11-30

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HxB*:											
Huntimer	0-10	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	45-65	15-35
	10-22	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	45-70	20-35
	22-31	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	40-65	15-30
	31-60	Silty clay loam, silt loam.	CL, CH, MH	A-6, A-7	0	100	95-100	95-100	85-100	35-55	11-30
Egan	0-9	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	9-38	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	38-60	Clay loam, loam	CL, CH, ML, MH	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-25
La Lamo	0-21	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	80-95	40-65	14-35
	21-60	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-95	30-55	11-35
Sd*:											
Stickney	0-10	Loam	CL, ML	A-4, A-6, A-7	0	95-100	95-100	85-100	60-90	30-50	8-20
	10-28	Clay loam, silty clay loam, clay.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-95	40-60	14-34
	28-60	Clay loam, loam	CL, CH, MH, ML	A-6, A-7	0-5	95-100	90-100	80-100	55-90	35-60	10-35
Dudley	0-9	Silt loam	CL, ML	A-4, A-6, A-7	0	95-100	95-100	90-100	65-90	35-45	10-20
	9-17	Clay loam, silty clay loam, clay.	CL, CH, MH	A-7	0	95-100	95-100	85-100	65-85	40-60	15-35
	17-29	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	65-85	35-60	15-35
	29-60	Loam, clay loam	CL, CH	A-6, A-7	0	95-100	90-100	80-100	55-80	30-60	11-35
Te Tetonka	0-16	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	16-23	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	30-50	10-25
	23-51	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	51-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
Wo Worthing	0-9	Silty clay, loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-60	15-30
	9-36	Silty clay, silty clay loam, clay.	CH, MH	A-7	0	100	100	95-100	85-100	50-70	22-35
	36-60	Silty clay, silty clay loam, clay loam.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	70-100	40-65	15-30
Wp Worthing	0-9	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-60	15-30
	9-36	Silty clay, silty clay loam, clay.	CH, MH	A-7	0	100	100	95-100	80-100	50-70	25-40
	36-60	Silty clay, silty clay loam, clay loam.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	70-100	40-65	15-30

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
Ar	0-7	0.6-2.0	0.19-0.22	6.6-8.4	<2	Moderate	0.28	4	4L	2-4
Arlo	7-36	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28			
	36-60	6.0-20	0.03-0.06	7.4-8.4	<4	Low	0.10			
Ba	0-15	0.2-0.6	0.16-0.16	7.4-8.4	<2	Moderate	0.37	5	7	4-8
Baltic	15-42	0.06-0.2	0.11-0.18	7.4-8.4	2-4	High	0.37			
	42-60	0.06-0.6	0.08-0.17	7.4-8.4	2-4	High	0.37			
Bn, Bo*	0-27	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low	0.24	5	6	4-6
Bon	27-60	0.6-6.0	0.11-0.16	7.4-8.4	<2	Low	0.32			
Ca*:										
Chancellor	0-14	0.06-0.6	0.13-0.19	6.1-7.3	<2	High	0.28	5	7	4-6
	14-31	0.06-0.2	0.11-0.19	6.1-7.8	<2	High	0.28			
	31-60	0.06-0.6	0.14-0.20	7.4-8.4	2-4	High	0.28			
Tetonka	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6	2-4
	16-23	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.32			
	23-51	<0.2	0.13-0.19	6.1-7.8	<2	High	0.32			
	51-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High	0.32			
Cc	0-7	0.06-0.2	0.16-0.19	6.1-7.8	<2	High	0.28	5	7	4-6
Clamo	7-42	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.28			
	42-60	0.06-2.0	0.14-0.16	7.4-8.4	2-8	Moderate	0.28			
CfA*, CfB*:										
Clarno	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6	2-4
	6-28	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37			
	28-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Bonilla	0-13	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.24	5	6	4-6
	13-37	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24			
	37-60	0.2-2.0	0.16-0.20	7.4-8.4	<8	Moderate	0.37			
CgA*:										
Clarno	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6	2-4
	6-28	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37			
	28-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Crossplain	0-11	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.24	5	6	3-6
	11-38	0.06-0.6	0.11-0.17	6.1-7.3	<2	High	0.32			
	38-60	0.06-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	0.32			
CkB*:										
Clarno	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6	2-4
	6-28	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37			
	28-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
Ethan	0-8	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28	5	6	1-3
	8-18	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	18-60	0.2-2.0	0.16-0.20	7.4-9.0	2-4	Moderate	0.37			
CnA*, CnB*:										
Clarno	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6	2-4
	6-28	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.37			
	28-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
CnA*, CnB*:										
Stickney--------	0-10	0.6-2.0	0.18-0.22	5.6-7.8	<2	Moderate----	0.37	3	6	2-4
	10-28	0.06-0.2	0.16-0.19	6.1-7.8	4-16	High--------	0.37			
	28-60	0.06-0.6	0.14-0.18	7.4-8.4	>4	High--------	0.37			
Tetonka---------	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.24	3	6	2-4
	16-23	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate----	0.32			
	23-51	<0.2	0.13-0.19	6.1-7.8	<2	High--------	0.32			
	51-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High--------	0.32			
Ct*:										
Crossplain------	0-11	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate----	0.24	5	6	3-6
	11-38	0.06-0.6	0.11-0.17	6.1-7.3	<2	High--------	0.32			
	38-60	0.06-0.6	0.16-0.20	6.6-8.4	2-8	Moderate----	0.32			
Tetonka---------	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.24	3	6	2-4
	16-23	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate----	0.32			
	23-51	<0.2	0.13-0.19	6.1-7.8	<2	High--------	0.32			
	51-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High--------	0.32			
Da----------	0-6	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate----	0.24	5	6	4-6
Davis	6-40	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate----	0.24			
	40-60	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate----	0.24			
Do*:										
Dudley----------	0-9	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate----	0.43	3	6	2-4
	9-17	<0.2	0.13-0.19	6.1-8.4	4-8	High--------	0.32			
	17-29	0.06-0.2	0.13-0.19	7.4-9.0	8-16	Moderate----	0.32			
	29-60	0.06-0.6	0.13-0.19	7.9-9.0	8-16	Moderate----	0.32			
Jerauld---------	0-2	0.6-2.0	0.18-0.22	5.6-7.3	<4	Moderate----	0.43	1	6	1-3
	2-14	<0.2	0.10-0.15	6.6-8.4	2-8	High--------	0.32			
	14-24	<0.2	0.10-0.15	7.9-9.0	4-16	High--------	0.32			
	24-60	<0.2	0.08-0.13	7.4-9.0	4-16	High--------	0.32			
Du----------	0-2	0.6-2.0	0.17-0.20	6.1-7.3	4-16	Low---------	0.37	1	6	1-3
Durrstein	2-17	<0.2	0.10-0.15	6.6-9.0	4-16	High--------	0.37			
	17-60	<0.2	0.08-0.13	>7.3	4-16	High--------	0.37			
EbB*:										
Egan----------	0-9	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	7	3-6
	9-38	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate----	0.43			
	38-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate----	0.43			
Trent----------	0-11	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.28	5	7	4-6
	11-31	0.6-2.0	0.17-0.20	6.1-7.3	<2	Moderate----	0.43			
	31-60	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate----	0.43			
EdA*:										
Enet----------	0-6	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low---------	0.28	4	6	2-4
	6-21	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low---------	0.28			
	21-31	0.6-6.0	0.11-0.20	6.6-8.4	<2	Low---------	0.28			
	31-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low---------	0.10			
Delmont---------	0-6	0.6-2.0	0.18-0.20	6.1-7.8	<2	Low---------	0.28	3	6	2-4
	6-16	0.6-6.0	0.12-0.18	6.1-7.8	<2	Low---------	0.28			
	16-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low---------	0.10			
EgC*, EgD*:										
Ethan----------	0-8	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate----	0.28	5	6	1-3
	8-18	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate----	0.37			
	18-60	0.2-2.0	0.16-0.20	7.4-9.0	2-4	Moderate----	0.37			
Clarno----------	0-6	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low---------	0.28	5	6	2-4
	6-28	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate----	0.37			
	28-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
EmB*:										
Ethan----------	0-8	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate----	0.28	5	6	1-3
	8-18	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate----	0.37			
	18-60	0.2-2.0	0.16-0.20	7.4-9.0	2-4	Moderate----	0.37			
Egan----------	0-9	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	7	3-6
	9-38	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate----	0.43			
	38-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate----	0.43			
HdA*, HdB*:										
Houdek----------	0-6	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate----	0.28	5	6	2-4
	6-16	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate----	0.37			
	16-27	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate----	0.37			
	27-60	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate----	0.37			
Dudley----------	0-9	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate----	0.43	3	6	2-4
	9-17	<0.2	0.13-0.19	6.1-8.4	4-8	High--------	0.32			
	17-29	0.06-0.2	0.13-0.19	7.4-9.0	8-16	Moderate----	0.32			
	29-60	0.06-0.6	0.13-0.19	7.9-9.0	8-16	Moderate----	0.32			
HgA*, HgB*:										
Houdek----------	0-6	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate----	0.28	5	6	2-4
	6-16	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate----	0.37			
	16-27	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate----	0.37			
	27-60	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate----	0.37			
Dudley----------	0-9	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate----	0.43	3	6	2-4
	9-17	<0.2	0.13-0.19	6.1-8.4	4-8	High--------	0.32			
	17-29	0.06-0.2	0.13-0.19	7.4-9.0	8-16	Moderate----	0.32			
	29-60	0.06-0.6	0.13-0.19	7.9-9.0	8-16	Moderate----	0.32			
Tetonka---------	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.24	3	6	2-4
	16-23	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate----	0.32			
	23-51	<0.2	0.13-0.19	6.1-7.8	<2	High--------	0.32			
	51-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High--------	0.32			
Ho----------	0-5	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.37	1	7	2-4
Hoven	5-9	<0.06	0.10-0.19	6.1-7.8	4-16	High--------	0.37			
	9-37	<0.06	0.10-0.19	7.4-8.4	4-16	High--------	0.37			
	37-60	<0.2	0.08-0.17	7.4-9.0	4-16	High--------	0.37			
HuA----------	0-10	0.2-0.6	0.13-0.19	5.6-7.3	<2	High--------	0.28	5	4	3-6
Huntimer	10-22	0.2-0.6	0.11-0.19	6.1-7.3	<2	High--------	0.28			
	22-31	0.2-0.6	0.11-0.20	7.4-8.4	<2	High--------	0.28			
	31-60	0.06-0.6	0.11-0.20	7.4-8.4	<4	Moderate----	0.28			
HxB*:										
Huntimer--------	0-10	0.2-0.6	0.13-0.19	5.6-7.3	<2	High--------	0.28	5	4	3-6
	10-22	0.2-0.6	0.11-0.19	6.1-7.3	<2	High--------	0.28			
	22-31	0.2-0.6	0.11-0.20	7.4-8.4	<2	High--------	0.28			
	31-60	0.06-0.6	0.11-0.20	7.4-8.4	<4	Moderate----	0.28			
Egan----------	0-9	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	7	3-6
	9-38	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate----	0.43			
	38-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate----	0.43			
La----------	0-21	0.2-0.6	0.21-0.23	7.4-8.4	<2	High--------	0.32	5	7	3-6
Lamo	21-60	0.2-0.6	0.18-0.22	7.4-8.4	<2	High--------	0.32			
Sd*:										
Stickney--------	0-10	0.6-2.0	0.18-0.22	5.6-7.8	<2	Moderate----	0.37	3	6	2-4
	10-28	0.06-0.2	0.16-0.19	6.1-7.8	4-16	High--------	0.37			
	28-60	0.06-0.6	0.14-0.18	7.4-8.4	>4	High--------	0.37			
Dudley----------	0-9	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate----	0.43	3	6	2-4
	9-17	<0.2	0.13-0.19	6.1-8.4	4-8	High--------	0.32			
	17-29	0.06-0.2	0.13-0.19	7.4-9.0	8-16	Moderate----	0.32			
	29-60	0.06-0.6	0.13-0.19	7.9-9.0	8-16	Moderate----	0.32			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
Te	0-16	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.24	3	6	2-4
Tetonka	16-23	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.32			
	23-51	<0.2	0.13-0.19	6.1-7.8	<2	High	0.32			
	51-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High	0.32			
Wo	0-9	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.37	5	7	3-5
Worthing	9-36	0.06-0.2	0.13-0.18	6.1-7.3	<2	High	0.37			
	36-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High	0.37			
Wp	0-9	0.2-0.6	0.19-0.22	5.6-7.3	<2	High	0.37	5	7	3-5
Worthing	9-36	0.06-0.2	0.13-0.18	6.1-7.8	<2	High	0.37			
	36-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Ar---------- Arlo	B	Frequent----	Brief-----	Mar-Aug	0-2.0	Apparent	Oct-Jun	High-----	High-----	Moderate.
Ba---------- Baltic	D	Frequent----	Very brief to brief.	Mar-Sep	0-2.0	Apparent	Jan-Dec	High-----	High-----	Moderate.
Bn---------- Bon	B	Rare--------	---	---	4.0-6.0	Apparent	Oct-Jul	Moderate	Moderate	Low.
Bo*:										
Bon----------	B	Frequent----	Brief-----	Apr-Oct	2.0-6.0	Apparent	Oct-Jul	High-----	Moderate	Low.
Bon----------	B	Rare--------	---	---	4.0-6.0	Apparent	Oct-Jul	Moderate	Moderate	Low.
Ca*:										
Chancellor----	C	Frequent----	Brief-----	Sep-Jun	0-3.0	Perched	Sep-Jun	High-----	High-----	Moderate.
Tetonka----------	C/D	None--------	---	---	+1-1.0	Perched	Jan-Dec	High-----	High-----	Moderate.
Cc---------- Clamo	C/D	Occasional	Long------	Mar-Oct	0-3.0	Apparent	Oct-Jun	High-----	High-----	High.
CfA*, CfB*:										
Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Bonilla----------	B	Occasional	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate	High-----	Moderate.
CgA*:										
Clarno----------	B	None--------	---	---	3.0-6.0	Perched	Oct-Jul	Moderate	High-----	Moderate.
Crossplain----	C/D	Frequent----	Brief-----	Sep-Jun	0-3.0	Perched	Sep-Jun	High-----	High-----	Moderate.
CkB*:										
Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
CnA*, CnB*:										
Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Stickney----------	C	None--------	---	---	>6.0	---	---	Moderate	High-----	High.
Tetonka----------	C/D	None--------	---	---	+1-1.0	Perched	Jan-Dec	High-----	High-----	Moderate.
Ct*:										
Crossplain----	C/D	Frequent----	Brief-----	Sep-Jun	0-3.0	Perched	Sep-Jun	High-----	High-----	Moderate.
Tetonka----------	C/D	None--------	---	---	+1-1.0	Perched	Jan-Dec	High-----	High-----	Moderate.
Da---------- Davis	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Do*:										
Dudley----------	D	None--------	---	---	>6.0	---	---	Moderate	High-----	High.
Jerauld----------	D	None--------	---	---	>6.0	---	---	Low------	High-----	Moderate.
Du---------- Durrstein	D	Frequent----	Brief-----	Apr-Oct	0-1.5	Apparent	Oct-Jun	Moderate	High-----	High.
EbB*:										
Egan----------	B	None--------	---	---	>6.0	---	---	High-----	High-----	Moderate.
Trent----------	B	Rare--------	---	---	>6.0	---	---	High-----	Moderate	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
EdA*:										
Enet	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
Delmont	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
EgC*, EgD*:										
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Clarno	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
EmB*:										
Ethan	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Egan	B	None	---	---	>6.0	---	---	High	High	Moderate.
HdA*, HdB*:										
Houdek	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Dudley	D	None	---	---	>6.0	---	---	Moderate	High	High.
HgA*, HgB*:										
Houdek	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Dudley	D	None	---	---	>6.0	---	---	Moderate	High	High.
Tetonka	C/D	None	---	---	+1-1.0	Perched	Jan-Dec	High	High	Moderate.
Ho Hoven	D	None	---	---	+1-1.5	Perched	Mar-Jul	Moderate	High	Moderate.
HuA Huntimer	C	None	---	---	>6.0	---	---	Moderate	High	Moderate.
HxB*:										
Huntimer	C	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Egan	B	None	---	---	>6.0	---	---	High	High	Moderate.
La Lamo	C	Occasional	Brief	Mar-Aug	1.5-3.0	Apparent	Nov-May	High	High	Low.
Sd*:										
Stickney	C	None	---	---	>6.0	---	---	Moderate	High	High.
Dudley	D	None	---	---	>6.0	---	---	Moderate	High	High.
Te Tetonka	C/D	None	---	---	+1-1.0	Perched	Jan-Dec	High	High	Moderate.
Wo Worthing	D	None	---	---	+1-1.0	Perched	Jan-Dec	High	High	Moderate.
Wp Worthing	D	None	---	---	+3-0.5	Perched	Jan-Dec	High	High	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution							Liquid limit	Plasticity index	Moisture density	
			Percentage passing sieve--				Percentage smaller than--						
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Max. dry density	Optimum moisture
										Pct		Lb/ft^3	Pct
Arlo clay loam: (S81SD-097-019)													
A------- 0 to 7	A-7-6(18)	CL	100	100	95	85	---	46	---	56	28	92	26
ACk----- 7 to 18	A-7-6(17)	CL	100	100	95	85	---	50	---	49	28	101	21
Ck1----- 18 to 26	A-7-6(16)	CL	100	100	95	84	---	48	---	46	28	101	21
Ck2----- 26 to 40	A-7-6(14)	CL	100	99	95	74	---	35	---	42	24	102	20
2C------ 40 to 60	A-2-4(0)	SM-SC	98	94	44	18	---	7	---	31	10	---	---
Crossplain loam: (S81SD-097-020)													
A------- 0 to 6	A-7-6(14)	ML	100	100	96	82	---	32	---	48	19	85	31
Btg----- 6 to 27	A-7-6(15)	CL	100	100	95	79	---	39	---	47	25	102	20
Cg------ 27 to 60	A-6(10)	CL	98	96	86	63	---	34	---	36	20	117	14
Dudley silt loam: (S81SD-097-004)													
A------- 0 to 9	A-7-6(10)	ML	100	99	94	80	---	27	---	42	16	85	31
Bt------ 9 to 22	A-7-6(19)	CH	100	99	96	81	---	45	---	55	33	96	24
C------- 47 to 60	A-7-6(20)	CL	100	98	91	76	---	49	---	60	36	93	25
Huntimer silty clay loam: (S78SD-097-012)													
Ap------ 0 to 6	A-7-6(12)	ML	100	100	99	94	---	38	---	45	17	92	26
Bw------ 10 to 23	A-7-6(17)	CL	100	100	99	96	---	44	---	50	27	101	21
BCk----- 23 to 34	A-7-6(15)	CL	100	100	100	99	---	46	---	47	26	101	21
C------- 34 to 60	A-7-6(15)	CL	100	100	100	98	---	44	---	46	26	102	20
Stickney loam: (S81SD-097-5)													
A------- 0 to 9	A-7-6(13)	ML	100	100	95	83	---	26	---	49	18	85	31
Bt------ 13 to 21	A-7-6(19)	CH	100	99	92	77	---	43	---	55	30	97	23
BCk----- 21 to 35	A-7-6(18)	CH	99	98	92	74	---	42	---	52	31	102	20
Cz------ 46 to 60	A-7-6(12)	CH	100	98	91	72	---	41	---	52	29	100	22

TABLE 17.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Arlo	Fine-loamy over sandy or sandy-skeletal, mesic Typic Calciaquolls
Baltic	Fine, montmorillonitic (calcareous), mesic Cumulic Haplaquolls
Bon	Fine-loamy, mixed, mesic Cumulic Haplustolls
Bonilla	Fine-loamy, mixed, mesic Pachic Haplustolls
Chancellor	Fine, montmorillonitic, mesic Typic Argiaquolls
Clamo	Fine, montmorillonitic, mesic Cumulic Haplaquolls
Clarno	Fine-loamy, mixed, mesic Typic Haplustolls
Crossplain	Fine, montmorillonitic, mesic Typic Argiaquolls
Davis	Fine-loamy, mixed, mesic Pachic Haplustolls
Delmont	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplustolls
Dudley	Fine, montmorillonitic, mesic Typic Natrustolls
Durrstein	Fine, montmorillonitic, mesic Typic Natraquolls
Egan	Fine-silty, mixed, mesic Udic Haplustolls
*Enet	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Ethan	Fine-loamy, mixed, mesic Typic Calciustolls
Houdek	Fine-loamy, mixed, mesic Typic Argiustolls
Hoven	Fine, montmorillonitic, mesic Typic Natraquolls
Huntimer	Fine, montmorillonitic, mesic Udic Haplustolls
Jerauld	Fine, montmorillonitic, mesic Leptic Natrustolls
Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Stickney	Fine, montmorillonitic, mesic Glossic Natrustolls
Tetonka	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Trent	Fine-silty, mixed, mesic Pachic Haplustolls
Worthing	Fine, montmorillonitic, mesic Typic Argiaquolls

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