United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Iowa Agriculture and
Home Economics
Experiment Station;
Cooperative Extension
Service, Iowa State
University; and Department
of Soil Conservation,
State of Iowa

Soil Survey of Pottawattamie County, Iowa

How To Use This Soil Survey

General Soil Map

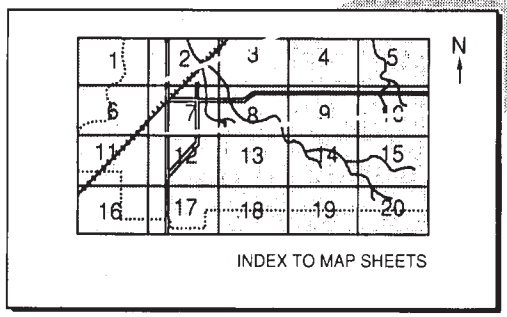
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

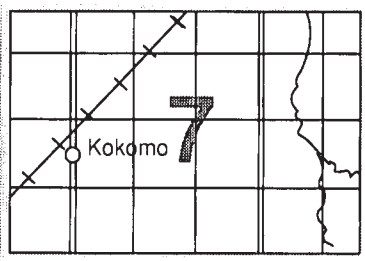
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

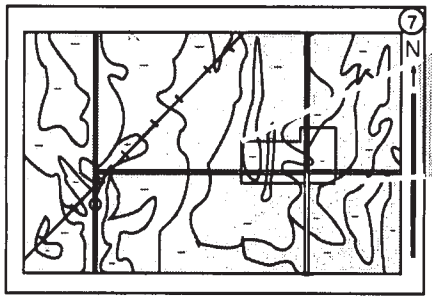


INDEX TO MAP SHEETS

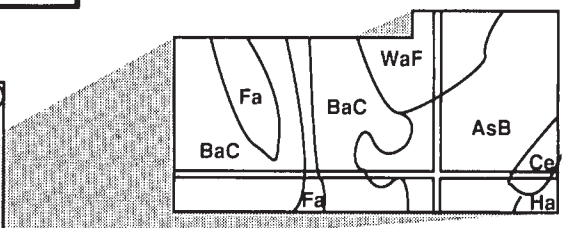


MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

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, handicap, or age.

Major fieldwork for this soil survey was completed during the period 1978 to 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the East and West Pottawattamie County Soil Conservation Districts. Funds appropriated by Pottawattamie County were used to defray part of the cost of the survey.

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: An area of very steep Hamburg soils in the foreground. Bottom land along the Missouri River is in the background.

Contents

Soil Series

Issued September 1989

Index to Map Units

Summary of Tables

Preface

This soil survey contains information that can be used in land-planning programs in Pottawattamie County. 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, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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

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

Soil Survey of Pottawattamie County, Iowa

By Charles E. Branham, Soil Conservation Service

Fieldwork by Willie D. Bragg, Charles E. Branham, Craig R. Busskohl, Steven Donath, Jonathan W. Hempel, Pat Pisarik, and John R. Nixon, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with
the Iowa Agriculture and Home Economics Experiment Station;
the Cooperative Extension Service, Iowa State University;
and the Department of Soil Conservation, State of Iowa

POTTAWATTAMIE COUNTY is in the southwestern part of Iowa (fig. 1). It is in the third tier of counties north of the Iowa-Missouri state line and is bounded on the west by the Missouri River. It has an area of about 616,448 acres, or 963 square miles, and a population of 86,560. Council Bluffs is the county seat. It is in the southwestern part of the county, about 115 miles from Des Moines. It has a population of about 56,500.

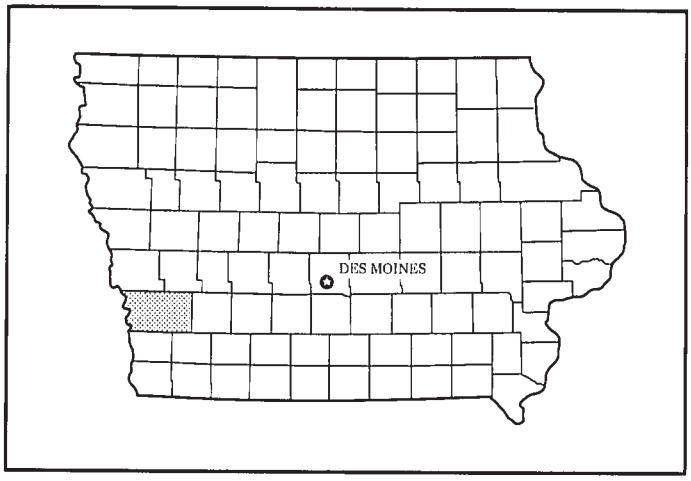


Figure 1.—Location of Pottawattamie County in Iowa.

This survey updates the soil survey of Pottawattamie County published in 1916 (*6*). It provides additional information and larger maps, which show the soils in greater detail.

General Nature of the County

This section describes the history and development, vegetation, relief and drainage, climate, and transportation facilities in the county.

History and Development

Pottawattamie County was established in 1851. It originally included all of Cass County and parts of the currently adjacent counties. The county seat was located at Kanesville, now called Council Bluffs. The county was named for the Pottawattamie Indians, who were relocated from Illinois to the region around Council Bluffs in 1835. Later, an agreement was signed granting the Pottawattamies a sum of money and 30 square miles of Kansas land in exchange for their land in Iowa. Pottawattamie is an Indian word meaning "makers of fire."

Francis Guittar was the first known permanent settler in the county. He traded with the Indians and established Traders Point, in the southwestern corner of the county. Later, Peter A. Sarpy established the first ferry at the same location.

In 1846, members of the Mormon religion first arrived in the area around Council Bluffs on their way to "New Zion." They established the village of Kanesville, named in honor of Colonel Thomas Kane. The Mormons greatly contributed to the growth and development of the area until 1852, when they moved to Salt Lake City. In 1853, the community of Kanesville officially became known as Council Bluffs (*10*).

Pottawattamie County has two soil conservation districts. The East Pottawattamie County Soil Conservation District was organized in 1942. It has an office in Oakland. It was the 13th soil conservation district established in Iowa. The West Pottawattamie County Soil Conservation District was organized in 1944. It was the 39th soil conservation district in Iowa. The district office is located in Council Bluffs.

Vegetation

The native vegetation in Pottawattamie County was mainly prairie grasses (bluestems) and an oak-maple forest. Prairie grasses were dominant on nearly all of the uplands, except for some of the steeper areas. The dominant vegetation on the bottom land was marsh grasses and water-tolerant trees. The original stands of timber have been cut in nearly all areas, except for the very steep slopes in the western part of the county.

Relief and Drainage

Pottawattamie County is in the part of western Iowa covered by a thick layer of loess. It has three general regions—the bottom land along the Missouri River, the very steep bluffs adjacent to the valley of the Missouri River, and the gently rolling to hilly uplands in the central and eastern parts of the county.

The width of the bottom land along the Missouri River ranges from about 7 miles near Loveland to less than 0.5 mile near Council Bluffs. Abandoned river channels and sandy hummocks are minor breaks in the nearly level topography. The lowest elevation in the county, about 960 feet above sea level, is on this bottom land. It is in an area where the Missouri River flows out of the county.

The bluffs adjacent to the valley of the Missouri River are characterized by catsteps, which formed through slippage on the side slopes. Narrow ridgetops, very steep side slopes, and deep gullies also are characteristic of this area. The major streams flowing through this area are Pigeon, Mosquito, Honey, and Indian Creeks.

The gently rolling to hilly uplands in the central and eastern parts of the county are divided by Keg, Silver, and Walnut Creeks and by the West Nishnabotna River. These streams flow south and southwest into the adjoining counties. The highest elevation in the county, about 1,360 feet above sea level, is in the uplands near the northern boundary of the county. The loess-covered uplands have a well developed dendritic drainage pattern that is influenced by the underlying glacial till.

Climate

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

Pottawattamie County is cold in winter. Summer is characterized by quite hot temperatures and occasional cool spells. During the winter, precipitation frequently occurs as snow. During the warmer months, it falls chiefly as showers, which often are heavy. The total annual rainfall is normally adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Oakland in the period 1951 to 1981. 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 24 degrees F, and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Oakland on January 12, 1974, is -31 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred at Oakland on July 31, 1955, is 105 degrees.

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

The total annual precipitation is about 32 inches. Of this, 24 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 19 inches. The heaviest 1-day rainfall during the period of record was 4.65 inches at Oakland on September 29, 1954. Thunderstorms occur on about 48 days each year. Tornadoes and severe thunderstorms strike occasionally. These storms are local in extent and of short duration and result in sparse damage in narrow belts. During the warmer part of the year, hailstorms sometimes occur in scattered small areas.

The average seasonal snowfall is about 28 inches. The greatest snow depth at any one time during the period of record was 16 inches. On the average, 30 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent

of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 13 miles per hour, in spring.

Transportation Facilities

Federal, state, and county highways provide good access to all parts of the county. Interstates 80 and 680 run east and west across the county and Interstate 29 runs north and south. U.S. Highway 6 and State Highway 92 are other major east-west routes, and U.S. Highway 59 is another north-south route. The farm-to-market roads throughout the county are paved or are surfaced with rock.

Railroad service is extensive in Pottawattamie County. Council Bluffs serves as a rail center. Freight service by train is available in many communities, and truck service is available in all communities. Bus service is available in Council Bluffs, Oakland, and Treynor and in Omaha, Nebraska, which is along the Missouri River. Small aircraft are served at the Council Bluffs Municipal Airport and commercial flights are available at Eppley Airfield, in Omaha.

How This Survey Was Made

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

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

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

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

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

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

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

and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

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

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

General Soil Map Units

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

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

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

Soil Descriptions

1. Albaton-Haynie-Sarpy Association

Nearly level and very gently sloping, poorly drained, well drained, and excessively drained, clayey, silty, and sandy soils formed in alluvium on bottom land

This association is on bottom land along the Missouri River. The landscape is characterized by crescent-shaped oxbow lakes and swales that mark old river channels. Slopes range from 0 to 3 percent.

This association makes up about 5 percent of the county. It is about 25 percent Albaton soils, 25 percent Haynie soils, 15 percent Sarpy soils, and 35 percent soils of minor extent.

Albaton soils are poorly drained and are in swales and other low areas. Haynie soils are well drained and are at the higher elevations and on short escarpments in areas of recent deposition. Sarpy soils are excessively drained and are in areas of recent deposition adjacent to the Missouri River.

Typically, the surface layer of the Albaton soils is very dark grayish brown, calcareous silty clay about 9 inches thick. The substratum to a depth of about 60 inches is dark gray, dark grayish brown, and grayish brown, mottled, calcareous, stratified silty clay.

Typically, the surface layer of the Haynie soils is very dark grayish brown silt loam about 7 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, calcareous, stratified silt loam.

Typically, the surface layer of the Sarpy soils is very dark grayish brown loamy fine sand about 6 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, calcareous, stratified fine sand.

The minor soils in this association are the Blake, Grable, Modale, Onawa, and Percival soils. Blake and Percival soils are somewhat poorly drained and are in swales and the lower areas. Grable soils are rapidly permeable in the lower part. They are in the higher areas. Onawa soils are slowly permeable in the upper part and moderately permeable in the lower part. They are in the lower areas. Modale soils are slowly permeable in the lower part. They are in the somewhat higher areas.

This association is used mainly for cultivated crops. Most areas have been cleared of trees and are artificially drained. The suitability of the major soils for cultivated crops ranges from good to poor. The suitability for wetland wildlife habitat is good in some areas.

The wetness of the Albaton soils and droughtiness in the Sarpy soils are concerns in managing cultivated areas. Flooding was a serious hazard until dams were constructed in upstream areas of the Missouri River. Some flooding can still occur in areas where tributaries enter the Missouri River downstream from the dams. Some of these areas are on the river side of the levees. The sandy Sarpy soils are subject to soil blowing. Plowing to a depth of 2 or 3 feet has improved areas where sandy material has been deposited by floodwater.

2. Luton-Cooper-Salix Association

Nearly level, very poorly drained, somewhat poorly drained, and moderately well drained, clayey and silty soils formed in alluvium on bottom land

This association is on the bottom land along the Missouri River. Slopes range from 0 to 2 percent.

This association makes up about 3 percent of the county. It is about 40 percent Luton and similar soils, 20 percent Cooper soils, 15 percent Salix and similar soils, and 25 percent soils of minor extent.

Luton soils are very poorly drained and are in the lower depressions. Cooper soils are somewhat poorly drained and are at intermediate elevations. Salix soils

are moderately well drained and are at the slightly higher elevations.

Typically, the surface layer of the Luton soils is black silty clay about 7 inches thick. The subsurface layer is black and very dark gray silty clay about 17 inches thick. The subsoil is very firm, calcareous silty clay about 18 inches thick. The upper part is dark gray, and the lower part is gray and mottled. The substratum to a depth of about 60 inches is gray, mottled, calcareous silty clay.

Typically, the surface layer of the Cooper soils is very dark brown silty clay loam about 8 inches thick. The subsurface layer also is very dark brown silty clay loam about 8 inches thick. The subsoil is dark grayish brown, friable, calcareous silty clay loam about 8 inches thick. Below this to a depth of about 60 inches is a buried layer of very dark gray and dark grayish brown, calcareous silty clay.

Typically, the surface layer of the Salix soils is black silty clay loam about 8 inches thick. The subsurface layer also is black silty clay loam about 8 inches thick. The subsoil is about 18 inches thick. The upper part is very dark grayish brown, friable silty clay loam, and the lower part is dark grayish brown, friable silt loam. The substratum to a depth of about 60 inches is brown and grayish brown, mottled, calcareous silt loam.

The minor soils in this association are the Blencoe, Keg, and Lakeport soils. Blencoe soils are poorly drained and are in the lower areas. They are slowly permeable throughout. Keg soils are well drained and are in the slightly higher areas. They have a surface layer of silt loam. Lakeport soils are somewhat poorly drained and are at intermediate elevations. They are moderately permeable in the lower part.

This association is used for cultivated crops or for urban development. Wetness is a limitation affecting both uses. If drained and protected against flooding, the major soils are suitable for cultivated crops. Some areas are better suited to these crops than others. Most of the drainage systems consist of surface drains. In the urban areas, however, subsurface drains are installed.

3. McPaul-Nodaway-Napier Association

Nearly level to moderately sloping, moderately well drained and well drained, silty soils formed in alluvium in upland drainageways, on bottom land, and on foot slopes

This association is on bottom land along the Missouri River, in small drainageways, and on alluvial fans and foot slopes. The soils formed in alluvium deposited by upland streams. Slopes range from 0 to 9 percent.

This association makes up about 6 percent of the county. It is about 30 percent McPaul soils, 30 percent Nodaway soils, 30 percent Napier soils, and 10 percent soils of minor extent.

McPaul soils are moderately well drained and nearly level and are in settling basins on broad bottom land and in upland drainageways. Nodaway soils are moderately well drained and nearly level and are on bottom land. Napier soils are well drained and are gently sloping and moderately sloping. They are on foot slopes and in upland drainageways.

Typically, the surface layer of the McPaul soils is very dark grayish brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, calcareous, stratified silt loam.

Typically, the surface layer of the Nodaway soils is very dark grayish brown silt loam about 9 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, dark brown, and brown, stratified silt loam.

Typically, the surface layer of the Napier soils is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark brown, friable silt loam about 22 inches thick. The subsoil to a depth of about 60 inches is dark brown and brown, friable silt loam.

The minor soils in this association are the Colo, Kennebec, Moville, and Rawles soils. Colo soils are poorly drained and are at the lower elevations in upland drainageways. Kennebec soils are moderately well drained and are lower on the landscape than the Napier soils. Moville soils are somewhat poorly drained and are in landscape positions similar to those of the McPaul soils. Rawles soils are moderately well drained and are on bottom land. They have a buried surface layer and are calcareous. Also of minor extent is the Napier-Urban land complex in and near Council Bluffs.

This association is used for cultivated crops or for urban development. If protected against flooding, it is well suited to cultivated crops. Some areas are better suited to these crops than others. Wetness is a problem in areas of the poorly drained Colo soils, which are of minor extent. Most of the drainage systems consist of surface drains. In urban areas, however, subsurface drains are installed.

4. Ida-Hamburg Association

Moderately sloping to very steep, well drained and somewhat excessively drained, silty soils formed in loess on uplands

This association consists of moderately sloping and strongly sloping soils on ridgetops and moderately steep to very steep soils on side slopes. Slopes range from 5 to 75 percent.

This association makes up about 3 percent of the county. It is about 50 percent Ida soils, 20 percent Hamburg soils, and 30 percent soils of minor extent (fig. 2).

Ida soils are well drained and are moderately sloping and strongly sloping on ridgetops and moderately steep to very steep on side slopes. Hamburg soils are somewhat excessively drained and very steep. They are on side slopes.

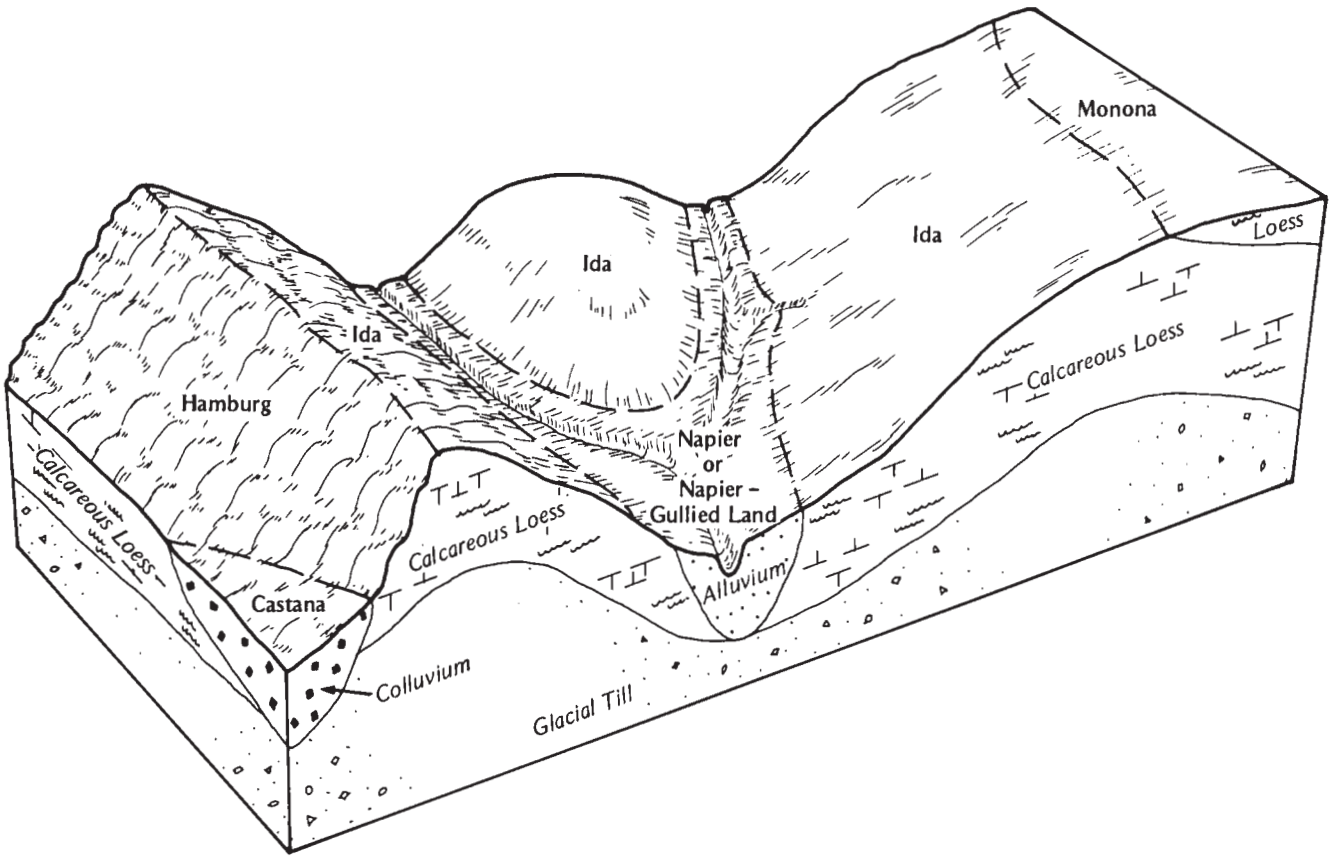


Figure 2.—Typical pattern of soils and parent material in the Ida-Hamburg association.

Typically, the surface layer of the Ida soils is brown, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark brown material. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam.

Typically, the surface layer of the Hamburg soils is dark brown, calcareous silt loam about 4 inches thick. The next layer is brown, very friable, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, calcareous silt loam.

The minor soils in this association are the Castana, Monona, and Napier soils. Also of minor extent is Gullied land. This land is subject to sloughing. The well drained Castana, Monona, and Napier soils have a surface soil that is thicker than that of the major soils. Castana soils are on foot slopes. Monona soils are on ridgetops and side slopes. Napier soils are on foot slopes and in drainageways.

Most areas are pastured. Some areas support native vegetation, and some small areas are used for cultivated crops. Because of the hazard of erosion, this association is better suited to pasture and wildlife habitat than to cultivated crops. The suitability for residential and other urban uses is good in some areas. The slope is a concern in managing the major soils for most uses.

5. Monona-Ida Association

Nearly level to very steep, well drained, silty soils formed in loess on uplands

This association consists of nearly level to strongly sloping soils on ridgetops and moderately sloping to very steep soils on side slopes. The landscape is characterized by an extensive network of drainageways. Slopes range from 0 to 40 percent.

This association makes up about 25 percent of the county. It is about 40 percent Monona soils, 30 percent Ida soils, and 30 percent soils of minor extent (fig. 3).

Monona soils are nearly level to moderately sloping on ridgetops and moderately sloping to very steep on side slopes. Ida soils are moderately sloping and strongly sloping on ridgetops and moderately sloping to very steep on side slopes.

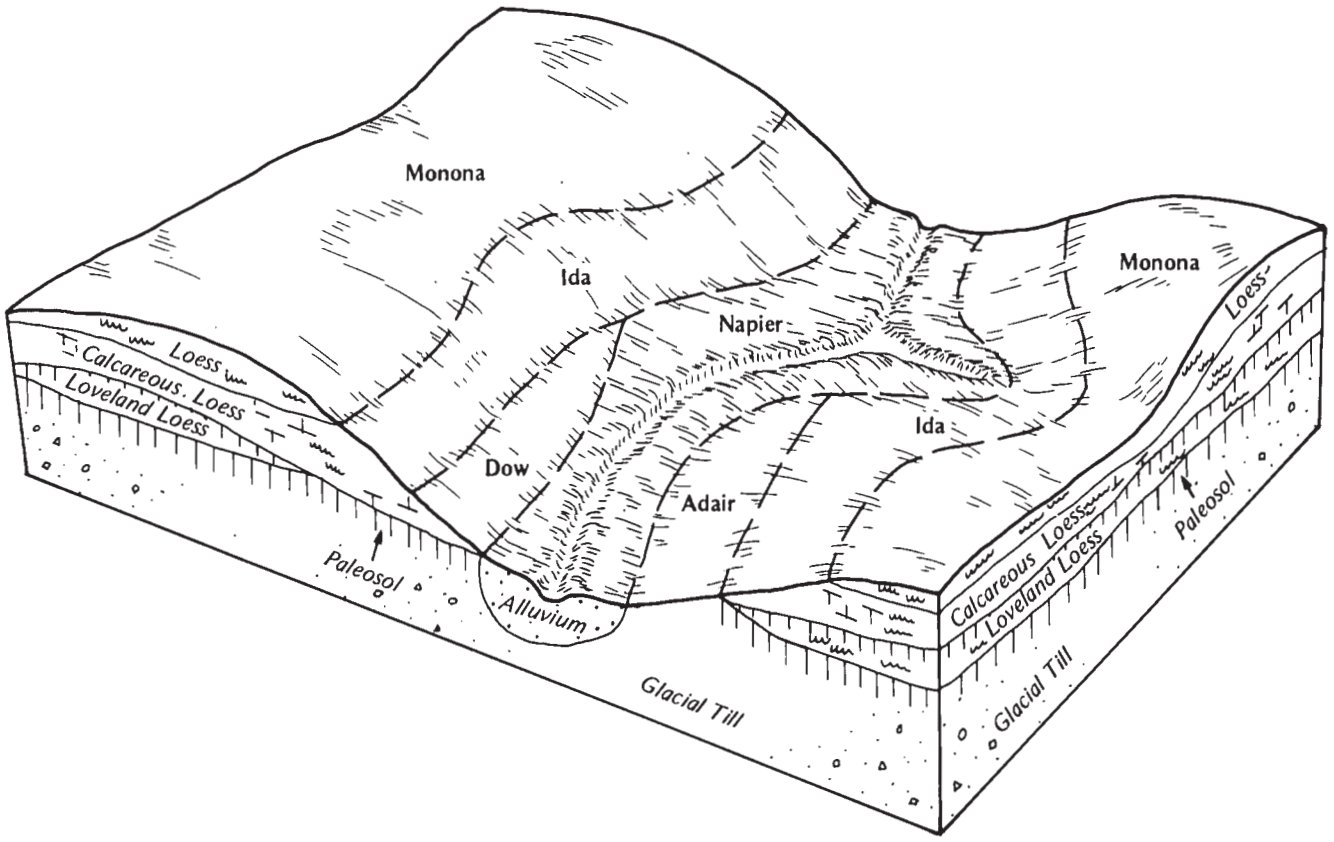


Figure 3.—Typical pattern of soils and parent material in the Monona-Ida association.

Typically, the surface layer of the Monona soils is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam.

Typically, the surface layer of the Ida soils is dark yellowish brown, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark brown material. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam.

The minor soils in this association are the Adair, Dow, and Napier soils. Adair soils formed in a paleosol that formed in glacial till. They have a reddish subsoil. They are on the lower side slopes. Dow soils have a subsoil that is grayer than that of the major soils. They commonly are on side slopes. Napier soils are along drainageways. Their surface soil is thicker than that of the major soils.

This association is used for cultivated crops, pasture, or hay. Controlling runoff and water erosion is the main concern in managing the major soils.

6. Monona-Marshall Association

Gently sloping to moderately steep, well drained, silty soils formed in loess on uplands

This association consists of gently sloping soils on ridgetops and moderately sloping to moderately steep soils on side slopes. The landscape is characterized by an extensive network of drainageways. Slopes range from 2 to 20 percent.

This association makes up about 18 percent of the county. It is about 45 percent Monona soils, 25 percent Marshall soils, and 30 percent soils of minor extent (fig. 4).

Monona soils are gently sloping to moderately steep and are on narrow ridgetops and side slopes. Marshall soils also are on ridgetops and side slopes. They are gently sloping to strongly sloping.

Typically, the surface layer of the Monona soils is very dark brown silt loam about 7 inches thick. The

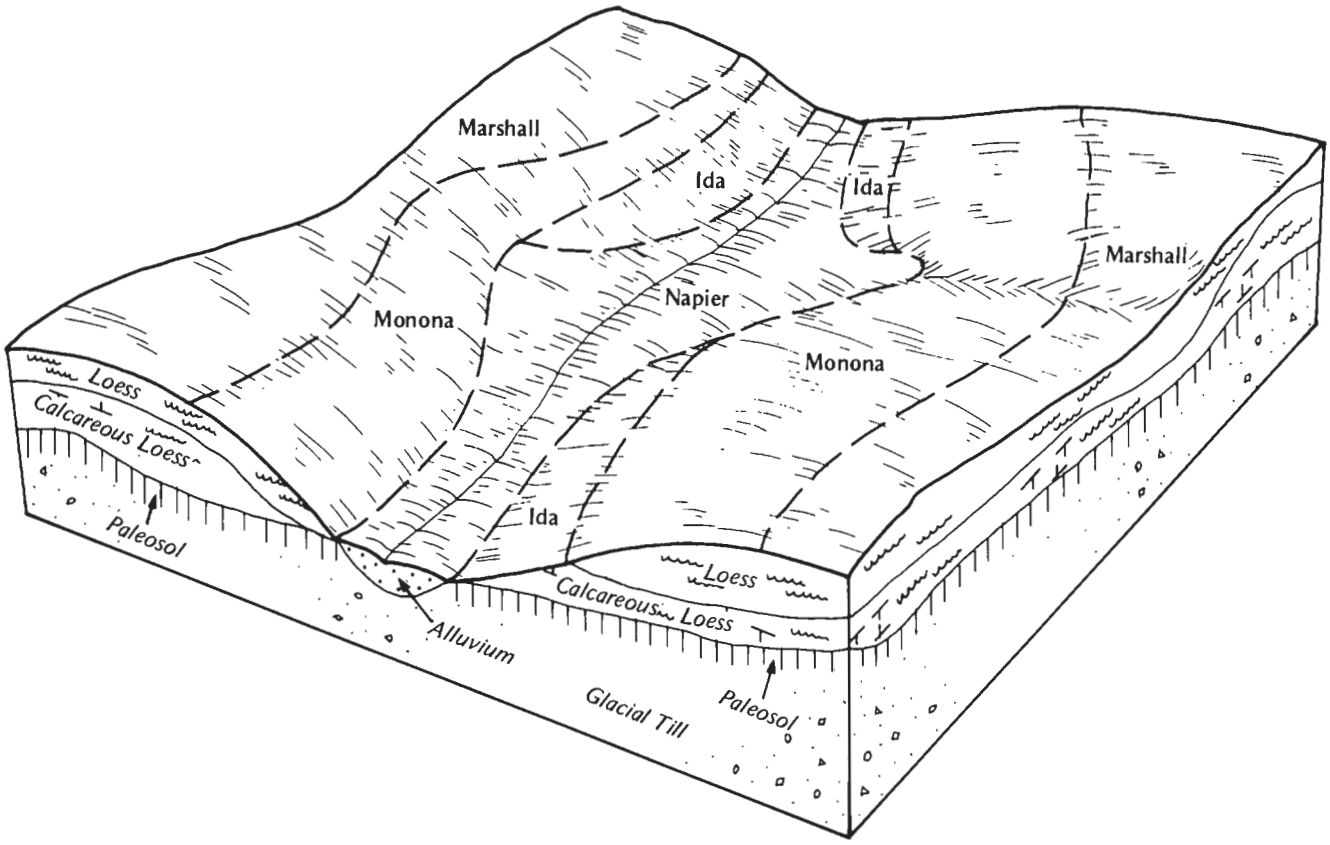


Figure 4.—Typical pattern of soils and parent material in the Monona-Marshall association.

subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam.

Typically, the surface layer of the Marshall soils is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 17 inches thick. The subsoil is friable silty clay loam about 36 inches thick. The upper part is brown, and the lower part is dark yellowish brown and yellowish brown and is mottled.

The minor soils in this association are the Dow, Ida, and Napier soils. The well drained Dow and Ida soils are on the sides of ridges. They are calcareous. The moderately well drained Napier soils are along drainageways. Their surface soil is thicker than that of the major soils.

This association commonly is used for cultivated crops. Some areas are used for hay, and some are pastured. If erosion and runoff are controlled, the major soils are suited to cultivated crops.

7. Zook-Nodaway-Marshall Association

Nearly level to moderately sloping, poorly drained, moderately well drained, and well drained, silty soils formed in alluvium on bottom land and in loess on stream benches

This association is along streams in the eastern part of the county. Slopes range from 0 to 9 percent.

This association makes up about 5 percent of the county. It is about 25 percent Zook soils, 25 percent Nodaway soils, 15 percent Marshall soils, and 35 percent soils of minor extent.

Zook soils are poorly drained and nearly level and are in areas away from stream channels. Nodaway soils are moderately well drained and nearly level and commonly are adjacent to the stream channels. Marshall soils are well drained and are nearly level to moderately sloping. They are on stream benches.

Typically, the surface layer of the Zook soils is black silty clay loam about 7 inches thick. The subsurface layer is about 33 inches thick. The upper part is black silty clay loam, and the lower part is black silty clay. The subsoil is very dark gray, very firm silty clay about 16

inches thick. The substratum to a depth of about 60 inches is dark gray silty clay.

Typically, the surface layer of the Nodaway soils is very dark grayish brown silt loam about 9 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, dark brown, and brown, stratified silt loam.

Typically, the surface layer of the Marshall soils is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 17 inches thick. The subsoil is friable silty clay loam about 36 inches thick. The upper part is brown, and the lower part is dark yellowish brown and yellowish brown and is mottled.

The minor soils in this association are the Ackmore, Bremer, Colo, Corley, Kennebec, Minden, Nevin, and Nishna soils. The somewhat poorly drained Ackmore soils are in landscape positions similar to those of the Zook soils. They have a buried surface layer. The poorly drained Bremer and somewhat poorly drained Nevin soils are on second bottoms and are slightly higher on the landscape than the Zook soils. The poorly drained, moderately permeable Colo soils are in landscape positions similar to those of the Zook soils or are slightly higher on the landscape. The poorly drained Corley and somewhat poorly drained Minden soils are on loess-covered stream benches in the slightly lower or depressional areas adjacent to the Marshall soils. Corley soils have a grayish subsurface layer. The moderately well drained Kennebec soils are at the lower elevations. Their surface soil is thicker than that of the Nodaway soils. The poorly drained Nishna soils are in the lower areas away from stream channels. They are calcareous.

This association is used for cultivated crops. The major management concerns are flooding and wetness in areas of the Zook and Nodaway soils.

8. Marshall-Exira Association

Nearly level to moderately steep, well drained, silty soils formed in loess on uplands

This association consists of nearly level and gently sloping soils on ridgetops and gently sloping to moderately steep soils on side slopes. The landscape is characterized by an extensive network of drainageways. Slopes range from 0 to 20 percent.

This association makes up about 35 percent of the county. It is about 35 percent Marshall soils, 35 percent Exira soils, and 30 percent soils of minor extent (fig. 5).

Marshall soils are nearly level and gently sloping on ridgetops and moderately sloping on side slopes. Exira soils are moderately sloping to moderately steep and are on side slopes.

Typically, the surface layer of the Marshall soils is very dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark yellowish

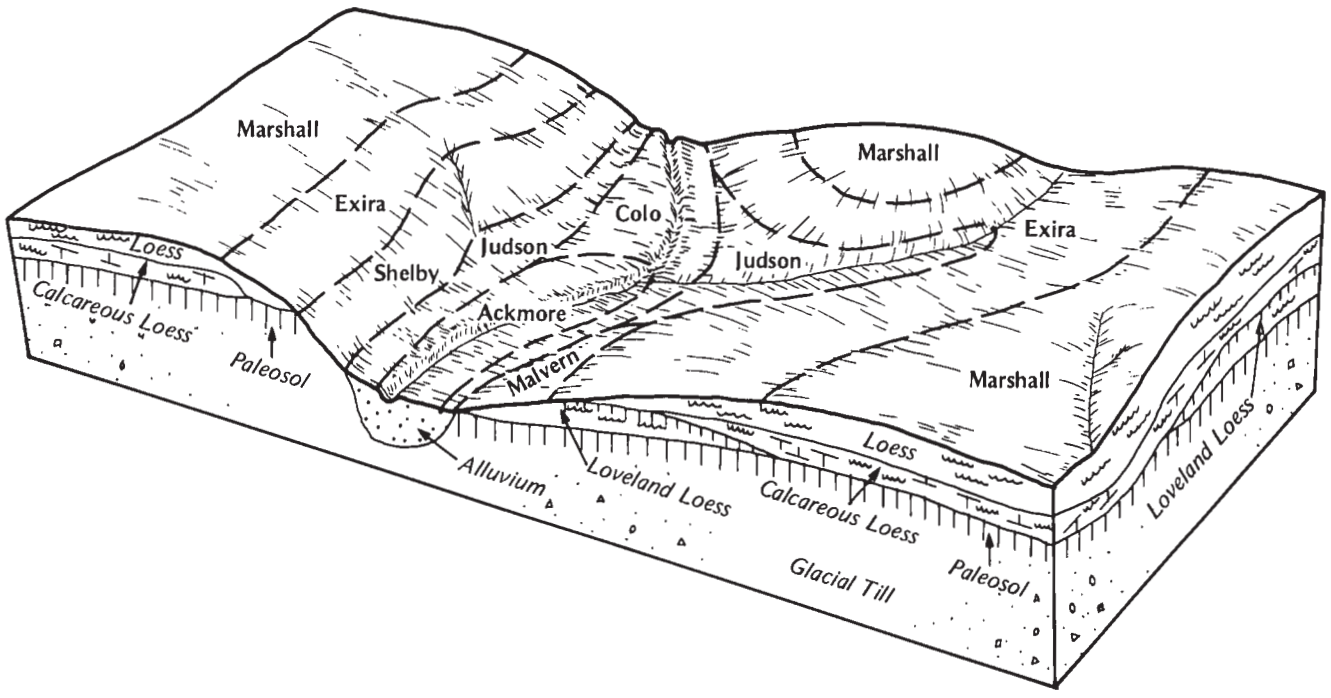


Figure 5.—Typical pattern of soils and parent material in the Marshall-Exira association.

brown subsoil material into the surface layer. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam.

Typically, the surface layer of the Exira soils is very dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown subsoil material into the surface layer. The subsoil is about 39 inches thick. The upper part is brown, friable silty clay loam, and the lower part is mottled light brownish gray, yellowish brown, and brown silt loam. The substratum to a depth of about 60 inches is mottled light brownish gray and brown silt loam.

The minor soils in this association are the Ackmore, Adair, Colo, Judson, Malvern, and Shelby soils. The somewhat poorly drained Ackmore and poorly drained Colo soils are on bottom land. The somewhat poorly drained Adair and Malvern and moderately well drained Shelby soils are on the lower parts of side slopes. The well drained Judson soils are on foot slopes in upland drainageways. Their surface soil is thicker than that of the major soils.

This association is used mainly for cultivated crops. Controlling runoff and water erosion and maintaining fertility are the main management concerns. The wetness of the minor soils in drainageways also is a concern.

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 substratum, 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 substratum. 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, Monona silt loam, 2 to 5 percent slopes, is a phase of the Monona series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded, is an example.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

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

1C—Ida silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow, rounded ridgetops and the upper parts of side slopes in the uplands. Areas range from 5 to 25 acres in size and are narrow and irregularly shaped.

Typically, the surface layer is dark brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam. In places the upper 2 feet is noncalcareous because of leaching.

Permeability is moderate, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production.

Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

1C3—Ida silt loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, well drained soil is on narrow, rounded ridgetops and the upper parts of side slopes in the uplands. Areas range from 5 to 15 acres in size and are narrow and irregularly shaped.

Typically, the surface layer is dark yellowish brown, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the substratum. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam.

Permeability is moderate, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

1D—Ida silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam. In places the upper 2 feet is noncalcareous because of leaching. In a few areas the substratum is brownish gray and grayish brown.

Permeability is moderate, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

1D3—Ida silt loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 5 to 75 acres in size and are irregularly shaped.

Typically, the surface layer is dark yellowish brown, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the substratum. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam. In places it is brownish gray and grayish brown.

Permeability is moderate, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth,

increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

1E—Ida silt loam, 14 to 20 percent slopes. This moderately steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 75 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam. In places the upper 2 feet is noncalcareous because of leaching. In a few areas the substratum is brownish gray and grayish brown.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are used as pasture. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

1E3—Ida silt loam, 14 to 20 percent slopes, severely eroded. This moderately steep, well drained soil is on side slopes in the uplands. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is brown, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the substratum. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam. In places it is brownish gray and grayish brown.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

1F—Ida silt loam, 20 to 30 percent slopes. This steep, well drained soil is on side slopes in the uplands (fig. 6). Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam. In some places the upper 2 feet is noncalcareous because of leaching. In other places the substratum is brownish gray and grayish brown.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are used as pasture. Because of the slope and a severe hazard of erosion, this soil is generally unsuited to cultivated crops. It is better suited to native grasses for hay and pasture. A cover of pasture plants or hay is effective in preventing excessive soil loss. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is VIe.

1F3—Ida silt loam, 20 to 30 percent slopes, severely eroded. This steep, well drained soil is on side

Figure 6.—An area of Ida silt loam, 20 to 30 percent slopes, in the foreground. Bottom land along the Missouri River is in the background.

slopes in the uplands. Areas range from 5 to 60 acres in size and are irregularly shaped.

Typically, the surface layer is dark yellowish brown, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the substratum. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam. In places it is brownish gray and grayish brown.

Permeability is moderate, and runoff is very rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are pastured. Because of the slope and a severe hazard of erosion, this soil generally is unsuited to cultivated crops. It is better suited to native pasture grasses. A cover of pasture plants is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is VIe.

1G—Ida silt loam, 30 to 40 percent slopes. This very steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam. In some places the upper 2 feet is noncalcareous because of leaching. In other places the substratum is brownish gray and grayish brown.

Permeability is moderate, and runoff is very rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are used as pasture. Because of the slope and a severe hazard of erosion, this soil generally is unsuited to cultivated crops. It is better suited to native grasses for hay and pasture. A cover of pasture plants or hay is effective in preventing excessive soil loss. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is VIIe.

2G—Hamburg silt loam, 40 to 75 percent slopes. This very steep, somewhat excessively drained soil is on side slopes in the uplands. Catsteps are common. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, calcareous silt loam about 4 inches thick. The next layer is brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches also is brown, calcareous silt loam.

Permeability is moderate, and runoff is very rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas support native pasture grasses. Because of the slope and the hazard of erosion, this soil generally is unsuited to cultivated crops and to grasses and legumes for hay. It is suited, however, to native pasture grasses and to upland wildlife habitat. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition. The species that can grow well in a calcareous soil should be selected for planting.

The land capability classification is VIIe.

3E—Castana silt loam, 9 to 20 percent slopes. This strongly sloping and moderately steep, well drained soil is on foot slopes. Areas range from 5 to 35 acres in size and are narrow and irregularly shaped.

Typically, the surface layer is very dark grayish brown, calcareous silt loam about 6 inches thick. The subsurface layer also is very dark grayish brown, calcareous silt loam. It is about 8 inches thick. The next layer is brown, very friable, calcareous silt loam about 14 inches thick. The substratum to a depth of about 60 inches is brown, calcareous silt loam. In some places the surface soil is less than 6 inches thick. In other places it contains more organic matter and is not calcareous.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. Some large areas are used as pasture. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

8B—Judson silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on foot slopes and alluvial fans in upland drainageways. Areas range from 5 to 75 acres in size and are irregularly shaped.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is silty clay loam about 23 inches thick. The upper part is black, the next part is very dark brown, and the lower part is very dark grayish brown. The subsoil is dark brown and brown, mottled, friable silty clay loam about 25 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

Included with this soil in mapping are some small areas of the nearly level, poorly drained Colo soils adjacent to the drainageway channels. These soils dry out more slowly after rains than the Judson soil. They make up less than 10 percent of the unit.

Permeability is moderate in the Judson soil, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. In some areas runoff from the soils upslope results in siltation and gullying on this soil. Measures that control the runoff on the soils upslope are needed. Grassed waterways help to remove excess water and prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods,

however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIe.

8C—Judson silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on foot slopes and alluvial fans in upland drainageways. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is silty clay loam about 20 inches thick. The upper part is black, the next part is very dark brown, and the lower part is very dark grayish brown. The subsoil is dark brown and brown, mottled, friable silty clay loam about 20 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain. In some areas runoff from the soils upslope results in siltation and gullying on this soil. Measures that control the runoff on the soils upslope are needed. Grassed waterways help to remove excess water and prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is moderately suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIIe.

9—Marshall silty clay loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad, stable ridgetops in the uplands. Areas range from 5 to more than 100 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 17 inches thick. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

The land capability classification is I.

9B—Marshall silty clay loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on broad ridgetops in the uplands. Areas range from 5 to more than 100 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 17 inches thick. The subsoil to a depth of about 60 inches is friable silty clay loam. The upper part is brown, and the lower part is dark yellowish brown and yellowish brown and is mottled.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

9C—Marshall silty clay loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 17 inches thick. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam. In places gray mottles are within a depth of 24 inches.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

9C2—Marshall silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown subsoil material into the surface layer. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam. In some places gray mottles are within a depth of 24 inches. In other places the surface layer is less than 7 inches thick.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

9D—Marshall silty clay loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 17 inches thick. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam. In places gray mottles are within a depth of 24 inches.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

9D2—Marshall silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to 100 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown subsoil material into the surface layer. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam. In some places gray

mottles are within a depth of 24 inches. In other places the surface layer is less than 7 inches thick.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

10—Monona silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad ridgetops in the uplands. Areas range from 5 to more than 100 acres in size and are long and wide.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the surface soil and subsoil are silty clay loam.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

The land capability classification is I.

10B—Monona silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on broad ridgetops in the uplands. Areas range from 5 to more than 100 acres in size and are long and narrow.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the surface soil and subsoil are silty clay loam.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

10C—Monona silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow ridgetops and long side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the surface soil and subsoil are silty clay loam.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

10C2—Monona silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown subsoil material into the surface layer. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the surface layer is more than 8 inches thick.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

10C3—Monona silt loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, well drained soil is on narrow ridgetops and shoulders of ridges in the uplands. Areas range from 3 to 20 acres in size and are long and narrow.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. About 10 to 15 percent of this layer is streaks and pockets of very dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the subsoil. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the surface layer is darker.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

10D—Monona silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are pastured. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

10D2—Monona silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to 100 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown subsoil material into the surface layer. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the surface layer is more than 8 inches thick.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

10D3—Monona silt loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on side slopes in the uplands (fig. 7). Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the subsoil. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown,

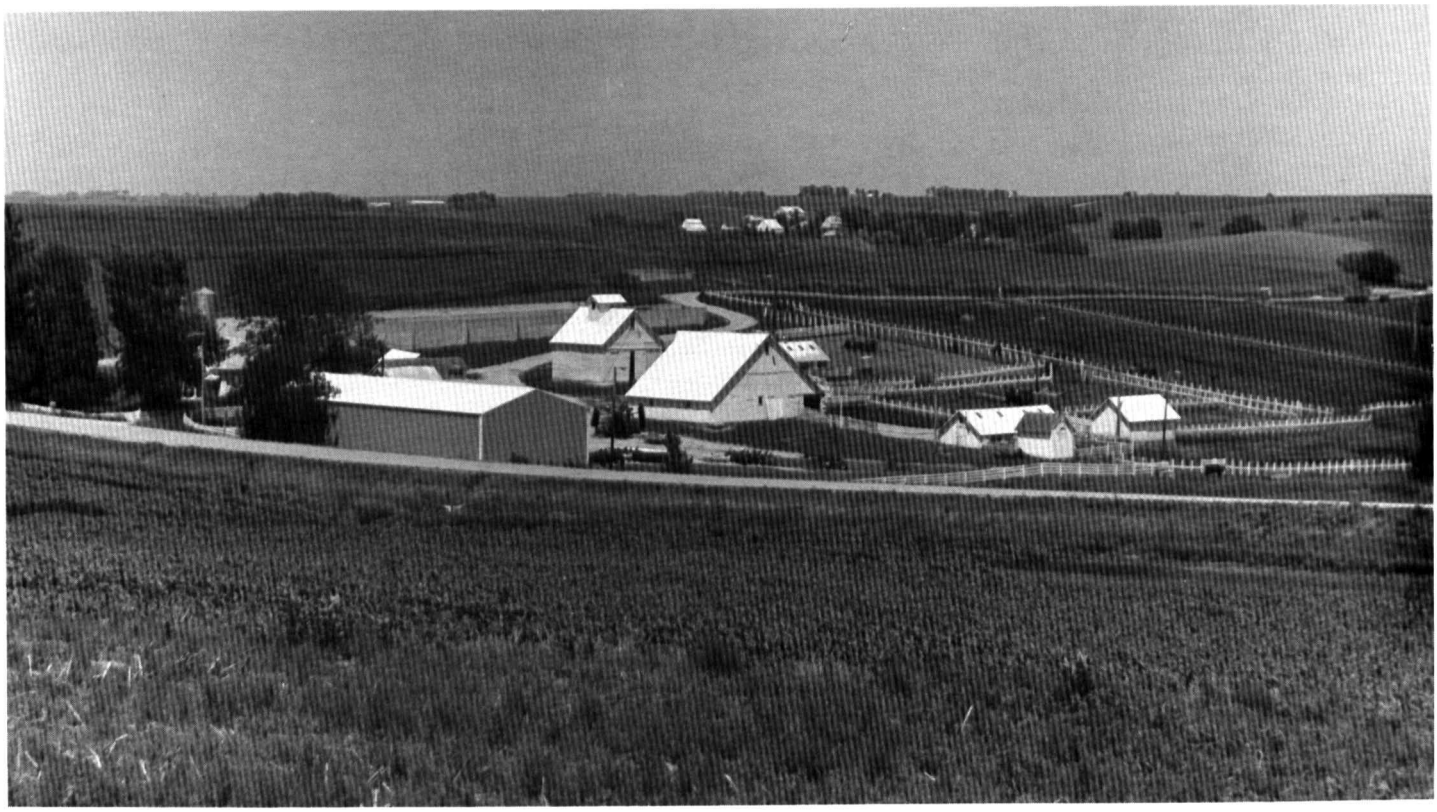


Figure 7.—A farmstead in an area of Monona silt loam, 9 to 14 percent slopes, severely eroded.

mottled silt loam. In places the soil is calcareous within a depth of 24 inches.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

10E—Monona silt loam, 14 to 20 percent slopes. This moderately steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are used as pasture. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

10E2—Monona silt loam, 14 to 20 percent slopes, moderately eroded. This moderately steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 100 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark yellowish brown subsoil material into the surface layer. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the surface layer is more than 7 inches thick.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

10E3—Monona silt loam, 14 to 20 percent slopes, severely eroded. This moderately steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 100 acres in size and are long and narrow or irregularly shaped.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the subsoil. The subsoil is brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the soil is calcareous within a depth of 24 inches.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and

legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

10F—Monona silt loam, 20 to 30 percent slopes. This steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsurface layer also is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 15 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the surface layer is more than 7 inches thick.

Permeability is moderate, and runoff is very rapid. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are pastured. Because of the slope and a severe hazard of erosion, this soil generally is unsuited to cultivated crops. It is moderately suited to grasses and legumes for hay and pasture. A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is VIe.

10G—Monona silt loam, 30 to 40 percent slopes. This very steep, well drained soil is on the sides of ridges in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. In places the subsurface layer is thinner.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are used as woodland. Because of the slope and the hazard of erosion, this soil generally is unsuited to cultivated crops and to grasses and legumes for hay. It is moderately suited to native pasture grasses. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition. Operating farm machinery is difficult on these slopes.

The land capability classification is VIIe.

11B—Ackmore-Colo-Judson complex, 0 to 5 percent slopes. These nearly level and gently sloping soils are along upland drainageways. The somewhat poorly drained Ackmore and poorly drained Colo soils are on the lower parts of the landscape and are subject to flooding unless they are protected. The well drained Judson soil is on the higher parts of the landscape. Areas range from 5 to 75 acres in size. They are about 40 percent Ackmore soil, 30 percent Colo soil, and 30 percent Judson soil. The three soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the surface layer of the Ackmore soil is very dark grayish brown silt loam about 6 inches thick. The substratum is very dark grayish brown, very dark gray, and dark grayish brown, mottled, stratified silt loam about 22 inches thick. Below this to a depth of about 60 inches is a buried layer of black silty clay loam or silty clay. In places the soil is silt loam to a depth of 40 inches.

Typically, the surface layer of the Colo soil is very dark gray silty clay loam about 7 inches thick. The subsurface layer is black silty clay loam about 16 inches thick. Below this is a transitional layer of very dark gray, firm silty clay loam about 11 inches thick. The subsoil is very dark gray silty clay loam about 14 inches thick. The substratum to a depth of about 60 inches is dark gray silty clay loam. In some places it is silty clay or is calcareous. In other places the upper 12 inches is recently deposited silt loam.

Typically, the surface layer of the Judson soil is black silt loam about 7 inches thick. The subsurface layer is silty clay loam about 23 inches thick. The upper part is black, the next part is very dark brown, and the lower part is very dark grayish brown. The subsoil is dark brown and brown, mottled, friable silty clay loam about 25 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

Permeability is moderate in all three soils, and runoff is slow. Available water capacity is high. The Ackmore and Colo soils have a seasonal high water table. The supply of available phosphorus and potassium is low in the Judson soil. The supply of available phosphorus is medium in the Colo soil and low in the Ackmore soil. The

supply of available potassium is very low in the Colo and Ackmore soils.

Most areas are used for row crops. These soils are well suited to corn, soybeans, and small grain. In some areas a drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains work well in the Colo soil if they are properly installed and if an adequate outlet is available. Tilth typically is good in the surface layer of the Ackmore and Judson soils and fair in the surface layer of the Colo soil. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soils are wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

These soils are well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The capability classification is IIw.

12B—Napier silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on foot slopes and in upland drainageways. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark brown, friable silt loam about 22 inches thick. The subsoil to a depth of about 60 inches is dark brown and brown, friable silt loam. In some places the surface layer contains less organic matter. In other places the soil is moderately well drained.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated (fig. 8). This soil is well suited to corn, soybeans, and small grain. Runoff from the soils upslope results in siltation and gullying in some areas of this soil. Measures that control the runoff on the soils upslope are needed. Grassed waterways help to remove excess water and prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIe.

12C—Napier silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on foot slopes and in upland drainageways. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark brown, friable silt loam about 22 inches thick. The subsoil to a depth of about 60 inches is dark brown and brown, friable silt loam.

Included with this soil in mapping are some small areas of Ida and Monona soils. These soils make up less than 10 percent of the unit. They are higher on the landscape than the Napier soil and contain less organic matter. Ida soils are calcareous.

Permeability is moderate in the Napier soil, and runoff is medium. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain. Runoff from the soils upslope results in siltation and gullying in some areas of this soil. Measures that control the runoff on the soils upslope are needed. Grassed waterways help to remove excess water and prevent gullying. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is moderately suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIIe.

12D—Napier silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on foot slopes and in upland drainageways. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark brown, friable silt loam about 22 inches thick. The subsoil to a depth of about 60 inches is dark brown and brown, friable silt loam.

Included with this soil in mapping are some small areas of Ida and Monona soils. These soils make up less than 10 percent of the unit. They are higher on the landscape than the Napier soil and contain less organic matter. Ida soils are calcareous. These soils make up less than 10 percent of the unit.

Permeability is moderate in the Napier soil, and runoff is medium. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Figure 8.—A cultivated area of Napier silt loam, 2 to 5 percent slopes.

This soil is moderately suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIIe.

22C3—Dow silt loam, 5 to 9 percent slopes, severely eroded. This moderately sloping, well drained soil is on side slopes and narrow ridgetops in the uplands. Areas range from 5 to 15 acres in size and are narrow and irregularly shaped.

Typically, the surface layer is grayish brown, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark grayish brown material. Erosion has removed most of the original darkened surface layer and in places part of the substratum. The substratum to a depth of about 60 inches is grayish brown, mottled, calcareous silt loam. In places, the soil is noncalcareous and the substratum is brown and dark yellowish brown or is grayish brown.

Permeability is moderate, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

22D3—Dow silt loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to 30 acres in size and are narrow and irregularly shaped.

Typically, the surface layer is grayish brown, friable, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark grayish brown material. Erosion has removed most of the original darkened surface layer and in places part of the substratum. The substratum to a depth of about 60 inches is grayish brown, mottled, calcareous silt loam. In places, the soil is noncalcareous and the substratum is brown and dark yellowish brown or is grayish brown.

Permeability is moderate, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

22E3—Dow silt loam, 14 to 20 percent slopes, severely eroded. This moderately steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 30 acres in size and are narrow and irregularly shaped.

Typically, the surface layer is grayish brown, friable, calcareous silt loam about 8 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark grayish brown material. Erosion has removed most of the original darkened surface layer and in places part of the substratum. The substratum to a depth of about 60 inches is grayish brown, mottled, calcareous silt loam. In places, the soil is noncalcareous and the substratum is brown and dark yellowish brown or is grayish brown.

Permeability is moderate, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The species that can grow well in a calcareous soil should be selected for planting. Overgrazing causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

24D2—Shelby clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown subsoil material into the surface layer. The subsoil is firm clay loam about 43 inches thick. The upper part is brown, the next part is dark yellowish brown, and the lower part is dark yellowish brown and mottled. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, calcareous clay loam. Pebbles are in the subsoil and substratum. In some areas the surface layer is more than 7 inches thick. In other areas it is less than 7 inches thick because of severe erosion. In these areas stones and pebbles are on the surface. In places the soil is calcareous.

Included with this soil in mapping are some small areas of the somewhat poorly drained Adair soils. These soils are higher on the landscape than the Shelby soil. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Shelby soil, and runoff is medium. Available water capacity is high. The

subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some large areas are pastured. In most areas this soil is managed along with the adjacent soils. It is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. The stones on the surface in some areas can result in damage to farm equipment unless they are removed. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

24E2—Shelby clay loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, moderately well drained soil is on convex side slopes in the uplands. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown subsoil material into the surface layer. The subsoil is firm clay loam about 43 inches thick. The upper part is brown, the next part is dark yellowish brown, and the lower part is dark yellowish brown and mottled. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, calcareous clay loam. Stones and pebbles are in the subsoil and substratum. In some areas the surface layer is more than 7 inches thick and is very dark gray. In other areas it is less than 7 inches thick because of severe erosion. In these areas stones and pebbles are on the surface. In places the soil is calcareous.

Included with this soil in mapping are some small areas of the somewhat poorly drained Adair soils. These soils are higher on the landscape than the Shelby soil. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Shelby soil, and runoff is rapid. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some large areas are pastured. In most areas this soil is managed along with the adjacent soils. It is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. The stones on the surface in some areas can result in damage to farm equipment unless they are removed. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

24E3—Shelby clay loam, 14 to 18 percent slopes, severely eroded. This moderately steep, moderately well drained soil is on convex side slopes in the uplands. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is brown clay loam about 7 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark grayish brown material. Erosion has removed most of the original darkened surface layer and in places part of the subsoil. The subsoil is firm clay loam about 43 inches thick. The upper part is brown, the next part is dark yellowish brown, and the lower part is dark yellowish brown and mottled. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, calcareous clay loam. Stones and pebbles are in the subsoil and substratum. In some places the surface layer is more than 7 inches thick and is very dark gray. In other places the soil is calcareous.

Included with this soil in mapping are some small areas of the somewhat poorly drained Adair soils. These soils are higher on the landscape than the Shelby soil. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Shelby soil, and runoff is rapid. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some large areas are pastured. In most areas this soil is managed along with the adjacent soils. It generally is unsuited to corn, soybeans, and small grain and is moderately suited to grasses and legumes for hay and pasture.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking

rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is VIe.

33D2—Steinauer clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes in the uplands. Areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, calcareous clay loam about 6 inches thick. Plowing has mixed some streaks and pockets of yellowish brown material into the surface layer. The next layer is yellowish brown, firm, calcareous clay loam about 5 inches thick. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. It has pebbles. It is mottled in the lower part. In some places the surface layer is only about 3 inches thick because of severe erosion. In other places stones and pebbles are on the surface. In some areas the soil is noncalcareous because of leaching.

Permeability is moderately slow, and runoff is rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some large areas are pastured. In most areas this soil is managed along with the adjacent soils. It is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. The stones on the surface in some areas can result in damage to farm equipment unless they are removed. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

33E2—Steinauer clay loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is yellowish brown, calcareous clay loam about 6 inches thick. Plowing has mixed some streaks and pockets of yellowish brown material into the surface layer. The next layer is yellowish brown, firm, calcareous clay loam about 5 inches thick. The substratum to a depth of about 60 inches is yellowish brown, calcareous clay loam. It has pebbles. It is mottled in the lower part. In places the soil is noncalcareous because of leaching.

Permeability is moderately slow, and runoff is rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some large areas are pastured. In most areas this soil is managed along with the adjacent soils. It is poorly suited to corn, soybeans, and small grain and moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. The stones on the surface in some areas can result in damage to farm equipment unless they are removed. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

36—Salix silty clay loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is at intermediate elevations on bottom land. It is subject to rare flooding. Areas range from 3 to 125 acres in size and are long and narrow or irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer also is black silty clay loam about 8 inches thick. The subsoil is about 18 inches thick. The upper part is very dark grayish brown, friable silty clay loam, and the lower part is dark grayish brown, mottled, friable, calcareous silt loam. The substratum to a depth of about 60 inches is brown and grayish brown, mottled, calcareous silt loam. In some places the upper 6 to 18 inches is recently deposited, light colored silt loam. In other places the surface soil and subsoil are silt loam.

Included with this soil in mapping are small areas of the poorly drained Blencoe soils. These soils are at the lower elevations. They make up less than 10 percent of the unit.

Permeability is moderate in the Salix soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a

very low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is I.

43—Bremer silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on low alluvial terraces. It is subject to rare flooding. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer also is black silty clay loam. It is about 12 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is very dark gray, and the lower part is dark gray and mottled. In some places the dark surface soil extends to a depth of 36 inches or more. In other places the subsoil has more clay.

Included with this soil in mapping are some small areas of the somewhat poorly drained Nevin soils. These soils are higher on the landscape than the Bremer soil and dry out more quickly. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Bremer soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Surface drains are needed in some areas. Tile drains work well if they are properly installed and if an adequate outlet is available. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

44—Blencoe silty clay, 0 to 2 percent slopes. This nearly level, poorly drained soil is at the lower elevations on bottom land. It is subject to rare flooding. Areas generally range from 5 to 75 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay about 8 inches thick. The subsurface layer also is black silty clay. It is about 10 inches thick. The subsoil is about 18 inches thick. The upper part is very dark gray, firm silty clay; the next part is dark grayish brown, mottled, friable silty clay loam; and the lower part is dark grayish brown, mottled, very friable, calcareous silt loam. The substratum to a depth of about 60 inches is grayish brown, mottled, calcareous silt loam. In places the surface soil and subsoil are silty clay loam.

Included with this soil in mapping are small areas of the moderately well drained Salix soils. These soils are slightly higher on the landscape than the Blencoe soil and dry out more rapidly after rains. They make up less than 10 percent of the unit.

Permeability is slow in the Blencoe soil. Runoff also is slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Tilth generally is poor in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

46—Keg silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on bottom land. It is subject to rare flooding. Areas generally range from 5 to more than 100 acres in size and are long and irregularly shaped.

Typically, the surface layer is black silt loam about 6 inches thick. The subsurface layer is very dark brown and black silt loam about 8 inches thick. The subsoil is dark grayish brown and brown, very friable silt loam about 21 inches thick. It is calcareous in the lower part. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, mottled, calcareous silt loam that has thin strata of silty clay loam. In places the surface layer is silty clay loam.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a very

low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is I.

54—Zook silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is at the lower elevations on bottom land. It is occasionally flooded for brief periods unless it is protected. Areas range from 5 to more than 200 acres in size and are wide and irregularly shaped.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is about 33 inches thick. The upper part is black silty clay loam, and the lower part is black silty clay. The subsoil is very dark gray, very firm silty clay about 16 inches thick. The substratum to a depth of about 60 inches is dark gray, mottled silty clay. In some places the surface layer is overlain by about 12 inches of recently deposited silt loam. In other places it is silty clay. In some areas the subsoil contains less clay.

Permeability and runoff are slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains generally work satisfactorily only if they are closely spaced and if an adequate outlet is available. Surface drains are needed to remove surface water in some areas. Tilth generally is fair in the surface layer. Returning crop residue to the soil and deferring tillage when the soil is wet help to maintain tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth.

The land capability classification is IIw.

54+—Zook silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is at the lower elevations on bottom land. It is occasionally flooded for brief periods unless it is protected. Areas range from 5 to 75 acres in size. They are long and narrow or are irregularly shaped.

Typically, the surface layer is recently deposited alluvium about 13 inches thick. It is dark grayish brown or grayish brown silt loam. The next 20 inches is black silty clay loam. Below this is about 15 inches of black silty clay. The subsoil is very dark gray, firm silty clay about 12 inches thick. In some places the dark underlying layers are calcareous. In other places the subsoil contains less clay.

Included with this soil in mapping are some small areas of the somewhat poorly drained Ackmore soils. These soils are slightly higher on the landscape than the Zook soil and dry out more rapidly after rains. They make up less than 10 percent of the unit.

Permeability is slow in the Zook soil. Runoff also is slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains generally work satisfactorily only if they are closely spaced and if an adequate outlet is available. Surface drains are needed to remove surface water in some areas. Good tilth generally can be easily maintained. Returning crop residue to the soil and deferring tillage when the soil is wet help to maintain tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth.

The land capability classification is IIw.

60D2—Malvern silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on side slopes in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of reddish brown silty clay from the subsoil into the surface layer. The subsoil is about 47 inches thick. The upper part is reddish brown, firm silty clay; the next part is yellowish red and brown, mottled, firm silty clay; and the lower part is brown, mottled, friable silty clay loam. The substratum to a depth of about 60 inches is brown, mottled silty clay loam. In places the surface layer is more than 7 inches thick.

Permeability is slow, and runoff is rapid. Available water capacity is moderate or high. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. Some are pastured. In most areas this soil is managed along with the adjacent soils. It is poorly suited to corn, soybeans, and small grain. It generally is suited to grasses and legumes for hay and

pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Interceptor tile is needed on some of the higher adjacent slopes to reduce wetness and control seepage in this soil. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

66—Luton silty clay, 0 to 2 percent slopes. This nearly level, very poorly drained soil is at the lower elevations on broad bottom land. It is occasionally flooded for brief periods unless it is protected. Areas range from 5 to more than 200 acres in size. They are irregularly shaped.

Typically, the surface layer is black silty clay about 7 inches thick. The subsurface layer is black and very dark gray silty clay about 17 inches thick. The subsoil is firm silty clay about 18 inches thick. The upper part is dark gray and mottled, and the lower part is gray, mottled, and calcareous. The substratum to a depth of about 60 inches is gray, mottled, calcareous silty clay. In places silt loam is below a depth of 40 inches.

Included with this soil in mapping are some small areas of the somewhat poorly drained Lakeport soils. These soils are slightly higher on the landscape than the Luton soil and dry out more rapidly after rains. Also, they can be tilled more easily. They make up less than 10 percent of the unit.

Permeability is very slow in the Luton soil. Runoff also is very slow. Available water capacity is moderate. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Tilth generally is poor in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is moderately suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIIw.

66+—Luton silt loam, overwash, 0 to 2 percent slopes. This nearly level, very poorly drained soil is at the lower elevations on broad bottom land. It is occasionally flooded for brief periods unless it is protected. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is recently deposited alluvium about 9 inches thick. It is very dark grayish brown and black, calcareous silt loam. The underlying material to a depth of about 60 inches is mottled, calcareous silty clay. It is black in the upper 26 inches and dark gray and very dark gray in the lower part.

Included with this soil in mapping are some small areas of the somewhat poorly drained Moville soils. These soils are at elevations similar to those of the Luton soil, but they dry out more rapidly after rains. They make up less than 10 percent of the unit.

Permeability is very slow in the Luton soil. Runoff also is very slow. Available water capacity is moderate. The soil has a seasonal high water table. The underlying material generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

The land capability classification is IIIw.

70—McPaul silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is in settling basins on broad bottom land and in upland drainageways. It is occasionally flooded for very brief periods unless it is protected. In some areas it is protected by dikes and levees. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, calcareous, stratified silt loam. In places it contains more clay in the upper part.

Permeability is moderate, and runoff is slow. Available water capacity is high. The substratum generally has a medium supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Good tilth generally can be easily maintained. Returning crop residue to the soil

or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, reduces forage production.

The land capability classification is I.

76C—Ladoga silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on ridgetops and the upper side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is dark yellowish brown and brown, firm silty clay loam about 42 inches thick. It has a few mottles in the lower part. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

Permeability is moderately slow, and runoff is medium. Available water capacity is high. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used as wooded pasture. If cleared of trees and protected against erosion, this soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion can be controlled by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

76D—Ladoga silt loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on side slopes in the uplands. Areas range from 5 to 100 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is dark yellowish brown, firm silty clay loam about 30 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

Permeability is moderately slow, and runoff is medium. Available water capacity is high. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used as wooded pasture. If cleared of trees and protected against erosion, this soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion can be controlled by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

76F—Ladoga silt loam, 14 to 25 percent slopes. This moderately steep and steep, moderately well drained soil is on side slopes in the uplands. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is dark yellowish brown, firm silty clay loam about 30 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

Permeability is moderately slow, and runoff is rapid. Available water capacity is high. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used as wooded pasture. This soil is generally unsuited to corn, soybeans, and small grain and to grasses and legumes for hay. It is moderately suited to pasture. A cover of pasture plants is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is VIe.

88—Nevin silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low alluvial terraces. It is subject to rare flooding. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 18 inches thick. The subsoil is silty clay loam about 25 inches thick. The

upper part is dark grayish brown and friable; the next part is dark grayish brown, mottled, and firm; and the lower part is dark grayish brown, mottled, and friable. The substratum to a depth of about 60 inches is mottled brown and dark grayish brown silty clay loam. In some places the subsoil contains less clay. In other places it is calcareous at a depth of 24 to 30 inches.

Permeability is moderate, and runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are used for row crops. This soil is well suited to corn, soybeans, and small grain. Tile drains generally are not needed but are beneficial in some areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is I.

93D2—Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded. These strongly sloping soils are on side slopes in the uplands. The Shelby soil is moderately well drained, and the Adair soil is somewhat poorly drained. Areas range from 5 to 30 acres in size and are irregularly shaped. They are about 60 percent Shelby soil and 40 percent Adair soil. The two soils occur as areas so small or so closely intermingled that mapping them separately is impractical.

Typically, the Shelby soil has a surface layer of very dark grayish brown clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown subsoil material into the surface layer. The subsoil is firm clay loam about 43 inches thick. The upper part is brown, the next part is dark yellowish brown, and the lower part is dark yellowish brown and mottled. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, calcareous clay loam. Stones and pebbles are in the subsoil and substratum. In some areas the surface layer is more than 7 inches thick. In other areas it is less than 7 inches thick because of severe erosion. In these areas stones and pebbles are on the surface. In places the soil is calcareous.

Typically, the Adair soil has a surface layer of dark brown silty clay loam about 9 inches thick. Plowing has mixed some streaks and pockets of reddish brown clay loam from the subsoil into the surface layer. The subsoil extends to a depth of about 60 inches. The upper part is yellowish brown, friable silty clay loam; the next part is brown, mottled clay loam; and the lower part is strong brown, mottled, firm clay loam. Some pebbles are throughout the subsoil. In some places the surface layer is only about 3 inches thick because of severe erosion. In other places no pebbles are in the subsoil or substratum.

Permeability is moderately slow in the Shelby soil and slow in the Adair soil. Runoff is rapid on both soils. Available water capacity is high. The Adair soil has a seasonal high water table. The subsoil of the Shelby soil generally has a low supply of available phosphorus and a high supply of available potassium. The subsoil of the Adair soil has a very low supply of available phosphorus and a very low or low supply of available potassium.

Most areas are cultivated. Some large areas are pastured. Most areas are managed along with the adjacent areas. These soils are poorly suited to corn, soybeans, and small grain. They are moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Tilth generally is fair in the surface layer. Returning crop residue to the soils or regularly adding other organic material and deferring tillage when the soils are wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

93D3—Shelby-Adair complex, 9 to 14 percent slopes, severely eroded. These strongly sloping soils are on side slopes in the uplands. The Shelby soil is moderately well drained, and the Adair soil is somewhat poorly drained. Areas range from 5 to 30 acres in size and are irregularly shaped. They are about 60 percent Shelby soil and 40 percent Adair soil. The two soils occur as areas so small or so closely intermingled that mapping them separately is impractical.

Typically, the Shelby soil has a surface layer of brown clay loam about 7 inches thick. About 10 to 15 percent of this layer is streaks and pockets of very dark grayish brown material. Erosion has removed most of the original surface layer and in places part of the subsoil. The subsoil is firm clay loam about 43 inches thick. The upper part is brown, the next part is dark yellowish, and the lower part is dark yellowish brown and mottled. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, calcareous clay loam. Stones and pebbles are in the subsoil and substratum. In some

places the surface layer is more than 7 inches thick. In other places the soil is calcareous.

Typically, the Adair soil has a surface layer of reddish brown clay loam about 6 inches thick. About 10 to 15 percent of this layer is streaks and pockets of dark yellowish brown silty clay loam. Erosion has removed most of the original darkened surface layer and in places part of the subsoil. The subsoil to a depth of about 60 inches is mottled, firm clay loam. The upper part is reddish brown, and the lower part is strong brown. Some pebbles are throughout the subsoil. In some places, the surface layer is more than 6 inches thick and no pebbles are in the subsoil or substratum. In other places the subsoil and substratum are grayish.

Permeability is moderately slow in the Shelby soil and slow in the Adair soil. Runoff is rapid on both soils. Available water capacity is high. The Adair soil has a seasonal high water table. The subsoil of the Shelby soil generally has a low supply of available phosphorus and a high supply of available potassium. The subsoil of the Adair soil has a very low supply of available phosphorus and a very low or low supply of available potassium.

Most areas are cultivated. Some large areas are pastured. Most areas are managed along with the adjacent areas. These soils are poorly suited to corn, soybeans, and small grain. They are moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Tilth generally is fair in the surface layer. Returning crop residue to the soils or regularly adding other organic material and deferring tillage when the soils are wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

99C2—Exira silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to more than 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown subsoil material into the surface layer. The subsoil is about 39 inches thick. The upper part is brown, mottled, friable silty clay loam, and the lower part is mottled light brownish gray, yellowish brown, and brown silt loam. The substratum to a depth of about 60 inches is mottled light brownish gray and brown silt loam. In places the soil does not have grayish mottles within a depth of 24 inches. In other places the surface layer is only about 3 inches thick because of severe erosion.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

99D2—Exira silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on side slopes in the uplands. Areas range from 5 to more than 100 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown subsoil material into the surface layer. The subsoil is about 39 inches thick. The upper part is brown, mottled, friable silty clay loam, and the lower part is mottled light brownish gray, yellowish brown, and brown silt loam. The substratum to a depth of about 60 inches is mottled light brownish gray and brown silt loam. In places the soil does not have grayish mottles within a depth of 24 inches.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to

maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

99D3—Exira silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on long side slopes in the uplands. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is brown silty clay loam about 7 inches thick. About 10 to 15 percent of this layer is streaks and pockets of very dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the subsoil. The subsoil is about 39 inches thick. The upper part is brown, mottled, friable silty clay loam, and the lower part is mottled light brownish gray, yellowish brown, and brown silt loam. The substratum to a depth of about 60 inches is mottled light brownish gray and brown silt loam. In places the soil does not have grayish mottles within a depth of 24 inches.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

99E2—Exira silty clay loam, 14 to 20 percent slopes, moderately eroded. This moderately steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown subsoil material into the surface layer. The subsoil is about 39 inches thick. The upper part is brown, mottled, friable silty clay loam, and the lower part is mottled light brownish gray, yellowish brown, and brown silt loam. The substratum to a depth of about 60 inches is mottled light brownish gray and brown silt loam. In places the soil does not have grayish mottles within a depth of 24 inches.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

99E3—Exira silty clay loam, 14 to 20 percent slopes, severely eroded. This moderately steep, well drained soil is on side slopes in the uplands. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is brown silty clay loam about 7 inches thick. About 10 to 15 percent of this layer is streaks and pockets of very dark brown material. Erosion has removed most of the original darkened surface layer and in places part of the subsoil. The subsoil is about 39 inches thick. The upper part is brown, mottled, friable silty clay loam, and the lower part is mottled light brownish gray, yellowish brown, and brown silt loam. The substratum to a depth of about 60 inches is mottled light brownish gray and brown silt loam. In places the soil does not have grayish mottles within a depth of 24 inches.

Permeability is moderate, and runoff is rapid. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled,

however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

133—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is at the lower elevations on bottom land. It is occasionally flooded for brief periods unless it is protected. Areas generally range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray silty clay loam about 7 inches thick. The subsurface layer is black and very dark gray, firm silty clay loam about 27 inches thick. The subsoil is very dark gray silty clay loam about 14 inches thick. The substratum to a depth of about 60 inches is dark gray silty clay loam. In some places it is silty clay or is calcareous. In other places about 12 inches of recently deposited silt loam overlies the surface layer.

Included with this soil in mapping are small areas of the well drained Judson and moderately well drained Kennebec soils. These soils are slightly higher on the landscape than the Colo soil and dry out more rapidly after rains. They make up less than 10 percent of the unit.

Permeability is moderate in the Colo soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if an adequate outlet is available. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

133+—Colo silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is at the lower elevations on bottom land. It is occasionally flooded for brief periods unless it is protected. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is recently deposited alluvium about 15 inches thick. It is very dark grayish brown and dark grayish brown silt loam. Below this is about 43 inches of black and very dark gray silty clay loam. The substratum to a depth of about 60 inches is very dark gray and very dark grayish brown, firm silty clay loam. In some places the underlying soil is calcareous throughout. In other places it is silt loam throughout.

Included with this soil in mapping are some small areas of the somewhat poorly drained Ackmore and moderately well drained Rawles soils. These soils are slightly higher on the landscape than the Colo soil and dry out more rapidly after rains. They make up less than 10 percent of the unit.

Permeability is moderate in the Colo soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if an adequate outlet is available. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

137—Haynie silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is at the higher elevations and on short escarpments in areas of recent deposition on bottom land. It is occasionally flooded for very brief periods on the river side of levees, but in other areas it is protected. Areas generally range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, mottled, calcareous, stratified silt loam. In some places the surface layer and the upper part of the

substratum are silty clay loam. In other places silty clay or sand is at a depth of about 30 inches.

Permeability is moderate, and runoff is slow. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. The occasional flooding is a hazard in some areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, reduces forage production.

The land capability classification is IIw.

144—Blake silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is at intermediate elevations in areas of recent deposition on bottom land. It is occasionally flooded for very brief periods on the river side of levees, but in other areas it is protected. Areas generally range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. The upper 19 inches of the substratum is dark grayish brown and brown, mottled, calcareous, stratified silty clay loam. The lower part to a depth of about 60 inches is grayish brown, dark yellowish brown, and light brownish gray, mottled, calcareous silt loam. In places the surface layer is silt loam or silty clay.

Permeability is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. The occasional flooding is a hazard in some areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

146—Onawa silty clay, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is at the lower elevations in areas of recent deposition on bottom land. It is subject to rare flooding. Areas generally range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silty clay about 8 inches thick. The upper 18 inches of the substratum is dark gray, mottled, calcareous silty clay. The lower part to a depth of about 60 inches is grayish brown, dark grayish brown, and olive gray, mottled, calcareous, stratified silt loam. In some places the surface layer is silty clay loam. In other places the soil is silty clay throughout.

Permeability is slow in the upper part of the profile and moderate or moderately rapid in the lower part of the substratum. Runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Tilth generally is poor in the surface layer. Clods form when the soil dries out. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

149—Modale silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is at the higher elevations in areas of recent deposition on bottom land. It is occasionally flooded for brief periods on the river side of levees, but in other areas it is protected. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The upper 17 inches of the substratum is dark grayish brown and grayish brown, mottled, very calcareous, stratified silt loam. The lower part to a depth of about 60 inches is very dark grayish brown and dark grayish brown, mottled, calcareous silty clay. In some places the silty upper part of the substratum extends to a depth of more than 30 inches. In other places the surface layer is loamy fine sand.

Permeability is moderate in the upper part of the profile and slow in the lower part of the substratum. Runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Good tilth generally can

be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, reduces forage production.

The land capability classification is I.

156—Albaton silty clay, 0 to 2 percent slopes. This nearly level, poorly drained soil is in swales and other low areas of recent deposition on bottom land. It is occasionally flooded for brief periods on the river side of levees, but in other areas it is protected. Areas generally range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, calcareous silty clay about 9 inches thick. The substratum to a depth of about 60 inches is dark gray, dark grayish brown, and grayish brown, mottled, calcareous, stratified silty clay. In places the lower part of the substratum is coarser textured.

Permeability is very slow, and runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Tilth generally is poor in the surface layer. Large cracks and clods form when the soil dries out. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is moderately suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIIw.

156+—Albaton silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is in swales and other low areas of recent deposition on bottom land. It is occasionally flooded for brief periods on the river side of levees, but in other areas it is protected. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is stratified dark grayish brown and grayish brown, calcareous silt loam about 12 inches thick. The subsurface layer is very dark grayish brown, calcareous silty clay about 9 inches thick. The substratum to a depth of about 60 inches is dark gray, dark grayish brown, and grayish brown, mottled, calcareous, stratified silty clay. In places the lower part of the substratum is coarser textured.

Permeability is very slow, and runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is moderately suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIIw.

179F—Gara loam, 10 to 24 percent slopes. This strongly sloping to steep, moderately well drained soil is on side slopes in the uplands. Areas range from 10 to more than 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray loam about 7 inches thick. The subsurface layer is dark grayish brown, friable loam about 3 inches thick. The subsoil is clay loam about 36 inches thick. The upper part is brown and friable, and the lower part is yellowish brown and firm. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. Pebbles are throughout the profile.

Included with this soil in mapping are small areas of the somewhat poorly drained Armstrong soils. These soils are higher in content of clay and lower in content of organic matter than the Gara soil. They make up about 10 percent of the unit.

Permeability is moderately slow in the Gara soil, and runoff is rapid. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for hay and pasture. Because of a very severe hazard of erosion, this soil generally is unsuited to corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and is well suited to pasture. A cover of hay or pasture plants is effective in controlling erosion. Overgrazing, however, causes surface compaction, increases the runoff rate and the susceptibility to erosion, and reduces forage production. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is VIe.

192C2—Adair silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, somewhat poorly drained soil is on convex side slopes in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 9 inches thick. Plowing has mixed some streaks and pockets of reddish brown clay loam from the subsoil into the surface layer. The subsoil to a depth of about 60 inches is clay loam. The upper part is reddish brown and firm, and the lower part is strong brown, mottled, and very firm. Some pebbles are throughout the subsoil. In some places the surface layer is only about 3 inches thick because of severe erosion. In other places it is more than 9 inches thick.

Permeability is slow, and runoff is medium. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. They are managed along with the adjacent areas. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops help to prevent excessive soil loss. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

192D2—Adair silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, somewhat poorly drained soil is on convex side slopes in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown silty clay loam about 9 inches thick. Plowing has mixed some streaks and pockets of yellowish brown subsoil material into the surface layer. The subsoil extends to a depth of about 60 inches. The upper part is yellowish brown silty clay loam, and the lower part is brown and strong brown, mottled, firm clay loam. Some pebbles are throughout the subsoil. In some places the surface layer is only about 3 inches thick because of severe erosion. In other places it is more than 9 inches thick.

Permeability is slow, and runoff is rapid. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some large areas are pastured. In most areas this soil is managed along with the adjacent soils. It is poorly suited to corn, soybeans, and small grain, mainly because it is subject to erosion. It is moderately suited to grasses and legumes for hay and pasture. Erosion can be controlled by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

212—Kennebec silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on bottom land. It is occasionally flooded for very brief periods. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer also is black silt loam. It is about 24 inches thick. The next layer is very dark gray, friable silt loam about 12 inches thick. The substratum to a depth of about 60 inches is very dark gray, friable silt loam. In places the upper 12 inches is recently deposited silt loam.

Included with this soil in mapping are some small areas of the poorly drained Colo soils. These soils are slightly lower on the landscape than the Kennebec soil and dry out more slowly after rains. They make up less than 10 percent of the unit.

Permeability is moderate in the Kennebec soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is I.

212+—Kennebec silt loam, overwash, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on bottom land. It is occasionally flooded for very brief periods. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is recently deposited alluvium about 18 inches thick. It is stratified dark grayish brown and grayish brown silt loam. Below this is about 18 inches of black silt loam. The substratum to a depth of about 60 inches is very dark gray and very dark grayish brown, friable silt loam.

Included with this soil in mapping are small areas of the poorly drained, overwashed Colo soils and small areas of Rawles soils. The overwashed Colo soils are slightly lower on the landscape than the Kennebec soil. Rawles soils are at elevations similar to those of the Kennebec soil, but they dry out more slowly after rains. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Kennebec soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is I.

220—Nodaway silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is in areas of recent deposition on bottom land. It is occasionally flooded for brief periods unless it is protected. Areas generally range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, dark brown, and brown, stratified silt loam. In places dark silty clay loam is within a depth of 36 inches.

Included with this soil in mapping are some small areas of Kennebec soils and the moderately well drained, calcareous McPaul soils. Both of these soils are at elevations similar to those of the Nodaway soil. Kennebec soils contain more organic matter in the surface layer than the Nodaway soil. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Nodaway soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. The flooding and the seasonal high water table are management concerns. Measures that reduce the wetness improve the timeliness of fieldwork. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, reduces forage production.

The land capability classification is IIw.

222D2—Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, poorly drained soil is on the lower part of side slopes in the uplands. Areas range from 2 to 10 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark gray silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark gray silty clay from the subsoil into the surface layer. The subsoil to a depth of about 60 inches is very firm silty clay. It is dark gray in the upper part and gray and mottled in the lower part. In some areas the surface layer and subsoil are reddish.

Permeability is very slow, and runoff is rapid. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and potassium.

Many areas are cultivated. Some of the larger areas are pastured. In most areas this soil is managed along with the adjacent soils. It is poorly suited to corn, soybeans, and small grain. It is moderately suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a conservation tillage system that leaves crop residue on the surface, and crop rotations that include meadow crops. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Also, the less desirable plant species invade overgrazed areas. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IVe.

234—Nishna silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in low

depressions on bottom land. It is occasionally flooded for brief periods unless it is protected. Areas range from 5 to more than 50 acres in size and are irregularly shaped.

Typically, the surface layer is black, calcareous silty clay loam about 7 inches thick. The subsurface layer is about 20 inches of black, calcareous silty clay loam and silty clay. The subsoil is very dark gray, firm, calcareous silty clay about 11 inches thick. The substratum to a depth of about 60 inches is dark gray, calcareous silty clay. In some places the upper 12 inches is recently deposited silt loam. In other places the soil is not calcareous or contains less clay between depths of 10 and 40 inches.

Permeability and runoff are slow. Available water capacity is moderate. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. If drained, this soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains generally work satisfactorily only if they are closely spaced and if an outlet is available. Surface drains are needed in some areas. Tilth generally is poor in the surface layer. It can be improved by returning crop residue to the soil and deferring tillage when the soil is wet.

If this soil is used for pasture, the species that can grow well in a calcareous soil should be selected for planting. Overgrazing or grazing during wet periods causes surface compaction and poor tilth.

The land capability classification is IIIw.

237—Sarpy loamy fine sand, 0 to 3 percent slopes. This very gently sloping, excessively drained soil is in areas of recent deposition on bottom land. It is frequently flooded on the river side of levees and rarely flooded where it is protected. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown loamy fine sand about 6 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, calcareous, stratified fine sand. In places the surface layer is fine sandy loam.

Included with this soil in mapping are some small areas of the somewhat excessively drained Grable soils. These soils are at elevations similar to those of the Sarpy soil. They have a silt loam surface layer and a moderate available water capacity. They make up less than 10 percent of the unit.

Permeability is rapid in the Sarpy soil, and runoff is slow. Available water capacity is low. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The low available water capacity is the main limitation. Also, soil blowing is a hazard. It can be controlled, however, by windbreaks; by artificial barriers, such as snow fences; by mulch tillage; and by a cover of crop residue. Tilth generally is poor in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing, however, greatly increases the susceptibility to soil blowing.

The land capability classification is IVs.

255—Cooper silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is at intermediate elevations on bottom land. It is subject to rare flooding. Areas range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 8 inches thick. The subsurface layer also is very dark brown silty clay loam about 8 inches thick. The subsoil is dark grayish brown, friable, calcareous silty clay loam about 8 inches thick. Below this to a depth of about 60 inches is a buried layer of very dark gray and dark grayish brown, mottled, calcareous silty clay. In some places the soil is better drained. In other places the surface layer is silt loam.

Included with this soil in mapping are some small areas of the well drained Keg soils. These soils are higher on the landscape than the Cooper soil and dry out more rapidly after rains. They make up less than 10 percent of the unit.

Permeability is moderate in the upper part of the Cooper soil and slow in the underlying buried layer. Runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

275—Moville silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on broad bottom land. It is occasionally flooded for brief periods unless it is protected. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, calcareous silt loam about 6 inches thick. The substratum is dark grayish brown and grayish brown, mottled, stratified silt loam about 20 inches thick. Below this to a depth of about 60 inches is a buried layer of black and gray silty clay. The lower part of this layer is mottled. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Luton soils. These soils are more poorly drained than the Moville soil and stay wet for longer periods after rains. They make up less than 10 percent of the unit.

Permeability is moderate in the upper part of the Moville soil and very slow in the underlying buried layer. Runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a medium supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, reduces forage production.

The land capability classification is IIw.

430—Ackmore silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on bottom land. It is occasionally flooded for very brief periods unless it is protected. Areas generally range from 5 to more than 50 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The substratum is very dark grayish brown, very dark gray, and dark grayish brown, mottled, stratified silt loam about 22 inches thick. Below this to a depth of about 60 inches is a buried layer of black silty clay loam. In places the buried layer is black silty clay. In other places the soil is silt loam to a depth of 40 inches.

Included with this soil in mapping are some small areas of the poorly drained Colo soils. These soils are lower on the landscape than the Ackmore soil and dry out more slowly after rains. Also, they have a higher organic matter content. They make up less than 10 percent of the unit.

Permeability is moderate in the Ackmore soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The substratum generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if an adequate outlet is available. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, reduces forage production.

The land capability classification is IIw.

436—Lakeport silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is at intermediate elevations on bottom land. It is subject to rare flooding. Areas generally range from 5 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 6 inches thick. The subsurface layer is black and very dark gray silty clay loam about 14 inches thick. The subsoil is about 28 inches of dark grayish brown, grayish brown, and dark gray, mottled, firm silty clay loam and silty clay. The substratum to a depth of about 60 inches is light brownish gray, grayish brown, and gray, mottled, calcareous silt loam. In some places silt loam is within a depth of 30 inches. In other places the surface layer is silty clay.

Permeability is moderately slow in the upper part of the profile and moderate in the substratum. Runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is I.

509—Marshall silty clay loam, benches, 0 to 2 percent slopes. This nearly level, well drained soil is on

broad, loess-covered stream benches. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 17 inches thick. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam. In places the loess is underlain by sandy alluvial sediments.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to control erosion and prevent surface crusting, and increase the rate of water infiltration.

The land capability classification is I.

509B—Marshall silty clay loam, benches, 2 to 5 percent slopes. This gently sloping, well drained soil is on broad, loess-covered stream benches. Areas range from 5 to 50 acres in size and are long and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 17 inches thick. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam. In places the loess is underlain by sandy alluvial sediments.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated (fig. 9). This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

509C2—Marshall silty clay loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on the sides of loess-covered stream benches. Areas range from 5 to 25 acres in size and are narrow and irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. Plowing has mixed some streaks and pockets of brown subsoil material into the surface layer. The subsoil is friable silty clay loam about 31 inches thick. The upper part is brown, and the lower part is mottled dark yellowish brown and yellowish brown. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown silty clay loam. In some places the surface layer is more than 7 inches thick. In other places the loess is underlain by alluvial sediments of various textures. On some of the side slopes, sandy material is exposed.

Permeability is moderate, and runoff is medium. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

510—Monona silt loam, benches, 0 to 2 percent slopes. This nearly level, well drained soil is on loess-covered stream benches. Areas range from 5 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. The loess is underlain

Figure 9.—A cultivated area of Marshall silty clay loam, benches, 2 to 5 percent slopes.

by sandy alluvial sediments. In places the surface soil and subsoil are silty clay loam.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

The land capability classification is I.

510B—Monona silt loam, benches, 2 to 5 percent slopes. This gently sloping, well drained soil is on loess-covered stream benches. Areas range from 5 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. The loess is underlain by sandy alluvial sediments. In places the surface soil and subsoil are silty clay loam.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

510C2—Monona silt loam, benches, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on loess-covered stream benches. Areas range from 5 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. Plowing has mixed some streaks and pockets of dark brown subsoil material into the surface layer. The subsoil is dark brown and dark yellowish brown, friable silt loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled silt loam. The loess is underlain by sandy alluvial sediments. In places the surface soil and subsoil are silty clay loam.

Permeability is moderate, and runoff is slow. Available water capacity is high. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. It can be controlled, however, by contour farming, terraces, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and poor tilth, increases the runoff rate, and reduces forage production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

514—Grable silt loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is in areas of recent deposition on bottom land. It is occasionally flooded for very brief periods on the river side of levees, but in other areas it is protected. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper part of the substratum is grayish brown, calcareous, stratified silt loam. The lower part to a depth of about 60 inches is grayish brown, loose, calcareous fine sand. In some places the soil is silt loam to a depth of 40 inches. In other places the surface layer is silty clay or silty clay loam.

Included with this soil in mapping are some small areas of Sarpy soils. These soils are at elevations similar to those of the Grable soil. They have a low available water capacity. They make up less than 10 percent of the unit.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Runoff is slow. Available water capacity is low. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material helps to maintain tilth, improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, reduces forage production.

The land capability classification is IIs.

515—Percival silty clay, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is at the lower elevations in depressional areas of recent deposition on bottom land. It is occasionally flooded for very brief periods on the river side of levees, but in other areas it is protected. Areas range from 5 to 80 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, calcareous silty clay about 7 inches thick. The upper part of the substratum is dark grayish brown and grayish brown, mottled, calcareous, stratified silty clay. The lower part to a depth of about 60 inches is grayish brown, calcareous, stratified fine sand. In some places it is silt loam or silty clay. In other places the surface layer is silty clay loam.

Permeability is slow in the upper part of the profile and rapid in the lower part. Runoff is slow. Available water capacity is low. The soil has a seasonal high water table. The substratum generally has a very low supply of available phosphorus and a high supply of potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Land grading and surface drains reduce the wetness in most areas. Tilth generally is poor in the surface layer. Clods form when the soil dries out. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

670—Rawles silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on bottom

land. It is occasionally flooded for brief periods unless it is protected. Areas range from 5 to 75 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, calcareous silt loam about 8 inches thick. The substratum is very dark grayish brown and dark grayish brown, calcareous, stratified silt loam about 18 inches thick. Below this to a depth of about 60 inches is a buried layer of black silt loam and silty clay loam. In some places, the soil is noncalcareous and the buried layer is silty clay loam. In other places the thickness of the surface layer combined with that of the substratum is less than 18 inches.

Permeability is moderate, and runoff is slow. Available water capacity is high. The substratum generally has a low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if an adequate outlet is available. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing, however, reduces forage production.

The land capability classification is IIw.

717C—Napier-Gullied land complex, 2 to 10 percent slopes. This gently sloping to moderately sloping map unit occurs as areas of a well drained Napier soil intermingled with large gullies. The unit is in upland drainageways. Areas range from 5 to 50 acres in size and are narrow and irregularly shaped. They are about 55 percent Napier soil and 45 percent Gullied land. The Napier soil and Gullied land occur as areas so closely intermingled that mapping them separately is impractical.

Typically, the surface layer of the Napier soil is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 22 inches thick. The subsoil to a depth of about 60 inches is dark brown and brown, friable silt loam. In places the soil is calcareous.

Typically, the gullies are deep and wide and are subject to cutting by water in the drainageways. The sides are subject to sloughing because they generally are vertical.

Permeability is moderate in the Napier soil, and runoff varies. This soil has a high available water capacity. Its subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

This map unit generally is unsuited to corn, soybeans, and small grain. In some small areas it is moderately suited to grasses and legumes for hay and pasture. The gullies severely limit all uses. Controlling the formation or enlargement of the gullies is difficult and generally involves considerable earth moving. Trees grow in many of the gullies.

The land capability classification is VIIe.

1233—Corley silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in depressional areas on loess-covered stream benches. It is occasionally ponded for brief periods. Areas range from 5 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray silt loam about 6 inches thick. The subsurface layer is very dark gray and dark gray silt loam about 17 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. The upper part is very dark gray, and the lower part is mottled gray, dark brown, and dark yellowish brown. The loess is underlain by alluvial sediments of various textures.

Included with this soil in mapping are some small areas of the somewhat poorly drained Minden soils. These soils are slightly higher on the landscape than the Corley soil and dry out more rapidly after rains. They make up less than 10 percent of the unit.

Permeability is moderate in the Corley soil, and runoff is very slow or ponded. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. It generally is surrounded by a larger area of soils that are adequately drained. A drainage system is needed to reduce the wetness and provide good aeration and a deep root zone for plants. In many areas, however, deep cuts are needed to provide suitable outlets for tile or surface drains. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is IIw.

1299—Minden silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on loess-covered stream benches. Areas range from 5 to 75 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark

brown and very dark grayish brown silty clay loam about 15 inches thick. The subsoil is dark grayish brown, mottled, friable silty clay loam about 32 inches thick. The substratum to a depth of about 60 inches is grayish brown, mottled silt loam. The loess is underlain by alluvial sediments of various textures. In some places the subsoil is yellowish brown. In other places the surface layer is silt loam.

Included with this soil in mapping are small areas of the poorly drained Corley soils. These soils are slightly lower on the landscape than the Minden soil and are ponded after rains. They make up less than 10 percent of the unit.

Permeability is moderate in the Minden soil, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a medium supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. Tile drains generally are not needed but are beneficial in some areas. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, improve fertility, help to prevent surface crusting, and increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth and reduces forage production.

The land capability classification is I.

4001C—Ida-Urban land complex, 3 to 9 percent slopes. This map unit occurs as areas of a moderately sloping, well drained Ida soil intermingled with gently sloping Urban land. The unit is on long, narrow ridges and side slopes in and around Council Bluffs. Areas are long and irregularly shaped and range from 3 to 50 acres in size. They are about 65 percent Ida soil and 35 percent Urban land. The Ida soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Ida soil has a surface layer of dark brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Permeability is moderate in the Ida soil, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

The Ida soil is used for parks, building site development, lawns, and gardens. It is well suited to flowers, vegetables, lawns, trees, shrubs, and building site development. Erosion is a hazard if the surface of disturbed areas is exposed for a considerable period.

No land capability classification is assigned.

4001D—Ida-Urban land complex, 9 to 14 percent slopes. This map unit occurs as areas of a strongly sloping, well drained Ida soil intermingled with Urban land. The unit is on side slopes in and around Council Bluffs. Areas are long and irregularly shaped and range from 3 to 50 acres in size. They are about 60 percent Ida soil and 40 percent Urban land. The Ida soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Ida soil has a surface layer of dark brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Permeability is moderate in the Ida soil, and runoff is medium. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

The Ida soil is used for parks, building site development, lawns, and gardens. It is moderately suited to flowers, vegetables, lawns, trees, shrubs, and building site development. Erosion is a hazard if the surface of disturbed areas is exposed for a considerable period.

No land capability classification is assigned.

4001E—Ida-Urban land complex, 14 to 20 percent slopes. This map unit occurs as areas of a moderately steep, well drained Ida soil intermingled with Urban land. The unit is on side slopes in and around Council Bluffs. Areas are long and irregularly shaped and range from 3 to 50 acres in size. They are about 60 percent Ida soil and 40 percent Urban land. The Ida soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Ida soil has a surface layer of dark brown, calcareous silt loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, dark yellowish brown, and yellowish brown, mottled, calcareous silt loam.

The Urban land part is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Permeability is moderate in the Ida soil, and runoff is rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

The Ida soil is used for parks, building site development, lawns, and gardens. It is poorly suited to

flowers, vegetables, lawns, trees, shrubs, and building site development. Erosion is a hazard if the surface of disturbed areas is exposed for a considerable period.

No land capability classification is assigned.

4012B—Napier-Urban land complex, 2 to 5 percent slopes. This map unit occurs as areas of a gently sloping, well drained Napier soil intermingled with Urban land. The unit is on foot slopes and along narrow drainageways in and around Council Bluffs. Areas are long and irregularly shaped and range from 10 to 200 acres in size. They are about 60 percent Napier soil and 40 percent Urban land. The Napier soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Napier soil has a surface layer of very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 22 inches thick. The subsoil to a depth of about 60 inches is very dark brown and brown, friable silt loam.

The Urban land part is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Permeability is moderate in the Napier soil, and runoff is slow. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

The Napier soil is used for parks, building site development, lawns, and gardens. It is well suited to flowers, vegetables, lawns, trees, shrubs, and building site development.

No land capability classification is assigned.

4046—Keg-Urban land complex, 0 to 2 percent slopes. This map unit occurs as areas of a nearly level, well drained Keg soil intermingled with Urban land. The unit is on bottom land in and around Council Bluffs. Areas are irregular in shape and range from 50 to 500 acres in size. They are about 60 percent Keg soil and 40 percent Urban land. The Keg soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Keg soil has a surface layer of black silt loam about 8 inches thick. The subsurface layer is black and very dark brown silt loam about 8 inches thick. The subsoil is dark grayish brown and brown, very friable silt loam about 21 inches thick. It is calcareous in the lower part. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, calcareous silt loam that has thin strata of silty clay loam.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Permeability is moderate in the Keg soil, and runoff is slow. Available water capacity is high. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium.

The Keg soil is used for parks, building site development, lawns, and gardens. It is well suited to flowers, vegetables, lawns, trees, shrubs, and building site development.

No land capability classification is assigned.

4156—Albaton-Urban land complex, 0 to 2 percent slopes. This map unit occurs as areas of a nearly level, poorly drained Albaton soil intermingled with Urban land. The unit is on bottom land in and around Council Bluffs. It is subject to rare flooding. Areas are irregularly shaped and range from 10 to 100 acres in size. They are about 60 percent Albaton soil and 40 percent Urban land. The Albaton soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Albaton soil has a surface layer of very dark grayish brown, calcareous silty clay about 9 inches thick. The substratum to a depth of about 60 inches is dark gray and dark grayish brown, mottled, calcareous, stratified silty clay.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Permeability is very slow in the Albaton soil, and runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

The Albaton soil is used for parks, building site development, lawns, and gardens. It is moderately suited to flowers, vegetables, lawns, trees, and shrubs and is poorly suited to building site development.

No land capability classification is assigned.

4170C—Castana-Urban land complex, 5 to 9 percent slopes. This map unit occurs as areas of a moderately sloping, well drained Castana soil intermingled with Urban land. The unit is on foot slopes and along drainageways in and around Council Bluffs. Areas are long and irregularly shaped and range from 30 to 300 acres in size. They are about 60 percent Castana soil and 40 percent Urban land. The Castana soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Castana soil has a surface layer of very dark grayish brown, calcareous silt loam about 6 inches thick. The subsurface layer also is very dark grayish brown, calcareous silt loam. It is about 8 inches thick. The next layer is brown, very friable, calcareous silt loam about 14 inches thick. The substratum to a depth of about 60 inches is brown, calcareous silt loam.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Permeability is moderate in the Castana soil, and runoff is rapid. Available water capacity is high. The substratum generally has a very low supply of available phosphorus and a low supply of available potassium.

The Castana soil is used for parks, building site development, lawns, and gardens. It is moderately suited to flowers, vegetables, lawns, trees, shrubs, and building site development. Erosion is a hazard if the surface of the disturbed areas is exposed for a considerable period.

No land capability classification is assigned.

4237—Sarpy-Urban land complex, 1 to 3 percent slopes. This map unit occurs as areas of a very gently sloping, excessively drained Sarpy soil intermingled with Urban land. The unit is on bottom land in and around Council Bluffs. Areas are irregularly shaped and are as much as 500 acres in size. They are about 50 percent Sarpy soil and 40 percent Urban land. The Sarpy soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Sarpy soil has a surface layer of dark grayish brown loamy fine sand about 6 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, calcareous, stratified fine sand.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Included in this unit in mapping are some small areas of the somewhat excessively drained Grable soils. These soils are at elevations similar to those of the Sarpy soil. They have a surface layer of silt loam and a moderate available water capacity. They make up about 10 percent of the unit.

Permeability is rapid in the Sarpy soil, and runoff is slow. Available water capacity is low. The substratum generally has a very low supply of available phosphorus and a high supply of available potassium.

The Sarpy soil is used for parks, building site development, lawns, and gardens. It is moderately suited to flowers, vegetables, lawns, trees, and shrubs and is poorly suited to building site development.

No land capability classification is assigned.

4255—Cooper-Urban land complex, 0 to 2 percent slopes. This map unit occurs as areas of a nearly level, somewhat poorly drained Cooper soil intermingled with Urban land. The unit is on bottom land in and around Council Bluffs (fig. 10). Areas are irregularly shaped and range from 30 to 300 acres in size. They are about 50 percent Cooper soil and 40 percent Urban land. The Cooper soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Cooper soil has a surface layer of very dark brown silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is dark grayish brown, friable, calcareous silty clay loam about 8 inches thick. Below this to a depth of about 60 inches is a buried layer of very dark gray and dark grayish brown, calcareous silty clay.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the landscape that identification of the soil series is not feasible.

Included in this unit in mapping are some small areas of the well drained Keg soils. These soils are higher on the landscape than the Cooper soil and dry out more rapidly after rains. They make about 10 percent of the unit.

Permeability is moderate in the upper part of the Cooper soil and slow in the underlying buried layer. Runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium.

The Cooper soil is used for parks, building site development, lawns, and gardens. It is well suited to flowers, vegetables, lawns, trees, and shrubs and is poorly suited to building site development.

No land capability classification is assigned.

5030—Pits, quarries. These are excavations from which limestone, sand, and gravel have been removed. The excavations generally have very steep sides. Some of the inactive pits are filled with water. Areas range from 5 to 75 acres in size.

This map unit is not suitable for cultivation or grazing unless vegetation is reestablished. Some of the overburden and spoil banks can be leveled and planted to grasses or trees. Because soil properties and physical conditions vary, onsite investigation is needed before any decisions can be made about farm or nonfarm uses of specific areas.

No land capability classification is assigned.

5040—Orthents, loamy. These soils are in areas where the landscape has been leveled or reshaped or soil material has been removed during the development of industrial sites and of sites for dwellings and highways. The landscape has been so altered that the soil series cannot be identified. Areas range from 5 to 25 acres in size.

The soil material is dominantly silt loam and silty clay loam. In some areas so much of the soil material has been removed that calcareous silt loam is exposed.

Included with these soils in mapping are some areas of fill, where cement, bricks, and trash were covered with soil material and then were compacted and leveled.

Figure 10.—Commercial, industrial, and residential development in an area of the Cooper-Urban land complex, 0 to 2 percent slopes, in Council Bluffs.

These areas are used as sites for buildings, railroad yards, and highways.

Erosion is the main hazard in the newly cut and filled areas. Because soil properties and physical conditions vary, onsite investigation is needed before any decisions can be made about farm or nonfarm uses of specific areas.

No land capability classification is assigned.

5053—Psammaquents, frequently flooded. These soils consist of stratified, sandy and loamy sediments deposited along the channel of the Missouri River. These sediments have not been in place long enough to be significantly affected by the processes of soil formation. Areas range from 10 to more than 100 acres in size and are long and narrow.

Some areas support sparse stands of grasses and willow trees. Others have a dunelike topography, are

bare, and are subject to soil blowing. These soils are wet and are frequently flooded. They are not suitable for farm uses, but they provide habitat for some kinds of wildlife and have some potential for recreational uses.

The land capability classification is VIIs.

5080—Orthents-Dumps complex. These areas have been excavated and used as landfills. The soil material dominantly is silt loam or silty clay loam. The landscape has been so altered that the soil series cannot be identified. Most areas have been filled with refuse, covered with soil material, and then leveled and compacted.

Because soil properties and physical conditions vary, onsite investigation is needed before any decisions can be made about farm or nonfarm uses of specific areas.

No land capability classification 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 meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

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

About 276,000 acres in the survey area, or nearly 45 percent of the total acreage, meets the soil requirements for prime farmland. About 260,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly corn and soybeans, account for an estimated two-thirds of the county's total agricultural income each year.

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

The map units in the survey area that are considered prime farmland are listed in table 5. 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."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has 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 woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

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

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

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

Crops and Pasture

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

In 1984, about 476,000 acres in Pottawattamie County was cropland (*8*). Of this total, about 256,000 acres was used for corn and 145,000 acres for soybeans. The rest of the cropland was used mainly for hay, oats, sorghum, and wheat.

The paragraphs that follow describe the main concerns in managing the cropland and pasture in the county. These concerns are water erosion, wetness, fertility, and tilth.

Water erosion is the primary management concern on about 80 percent of the cropland and pasture in the county. It is a hazard if the slope is more than 2 percent.

Loss of the surface layer through erosion reduces the productivity of soils and results in sedimentation in streams. Productivity is reduced as the 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 having a subsoil that is low in fertility, such as Shelby soils, and on soils having a clayey subsoil, such as Adair and Clarinda soils. Preparing a good seedbed and tilling are difficult on eroded soils because part or all of the original friable surface layer has been removed. The more strongly structured subsoil becomes hard and cloddy if it is tilled when wet. Runoff from eroding soils can cause sedimentation in streams, drainageways, and road ditches. Control of erosion not only helps to maintain the productivity of the soils but also improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion-control measures reduce the runoff rate and increase the rate of water infiltration. These measures include cover crops, contour stripcropping, contour farming, terraces and diversions, grassed waterways, and conservation tillage. A combination of several measures is the most effective means of controlling erosion.

A cropping system that keeps a plant cover on the surface for extended periods can reduce soil losses to an amount that will not decrease the productive capacity of the soils. On livestock farms, where part of the acreage is hayland or pasture, including legumes and

grasses in the cropping sequence not only provides nitrogen and improves tilth for the following crops but also provides a protective plant cover.

Conservation tillage is effective in controlling water erosion, especially on the more sloping soils. It is effective only if enough crop residue is left on the surface after planting. The major kinds of conservation tillage are no-till or slot tillage, strip-till, ridge-till, and mulch-till.

No-till or slot tillage is a system in which the seedbed is prepared and the seed planted in one operation. The surface is disturbed only in the immediate area of the planted seed row. A protective cover of crop residue is left on at least 90 percent of the surface. Strip-till and ridge-till also are systems in which the seedbed is prepared and the seed planted in one operation. Where a strip-till system is applied, tillage is limited to a strip not wider than one-third of the row and a protective cover of crop residue is left on two-thirds of the surface. Where a ridge-till system is applied, the seed is planted on ridges that generally are 4 to 6 inches higher than the areas between the rows and about one-third of the surface is tilled at planting time with sweeps or row cleaners. This system offers several advantages on Luton and other poorly drained soils.

Where a mulch-till system is applied, tillage tools, such as chisels, field cultivators, and disks, loosen the entire surface. Part of the crop residue is incorporated into the soil, and at least 30 percent of the residue is left on the surface at planting time. Seedbed preparation and planting can be one or separate operations.

If good management is applied, a cover of pasture plants is effective in controlling erosion. The management needed on established stands includes applications of fertilizer, weed and brush control, rotation and deferred grazing, proper stocking rates, and adequate livestock watering facilities. Erosion is a severe hazard if the plant cover is destroyed when the more sloping areas of pasture and hayland are renovated. If cultivated crops are grown during pasture renovation, soil losses can be reduced by conservation tillage, contour farming, and grassed waterways. Interseeding grasses and legumes into the existing sod eliminates the need for destroying the plant cover during seedbed preparation.

Terraces and diversions reduce the length of slopes and thus help to control runoff and erosion. Terraces are most practical on the well drained, gently sloping and moderately sloping Exira, Ida, Marshall, and Monona soils. Soils having a subsoil that formed in glacial till, such as Gara and Shelby soils, can be terraced, but the terrace cuts should not expose the glacial till. The topsoil should be stockpiled and then used to cover the less fertile glacial till. Terraces and diversions are not so practical in areas where slopes are irregular or the soil has a dense, clayey subsoil.

Contour farming and contour stripcropping help to control erosion on many soils in the county. They are most effective on soils that have smooth, uniform slopes, including most areas of Exira, Ida, Marshall, and Monona soils.

Further information about the design of erosion-control measures for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Wetness is a major problem on about 20 percent of the acreage in Pottawattamie County. Some poorly drained soils are on uplands. Clarinda soils are an example. Other poorly drained soils are on stream terraces and bottom land. Examples are Bremer, Colo, Corley, Onawa, and Zook soils. These soils are more productive if tile is installed. In some areas of Bremer and Zook soils, a combination of drainage tile and surface drains is needed. A surface drainage system is needed in areas of the poorly drained Albaton and very poorly drained Luton soils.

The design of both surface and subsurface drainage systems varies with the kind of soil and with the availability of drainage outlets. Tile drains should be spaced more closely in moderately slowly permeable soils than in the more rapidly permeable soils. Some of the slowly permeable or very slowly permeable soils formed in a dense, clayey paleosol that formed in glacial till. Examples are Adair, Clarinda, and Malvern soils. The wetness of these soils can be reduced by installing interceptor tile in the more rapidly permeable soils on the higher adjacent slopes.

Soil fertility is affected by the supply of available phosphorus and potassium, by reaction, and by the content of organic matter. The supply of available phosphorus and potassium typically is low or very low in the subsoil of Ida, Marshall, Monona, and most other soils on uplands. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of lime and fertilizer needed.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth generally are high in content of organic matter, are porous, have granular structure, and have a moderate content of clay in the surface layer.

Most of the soils used for crops in the county have a surface layer of silt loam or silty clay loam. In some soils, such as Ladoga soils, the content of organic matter is low and the structure of the surface layer is weak. After periods of intense rainfall, a crust forms on the surface of these soils. Because it is hard when dry, the crust reduces the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve soil structure and minimize crusting.

Fall plowing is not suitable on the very fragile soils in Pottawattamie County. If a moldboard plow is used, very little crop residue is left on the surface. As a result, the susceptibility to water erosion is increased during periods of snowmelt and spring runoff.

Field crops suited to the soils and climate of the county include many crops that are not commonly grown. Corn and soybeans are the chief crops. Grain sorghum, sunflowers, potatoes, sugar beets, sweet corn, popcorn, canning peas, canning beans, and navy beans can be grown if economic conditions are favorable. Oats is the chief close-growing crop. Rye, barley, buckwheat, wheat, and flax can be grown. Also, grass seed could be produced from bromegrass, redtop, bluegrass, switchgrass, big bluestem, and indiangrass.

Pasture and hay species that are suited to the soils and climate of the county include several legumes, cool-season grasses, and warm-season grasses. Most of the permanent pasture in the county is seeded to bluegrass or bromegrass. Other suitable cool-season grasses include orchardgrass, tall fescue, timothy, and reed canarygrass. Alfalfa and red clover are the most common legumes grown for hay. They also are grown in mixtures with orchardgrass or timothy for hay and pasture. Other suitable legumes grown for pasture are crownvetch, ladino clover, and alsike clover.

Specialty crops grown commercially in the county are limited in extent. The county has a few apple orchards. Most of the well drained soils are suitable for orchards and nursery plants. A few areas of these soils are used for truck farming. Tomatoes, cucumbers, cabbage, squash, and sweet corn are the principal specialty crops grown on these soils. Soils in low areas where frost is frequent and air drainage is poor generally are poorly suited to early vegetables, small fruits, and orchards.

Yields Per Acre

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

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. Only class and subclass are used in this survey.

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.

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

Windbreaks and Environmental Plantings

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, reduce energy requirements, 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.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 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.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the

depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

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

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

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

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

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

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

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

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

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

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

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 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. 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 or to 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, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, 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.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of calcium carbonate affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

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

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

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 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, and flooding affect absorption of the effluent. Large stones and bedrock 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 are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

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

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is

placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

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

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

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

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

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

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

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

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches

of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by 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, and bedrock.

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

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

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

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. 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, 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 or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

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 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, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

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 affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing 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 affect the

construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, 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.

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

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

Engineering Index Properties

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

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

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

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

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

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

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

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

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

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

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

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

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

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

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

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

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

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

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

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. 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 soil blowing in cultivated areas. The groups indicate the

susceptibility to soil blowing. 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 soil blowing 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 soil blowing are used.

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

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 20 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 soil blowing are used.
6. Loamy soils that are 20 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 soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

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

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

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to two hydrologic groups in table 16, 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 and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

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

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

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 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 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. 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.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*16*). 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 Udoll (*Ud*, meaning humid, 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 Hapludolls (*Hapl*, meaning minimal horizonation, plus *udoll*, the suborder of the Mollisols that has a udic 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 Hapludolls.

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-silty, mixed, mesic Typic Hapludolls.

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 substratum can differ within a series.

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*15*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*16*). Unless otherwise stated, colors in the descriptions are for moist 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."

Ackmore Series

The Ackmore series consists of somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Ackmore silt loam, 0 to 2 percent slopes, in an area of cropland; 1,640 feet west and 300 feet south of the northeast corner of sec. 14, T. 75 N., R. 39 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure parting to moderate fine

granular; friable; medium acid; abrupt smooth boundary.
C—6 to 28 inches; stratified very dark grayish brown (10YR 3/2), very dark gray (10YR 3/l), and dark grayish brown (10YR 4/2) silt loam; few fine faint yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; friable; medium acid; clear smooth boundary.
2Ab1—28 to 45 inches; black (N 2/0) silty clay loam; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.
2Ab2—45 to 60 inches; black (N 2/0) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; medium acid.

The depth to the 2Ab horizon is 20 to 36 inches. The A horizon has value of 1 or 2 and chroma of 2 or 3. It is silt loam or silty clay loam. The C horizon has value of 2 to 5 and chroma of 1 or 2. The 2Ab horizon has hue of 10YR or is neutral in hue. It has chroma of 0 or 1.

Adair Series

The Adair series consists of somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a paleosol that formed in glacial till. The native vegetation was prairie grasses. Slopes range from 5 to 14 percent.

The Adair soils in this county are taxadjuncts to the series because they do not have a mollic epipedon.

Typical pedon of Adair silty clay loam, 9 to 14 percent slopes, moderately eroded, in an area of cropland; 1,560 feet west and 270 feet north of the southeast corner of sec. 24, T. 74 N., R. 41 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; mixed with some streaks and pockets of dark yellowish brown (10YR 4/4) material; weak fine granular structure; friable; neutral; clear smooth boundary.
BA—9 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.
2Bt1—18 to 30 inches; brown (7.5YR 4/4) clay loam; few fine prominent grayish brown (2.5Y 5/2) mottles; strong medium subangular blocky structure; firm; few faint reddish brown (5YR 4/4) clay films on faces of peds; neutral; clear smooth boundary.
2Bt2—30 to 42 inches; brown (7.5YR 4/4) clay loam; few fine prominent grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to strong medium subangular blocky; firm; common faint reddish brown (5YR 4/4) clay films on faces of peds; neutral; clear smooth boundary.
2Bt3—42 to 52 inches; brown (7.5YR 5/4) clay loam; few fine prominent grayish brown (2.5Y 5/2) and few fine faint reddish brown (5YR 5/4) mottles; strong medium subangular blocky structure; firm; common faint strong brown (7.5YR 5/6) clay films on faces of peds; neutral; clear smooth boundary.
2Bt4—52 to 60 inches; strong brown (7.5YR 5/6) clay loam; common fine prominent strong brown (7.5YR 5/8) and grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; firm; common faint brown (7.5YR 5/4) clay films on faces of peds; mildly alkaline.

The thickness of the solum is 45 to more than 60 inches. The A horizon is silty clay loam or clay loam in which the content of clay is 27 to 35 percent. The B horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 to 6. It is dominantly silty clay, clay, or clay loam. In some pedons, however, the upper part of this horizon is silty clay loam.

Albaton Series

The Albaton series consists of poorly drained, very slowly permeable soils on bottom land. These soils formed in alluvium. The native vegetation was water-tolerant grasses. Slopes range from 0 to 2 percent.

Typical pedon of Albaton silty clay, 0 to 2 percent slopes, in an area of cropland; 1,170 feet east and 200 feet north of the southwest corner of sec. 31, T. 74 N., R. 43 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay (about 49 percent clay), grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; firm; slight effervescence; mildly alkaline; clear smooth boundary.
Cg—9 to 60 inches; stratified dark gray (5Y 4/1), dark grayish brown (2.5Y 4/2), and grayish brown (2.5Y 5/2) silty clay; common fine distinct brown (10YR 4/3) and olive brown (2.5Y 4/4) mottles; appears massive but has distinct bedding planes; firm; few accumulations (calcium carbonate); few thin strata of light gray (10YR 6/1) and grayish brown (10YR 5/2) silt loam; strong effervescence; moderately alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer.

The Ap horizon has chroma of 1 or 2. The Cg horizon has value of 3 to 5 and chroma of 1 or 2. Some pedons have 6 to 18 inches of stratified silt loam overwash, which has hue of 10YR, value of 3 to 5, and chroma of 1 or 2.

Blake Series

The Blake series consists of somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses and trees. Slopes range from 0 to 2 percent.

Typical pedon of Blake silty clay loam, 0 to 2 percent slopes, in an area of cropland; 1,420 feet west and 2,040 feet south of the northeast corner of sec. 16, T. 76 N., R. 44 W.

Ap—0 to 7 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—7 to 26 inches; stratified dark grayish brown (2.5Y 4/2) and brown (10YR 4/3) silty clay loam; few fine faint brown (7.5YR 4/4) mottles; very weak fine subangular blocky structure; firm; strata of very dark grayish brown (2.5Y 3/2) silty clay at a depth of 14 to 16 inches and a 1-inch stratum of brown (10YR 4/3) silt loam at a depth of about 17 inches; strong effervescence; moderately alkaline; clear smooth boundary.

2Cg—26 to 60 inches; grayish brown (10YR 5/2) silt loam (about 14 percent clay); common fine and medium faint dark yellowish brown (10YR 4/4) and light brownish gray (10YR 6/2) mottles; appears massive but has weak bedding planes; very friable; strong effervescence; moderately alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. It is silty clay loam or silt loam. The content of clay in this horizon ranges from 23 to 29 percent. The C horizon has chroma of 2 to 4. The 2Cg horizon has value of 4 or 5. It is dominantly silt loam to very fine sandy loam but may have thin strata of other textures.

Blencoe Series

The Blencoe series consists of poorly drained, slowly permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Blencoe silty clay, 0 to 2 percent slopes, in an area of cropland; 2,260 feet west and 1,400 feet south of the northeast corner of sec. 29, T. 74 N., R. 43 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay (about 41 percent clay), dark gray (10YR 4/1) dry; strong medium and fine subangular blocky structure; firm; slightly acid; clear smooth boundary.

A—8 to 18 inches; black (10YR 2/1) silty clay (about 43 percent clay), dark gray (10YR 4/1) dry; moderate very fine and fine subangular blocky structure; firm; neutral; gradual smooth boundary.

BA—18 to 22 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; moderate fine subangular blocky structure; firm; mildly alkaline; gradual smooth boundary.

Bg—22 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine faint grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; friable; mildly alkaline; some fine calcium carbonate concretions; gradual smooth boundary.

2BCg—26 to 36 inches; dark grayish brown (2.5Y 4/2) silt loam; common fine faint dark yellowish brown (10YR 4/4) mottles; weak fine and medium subangular blocky structure; very friable; slight effervescence; mildly alkaline; gradual smooth boundary.

2Cg—36 to 60 inches; grayish brown (2.5Y 5/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles, which increase in number with increasing depth; appears massive but has weak bedding planes; very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

The thickness of the solum ranges from 30 to 40 inches. The thickness of the mollic epipedon ranges from 12 to 24 inches. The depth to the 2B horizon ranges from 20 to 30 inches.

The A horizon has chroma of 0 or 1. It is silty clay or silty clay loam in which the content of clay is 38 to 55 percent. The Bg horizon has value of 4 or 5. It is silty clay or silty clay loam. The 2B horizon has value of 4 or 5 and chroma of 2 to 4. The 2Cg horizon is silt loam in which the content of clay is 18 to 24 percent.

Bremer Series

The Bremer series consists of poorly drained, moderately slowly permeable soils on low alluvial terraces. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Bremer silty clay loam, 0 to 2 percent slopes, in an area of cropland; 530 feet west and 460 feet north of the southeast corner of sec. 8, T. 77 N., R. 39 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A—8 to 20 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; slightly acid; clear smooth boundary.

Btg1—20 to 34 inches; very dark gray (N 3/0) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; firm; few faint black (10YR 2/1) clay films on faces of peds; slightly acid; clear smooth boundary.

Btg2—34 to 50 inches; dark gray (10YR 4/1) silty clay loam; common medium faint grayish brown (2.5Y 5/2) and few fine distinct yellowish brown (10YR

5/6) mottles; strong medium prismatic structure; very firm; common faint very dark gray (10YR 3/1) clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg3—50 to 60 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; strong medium prismatic structure; common faint very dark gray (10YR 3/1) clay films on faces of peds; slightly acid.

The thickness of the solum ranges from 45 to more than 60 inches. The A horizon is 15 to 24 inches thick. It is neutral in hue or has hue of 10YR. It has value of 2 or 3 and chroma of 0 or 1. It has a clay content of 25 to 32 percent. The B horizon is neutral in hue or has hue of 10YR, 2.5Y, or 5Y. It has value of 3 to 5 and chroma of 2 or less. It is silty clay loam or silty clay.

Castana Series

The Castana series consists of well drained, moderately permeable soils on high foot slopes. These soils formed in local alluvium. The native vegetation was prairie grasses. Slopes range from 9 to 20 percent.

Typical pedon of Castana silt loam, 9 to 20 percent slopes, in a pasture; 2,550 feet east and 2,800 feet north of the southwest corner of sec. 12, T. 76 N., R. 44 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure parting to weak very fine granular; very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

A2—6 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slight effervescence; moderately alkaline; gradual smooth boundary.

AC—14 to 28 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; very weak coarse prismatic structure; very friable; few fine accumulations (calcium carbonate); slight effervesence; moderately alkaline; gradual smooth boundary.

C—28 to 60 inches; brown (10YR 5/3) silt loam; massive; very friable; some filaments of lime and calcium carbonate accumulations; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 12 to 24 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The A horizon has value of 2 or 3. The C horizon has value of 4 or 5 and chroma of 2 to 4.

Clarinda Series

The Clarinda series consists of poorly drained, very slowly permeable soils on uplands. These soils formed in a paleosol that formed in glacial till. The native vegetation was prairie grasses. Slopes range from 9 to 14 percent.

The Clarinda soils in this county are taxadjuncts to the series because they do not have a mollic epipedon.

Typical pedon of Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded, in an area of cropland; 2,200 feet north and 800 feet east of the southwest corner of sec. 17, T. 77 N., R. 38 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; mixed with streaks and pockets of dark gray (10YR 4/1) subsoil material; moderate medium granular and moderate fine granular structure; friable; slightly acid; clear smooth boundary.

2Btg1—7 to 15 inches; dark gray (10YR 4/1) silty clay; weak fine subangular blocky structure; firm; common faint very dark gray (10YR 3/1) clay films on faces of peds; common distinct black (10YR 2/1) organic stains on faces of peds; slightly acid; gradual smooth boundary.

2Btg2—15 to 25 inches; dark gray (5Y 4/1) silty clay; moderate medium angular blocky structure; very firm; common faint very dark gray (10YR 3/1) clay films on faces of peds; slightly acid; gradual smooth boundary.

2Btg3—25 to 30 inches; gray (5Y 5/1) silty clay; moderate fine prismatic structure parting to moderate medium angular blocky; very firm; common faint very dark gray (10YR 3/1) clay films on faces of peds; neutral; gradual smooth boundary.

2Btg4—30 to 50 inches; gray (5Y 5/1) silty clay; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; very firm; common faint very dark gray (10YR 3/1) clay films on faces of peds; neutral; gradual smooth boundary.

2BCg—50 to 60 inches; gray (5Y 5/1) silty clay loam; few fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; neutral.

The thickness of the solum ranges from 50 to more than 60 inches. The A horizon is silty clay loam or silty clay. It is 7 to 15 inches thick. Because of erosion, it is less than 10 inches thick in most pedons. The 2B horizon is neutral in hue or has hue of 10YR, 2.5Y, or 5Y. It has value of 4 or 5 and chroma of 0 or 1. It is silty clay or clay in which the content of clay is 45 to 60 percent. Some pedons have calcium carbonate in the 2Bt horizon.

Colo Series

The Colo series consists of poorly drained, moderately permeable soils on bottom land. These soils formed in

alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, in an area of cropland; 500 feet west and 100 feet south of the northeast corner of sec. 33, T. 77 N., R. 40 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.
A1—7 to 23 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; slightly acid; clear smooth boundary.
A2—23 to 34 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; firm; slightly acid; gradual smooth boundary.
Bg—34 to 48 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; neutral; gradual smooth boundary.
Cg—48 to 60 inches; dark gray (10YR 4/1) silty clay loam; massive; firm; neutral.

The thickness of the solum ranges from 36 to 60 inches. The mollic epipedon is 36 or more inches thick.

The A horizon is neutral in hue or has hue of 10YR. It has value of 2 or 3 and chroma of 0 or 1. Some pedons have 6 to 18 inches of stratified silt loam overwash, which has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. The B horizon is neutral in hue or has hue of 10YR. It has value of 2 to 4 and chroma of 2 or less. It is silty clay loam in which the content of clay is 30 to 35 percent. The Cg horizon is silt loam, silty clay loam, or clay loam.

Cooper Series

The Cooper series consists of somewhat poorly drained soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Permeability is moderate in the upper part of the profile and slow in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Cooper silty clay loam, 0 to 2 percent slopes, in an area of cropland; 150 feet south and 2,100 feet east of the northwest corner of sec. 32, T. 74 N., R. 43 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.
A—8 to 16 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.
Bw—16 to 24 inches; dark grayish brown (10YR 4/2) silty clay loam; weak fine subangular blocky structure; friable; mildly alkaline; abrupt smooth boundary.
2Ab—24 to 33 inches; very dark gray (10YR 3/1) silty clay; strong fine subangular blocky structure; very firm; few accumulations (calcium carbonate); slight effervescence; moderately alkaline; gradual smooth boundary.
2Cg—33 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay; olive gray (5Y 5/2) coatings on faces of some peds; few fine distinct yellowish brown (10YR 5/4) mottles; appears massive but has distinct bedding planes; very firm; many accumulations (calcium carbonate); strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. The depth to the 2Ab horizon and the depth to free carbonates range from 20 to 30 inches. The thickness of the mollic epipedon ranges from 10 to 24 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has value of 4 or 5 and chroma of 2 to 4. It is silty clay loam or silt loam. The 2Ab and 2C horizons have value of 3 to 5 and chroma of 1 or 2. The 2Ab horizon is silty clay or clay in which the content of clay is 42 to 60 percent.

Corley Series

The Corley series consists of poorly drained, moderately permeable soils on stream benches. These soils formed in loess. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Corley silt loam, 0 to 2 percent slopes, in an area of cropland; 160 feet north and 500 feet east of the southwest corner of sec. 21, T. 77 N., R. 39 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.
A—9 to 18 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.
E—18 to 26 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; weak thick platy structure parting to weak medium platy; friable; slightly acid; gradual smooth boundary.
Btg1—26 to 33 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; friable; common faint

black (10YR 2/1) clay films on faces of peds; slightly acid; abrupt smooth boundary.

Btg2—33 to 45 inches; dark gray (5Y 4/1) and very dark gray (5Y 3/1) silty clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many faint very dark gray (10YR 3/1) clay films on faces of peds; slightly acid; clear smooth boundary.

Btg3—45 to 55 inches; dark gray (5Y 4/1) silty clay loam; common medium distinct dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many faint very dark gray (10YR 3/1) clay films on faces of peds; slightly acid; gradual smooth boundary.

BCg—55 to 60 inches; mottled gray (5Y 5/1), dark yellowish brown (10YR 4/4), and dark brown (7.5YR 4/4) silty clay loam; weak coarse prismatic structure; firm; many thin clay films; slightly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The A horizon has value of 2 or 3. It is 16 to 24 inches thick. The E horizon has value of 4 or 5. It is 6 to 12 inches thick. The Btg horizon has hue of 10YR to 5Y and value of 3 to 6. The content of clay in this horizon is 28 to 32 percent.

Dow Series

The Dow series consists of well drained, moderately permeable soils on uplands. These soils formed in loess. The native vegetation was prairie grasses. Slopes range from 5 to 20 percent.

Typical pedon of Dow silt loam, 14 to 20 percent slopes, severely eroded, in an area of cropland; 1,880 feet north and 2,100 feet west of the southeast corner of sec. 3, T. 77 N., R. 41 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; mixed with streaks and pockets of grayish brown (2.5Y 5/2) substratum material; weak fine granular structure; friable; many fine roots; moderately alkaline; clear smooth boundary.

C—8 to 60 inches; grayish brown (2.5Y 5/2) silt loam; few fine and medium distinct yellowish brown (10YR 5/6) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; strong effervescence; moderately alkaline.

The thickness of the solum is 4 to 10 inches. It is the same as the thickness of the A horizon.

The A horizon has value of 2 to 5 and chroma of 2 or 3. The C horizon has hue of 2.5Y, 5Y, or 10YR and value of 5 or 6. The content of clay in the control section ranges from 18 to 25 percent.

Exira Series

The Exira series consists of well drained, moderately permeable soils on uplands. These soils formed in loess. The native vegetation was prairie grasses. Slopes range from 5 to 20 percent.

The Exira soils in this county are taxadjuncts to the series because they do not have a mollic epipedon.

Typical pedon of Exira silty clay loam, 5 to 9 percent slopes, moderately eroded, in an area of cropland; 1,644 feet east and 793 feet south of the northwest corner of sec. 22, T. 75 N., R. 39 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; mixed with streaks and pockets of brown (10YR 4/3) subsoil material; weak medium and fine granular structure; friable; slightly acid; abrupt smooth boundary.

BA—7 to 13 inches; brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.

Bw1—13 to 23 inches; brown (10YR 4/3) silty clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; slightly acid; gradual smooth boundary.

Bw2—23 to 34 inches; brown (10YR 4/3) silty clay loam; common medium distinct grayish brown (10YR 5/2) and brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

BC—34 to 46 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/4), and brown (7.5YR 4/4) silt loam; moderate medium prismatic structure parting to weak medium subangular blocky; friable; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.

C—46 to 60 inches; mottled brown (7.5YR 5/4) and light brownish gray (2.5Y 6/2) silt loam; massive; friable; few dark concretions (iron and manganese oxides); slightly acid.

The thickness of the solum ranges from 30 to 50 inches. The depth to relict mottles ranges from 10 to 30 inches.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The content of clay in this horizon ranges from 28 to 34 percent. The B horizon has value of 3 or 4. The C horizon is silt loam or silty clay loam.

Gara Series

The Gara series consists of moderately well drained, moderately slowly permeable soils on uplands. These soils formed in glacial till. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 10 to 24 percent.

Typical pedon of Gara loam, 10 to 24 percent slopes, in a pasture; 1,100 feet east and 1,650 feet south of the northwest corner of sec. 12, T. 74 N., R. 38 W.

A—0 to 7 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; slightly acid; clear smooth boundary.
E—7 to 10 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure; friable; distinct gray (10YR 6/1) coatings on faces of peds; slightly acid; clear smooth boundary.
Bt1—10 to 14 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; few faint very dark grayish brown (10YR 3/2) clay films on faces of peds; light gray (10YR 7/1) silt coatings on faces of peds; slightly acid; abrupt smooth boundary.
Bt2—14 to 27 inches; yellowish brown (10YR 5/6) clay loam; strong medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; slightly acid; gradual smooth boundary.
Bt3—27 to 36 inches; yellowish brown (10YR 5/6) clay loam; strong coarse subangular blocky structure; firm; many faint yellowish brown (10YR 5/4) clay films on faces of peds; medium acid; gradual smooth boundary.
BC—36 to 46 inches; yellowish brown (10YR 5/6) clay loam; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; firm; common thin discontinuous clay films; medium acid; gradual smooth boundary.
C—46 to 60 inches; yellowish brown (10YR 5/6) loam; common coarse distinct grayish brown (10YR 5/2) mottles; massive; firm; medium acid.

The thickness of the solum ranges from 36 to 50 inches. The A horizon has chroma of 1 or 2. It is loam, silt loam, or clay loam. The E horizon has value of 4 or 5. The B horizon has value of 4 or 5 and chroma of 4 to 6. The content of clay in the Bt horizon is 32 to 35 percent.

Grable Series

The Grable series consists of somewhat excessively drained soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Grable silt loam, 0 to 2 percent slopes, in an area of cropland; 50 feet south and 1,500 feet east of the northwest corner of sec. 11, T. 77 N., R. 45 W.

Ap—0 to 8 inches; very dark grayish brown (2.5Y 3/2) silt loam (about 15 percent clay), grayish brown (2.5Y 5/2) dry; weak fine subangular blocky structure; very friable; some very fine sand grains; slight effervescence; mildly alkaline; abrupt smooth boundary.
C1—8 to 22 inches; grayish brown (2.5Y 5/2) silt loam; appears massive but has weak bedding planes; very friable; few fine pores; some very fine sand on horizontal faces of peds; strong effervescence; mildly alkaline; abrupt smooth boundary.
2C2—22 to 60 inches; grayish brown (2.5Y 5/2) fine sand; single grained; loose; few thin strata of silt loam; strong effervescence; moderately alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer. The depth to the 2C horizon ranges from 20 to 30 inches. The Ap horizon has chroma of 1 or 2. The C and 2C horizons have value of 4 or 5. The 2C horizon is loamy sand or fine sand.

Hamburg Series

The Hamburg series consists of somewhat excessively drained, moderately permeable soils on uplands. These soils formed in loess. The native vegetation was prairie grasses. Slopes range from 40 to 75 percent.

Typical pedon of Hamburg silt loam, 40 to 75 percent slopes, in a pasture; 1,700 feet south and 2,340 feet east of the northwest corner of sec. 12, T. 76 N., R. 44 W.

A—0 to 4 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak very fine granular structure; very friable; strong effervescence; moderately alkaline; clear smooth boundary.
AC—4 to 12 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) and pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; strong effervescence; moderately alkaline; diffuse smooth boundary.
C—12 to 60 inches; brown (10YR 5/3) silt loam; massive; very friable; strong effervescence; moderately alkaline.

The A horizon has value of 3 or 4 and chroma of 2 or 3. The C horizon has value of 4 to 6 and chroma of 3 or 4. The control section averages less than 12 percent clay.

Haynie Series

The Haynie series consists of well drained, moderately permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Haynie silt loam, 0 to 2 percent slopes, in an area of cropland; 1,423 feet west and 2,360 feet south of the northeast corner of sec. 32, T. 76 N., R. 44 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam (about 25 percent clay), grayish brown (10YR 5/2) dry; weak fine subangular blocky and weak fine granular structure; very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

C—7 to 60 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, light brownish gray (2.5Y 6/2) dry; common fine faint gray (5Y 5/1) and few fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; appears massive but has weak bedding planes; very friable; strong effervescence; moderately alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer.

The Ap horizon typically is silt loam, but the range includes very fine sandy loam. The C horizon has value of 4 or 5 and chroma of 2 to 4. It is dominantly silt loam or very fine sandy loam but has thin strata that range from fine sandy loam to loamy fine sand. The content of clay in this horizon ranges from 10 to 17 percent.

Ida Series

The Ida series consists of well drained, moderately permeable soils on side slopes and narrow ridgetops in the uplands. These soils formed in loess. The native vegetation was prairie grasses. Slopes range from 5 to 40 percent.

Typical pedon of Ida silt loam, 14 to 20 percent slopes, severely eroded, in an area of cropland; 1,820 feet west and 180 feet south of the northeast corner of sec. 29, T. 75 N., R. 42 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; mixed with some streaks and pockets of dark brown (10YR 3/3) material; weak fine granular structure; friable; few accumulations (calcium carbonate); strong effervescence; moderately alkaline; clear smooth boundary.

C1—8 to 16 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silt loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak fine granular structure; friable; few accumulations (calcium carbonate); strong effervescence; moderately alkaline; gradual smooth boundary.

C2—16 to 25 inches; yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) and few fine distinct dark brown (7.5YR 4/4) mottles; massive; friable; many accumulations (calcium carbonate); strong effervescence; moderately alkaline; gradual smooth boundary.

C3—25 to 60 inches; yellowish brown (10YR 5/4) silt loam; common fine faint grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) and few fine distinct dark brown (7.5YR 4/4) mottles; massive; friable; many accumulations (calcium carbonate); strong effervescence; moderately alkaline.

The thickness of the solum is less than 10 inches. It is the same as the thickness of the Ap or A horizon.

The Ap or A horizon has value of 3 or 4. The C horizon has chroma of 3 or 4. The content of clay in the control section ranges from 18 to 25 percent.

Judson Series

The Judson series consists of well drained, moderately permeable soils on uplands. These soils formed in local alluvium. The native vegetation was prairie grasses. Slopes range from 2 to 9 percent.

Typical pedon of Judson silt loam, 2 to 5 percent slopes, in an area of cropland; 1,500 feet north and 200 feet west of the southeast corner of sec. 31, T. 75 N., R. 39 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

A1—7 to 15 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium granular structure parting to weak fine subangular blocky; friable; neutral; gradual smooth boundary.

A2—15 to 22 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

AB—22 to 30 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw—30 to 45 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

BC—45 to 55 inches; brown (10YR 4/3) silty clay loam; few fine distinct yellowish brown (10YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C—55 to 60 inches; brown (10YR 4/3) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; massive; slightly acid.

The solum typically is 40 to 55 inches thick but is thicker in some pedons. The A horizon typically is silt

loam, but the range includes silty clay loam. The Bw horizon has value and chroma of 3 or 4. The content of clay in this horizon is 30 to 35 percent. Some pedons have as much as 12 inches of stratified silt loam and silty clay loam overwash.

Keg Series

The Keg series consists of well drained, moderately permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Keg silt loam, 0 to 2 percent slopes, in an area of cropland; 1,680 feet north and 520 feet east of the southwest corner of sec. 15, T. 77 N., R. 44 W.

Ap—0 to 6 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; neutral; clear smooth boundary.
A—6 to 14 inches; very dark brown (10YR 2/2) and black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure parting to weak fine granular; very friable; neutral; clear smooth boundary.
Bw—14 to 27 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and very fine subangular blocky structure; very friable; slight effervescence; mildly alkaline; clear smooth boundary.
BC—27 to 35 inches; brown (10YR 4/3) silt loam; weak coarse subangular blocky structure; very friable; strong effervescence; mildly alkaline; gradual smooth boundary.
C1—35 to 46 inches; dark grayish brown (10YR 4/2) silt loam; few fine faint dark yellowish brown (10YR 4/4) mottles; massive; very friable; strong effervescence; moderately alkaline; gradual smooth boundary.
C2—46 to 60 inches; grayish brown (2.5Y 5/2) silt loam; massive; very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches. The depth to free carbonates ranges from 14 to 30 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has value of 2 or 3. The B horizon has value of 4 or 5 and chroma of 2 or 3. The C horizon has chroma of 2 to 4. It is dominantly silt loam, but the range includes very fine sandy loam.

Kennebec Series

The Kennebec series consists of moderately well drained, moderately permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Kennebec silt loam, 0 to 2 percent slopes, in an area of cropland; 1,360 feet south and 60 feet east of the northwest corner of sec. 2, T. 75 N., R. 43 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; very weak fine granular structure; friable; neutral; abrupt smooth boundary.
A1—8 to 20 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky and weak fine granular structure; friable; neutral; diffuse smooth boundary.
A2—20 to 32 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; neutral; diffuse smooth boundary.
A3—32 to 44 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; neutral; diffuse smooth boundary.
AC—44 to 56 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; very weak fine subangular blocky structure; friable; neutral; diffuse smooth boundary.
C—56 to 60 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; massive; friable; neutral.

The solum and the mollic epipedon are more than 36 inches thick. The A horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have 6 to 18 inches of stratified silt loam overwash, which has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. The C horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam. The content of clay in the control section ranges from 24 to 30 percent.

Ladoga Series

The Ladoga series consists of moderately well drained, moderately slowly permeable soils on uplands. These soils formed in loess. The native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 5 to 25 percent.

Typical pedon of Ladoga silt loam, 5 to 9 percent slopes, in a pasture; 910 feet east and 400 feet south of the northwest corner of sec. 12, T. 74 N., R. 38 W.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.
E—7 to 12 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; neutral; clear smooth boundary.
Bt1—12 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; strong medium angular blocky structure; firm; common grayish brown (10YR 5/2) silt coatings; few distinct very dark gray (10YR 3/1)

clay films on faces of peds; slightly acid; clear smooth boundary.
Bt2—16 to 30 inches; dark yellowish brown (10YR 4/4) silty clay loam; strong medium angular blocky structure; firm; many distinct very dark gray (10YR 3/1) clay films on faces of peds; slightly acid; clear smooth boundary.
Bt3—30 to 42 inches; dark yellowish brown (10YR 4/4) silty clay loam; strong medium subangular blocky structure; firm; few distinct very dark gray (10YR 3/1) clay films on faces of peds; medium acid; clear smooth boundary.
BC—42 to 54 inches; brown (10YR 4/3) silty clay loam; few fine distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; medium acid; gradual smooth boundary.
C—54 to 60 inches; brown (10YR 4/3) silty clay loam; common fine distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; massive; friable; medium acid.

The thickness of the solum ranges from 40 to 55 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 6 to 10 inches thick. The E horizon has value of 4 or 5. Pedons in some cultivated areas do not have an E horizon. The B horizon is silty clay loam or silty clay in which the content of clay ranges from 36 to 42 percent.

Lakeport Series

The Lakeport series consists of somewhat poorly drained soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Permeability is moderately slow in the solum and moderate in the substratum. Slopes range from 0 to 2 percent.

Typical pedon of Lakeport silty clay loam, 0 to 2 percent slopes, in an area of cropland; 800 feet east and 2,200 feet north of the southwest corner of sec. 15, T. 77 N., R. 44 W.

Ap—0 to 6 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.
A—6 to 14 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; moderate fine and very fine subangular blocky structure; friable; neutral; gradual smooth boundary.
AB—14 to 20 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine and very fine subangular blocky structure; firm; neutral; clear smooth boundary.
Bw—20 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; firm; neutral; gradual smooth boundary.
Bg1—26 to 36 inches; dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4) and few fine distinct brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; firm; neutral; gradual smooth boundary.
Bg2—36 to 48 inches; grayish brown (2.5Y 5/2), dark grayish brown (2.5Y 4/2), and dark gray (10YR to 5Y 4/1) silty clay; common fine distinct olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; firm; neutral; gradual smooth boundary.
Cg1—48 to 55 inches; light brownish gray (2.5Y 6/2) silt loam; many medium prominent brown (7.5YR 4/4) and common fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; strong effervescence; mildly alkaline; clear smooth boundary.
Cg2—55 to 60 inches; grayish brown (2.5Y 5/2) and gray (5Y 5/1) silt loam; many fine distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 48 inches. The depth to free carbonates ranges from 36 to 55 inches. The thickness of the mollic epipedon ranges from 12 to 24 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has value of 4 or 5 and chroma of 1 or 2. It is silty clay loam or silty clay. The content of clay in this horizon ranges from 35 to 42 percent. The C horizon is silt loam, loam, clay loam, or very fine sandy loam. It has chroma of 2 to 4.

Luton Series

The Luton series consists of very poorly drained, very slowly permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Luton silty clay, 0 to 2 percent slopes, in an area of cropland; 1,392 feet east and 264 feet north of the southwest corner of sec. 17, T. 74 N., R. 43 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; firm; neutral; clear smooth boundary.
A—7 to 15 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; moderate and strong fine subangular blocky structure; firm; neutral; clear smooth boundary.
AB—15 to 24 inches; very dark gray (5Y 3/1) silty clay, dark gray (10YR 4/1) dry; moderate and strong fine subangular blocky structure; firm; mildly alkaline; gradual smooth boundary.

Bg1—24 to 30 inches; dark gray (5Y 4/1) silty clay; few fine prominent yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; firm; common dark concretions (iron and manganese oxides); thin discontinuous clay films; mildly alkaline; gradual smooth boundary.

Bg2—30 to 36 inches; dark gray (5Y 4/1) silty clay; few fine prominent yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; firm; common dark concretions (iron and manganese oxides); thin continuous clay films; mildly alkaline; gradual smooth boundary.

BCg—36 to 42 inches; gray (5Y 5/1) silty clay; few fine prominent yellowish brown (10YR 5/6) mottles; strong fine subangular blocky and angular blocky structure; firm; common dark concretions (iron and manganese oxides); common accumulations (calcium carbonate); thin discontinuous clay films; strong effervescence; moderately alkaline; gradual smooth boundary.

Cg—42 to 60 inches; gray (5Y 5/1) silty clay; few fine prominent yellowish brown (10YR 5/6) mottles; weak very fine subangular blocky structure; firm; common dark concretions (iron and manganese oxides); thin discontinuous clay films; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 36 to 48 inches. The depth to free carbonates ranges from 36 to 46 inches. The thickness of the mollic epipedon ranges from 20 to 30 inches.

The A horizon has value of 2 or 3 and chroma of 0 or 1. It is silty clay or clay. Some pedons have 6 to 18 inches of stratified silt loam overwash, which has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. The B horizon has value of 3 to 5 and chroma of 1 or 2. It is silty clay or clay. The content of clay in this horizon ranges from 40 to 60 percent. The C horizon has value of 4 or 5.

Malvern Series

The Malvern series consists of somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a paleosol that formed in loess. The native vegetation was prairie grasses. Slopes range from 9 to 14 percent.

The Malvern soils in this county are taxadjuncts to the series because they do not have a mollic epipedon.

Typical pedon of Malvern silty clay loam, 9 to 14 percent slopes, moderately eroded, in an area of cropland; 792 feet east and 264 feet north of the southwest corner of sec. 34, T. 74 N., R. 39 W.

Ap—0 to 7 inches; dark brown (7.5YR 3/2) silty clay loam, brown (10YR 4/3) dry; mixed with streaks and pockets of reddish brown (5YR 4/4) material; weak fine granular structure; friable; slightly acid; clear smooth boundary.

2Bt1—7 to 16 inches; reddish brown (5YR 4/4) silty clay; moderate medium subangular blocky structure; firm; few distinct dark brown (7.5YR 3/2) clay films on faces of peds; neutral; clear smooth boundary.

2Bt2—16 to 26 inches; yellowish red (5YR 4/6) silty clay; few fine distinct gray (5YR 6/1) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; many distinct dark brown (7.5YR 3/2) clay films on faces of peds; neutral; gradual smooth boundary.

2Bt3—26 to 36 inches; brown (7.5YR 4/4) silty clay; common medium distinct gray (5YR 6/1) mottles; weak medium subangular blocky structure; firm; many distinct dark brown (7.5YR 3/2) clay films on faces of peds; neutral; gradual smooth boundary.

2BC—36 to 54 inches; brown (7.5YR 5/4) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; weak coarse subangular blocky structure; friable; neutral; gradual smooth boundary.

2C—54 to 60 inches; brown (7.5YR 5/4) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; massive; friable; neutral.

The thickness of the solum ranges from 40 to 60 inches. The depth to carbonates typically is more than 60 inches, but in some pedons it is 30 to 60 inches.

The A horizon has hue of 7.5YR or 10YR and value and chroma of 2 or 3. The 2B horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. If the matrix has hue of 10YR, this horizon has common mottles with hue of 7.5YR or 5YR. It is silty clay loam, silty clay, or clay in which the content of clay ranges from 38 to 50 percent. The 2C horizon has hue of 7.5YR, 10YR, or 5YR, value of 4 to 6, and chroma of 4 to 8.

Marshall Series

The Marshall series consists of well drained, moderately permeable soils on uplands and high stream benches. These soils formed in loess. The native vegetation was prairie grasses. Slopes range from 0 to 14 percent.

Typical pedon of Marshall silty clay loam, 2 to 5 percent slopes, in an area of cropland; 1,950 feet east and 180 feet south of the northwest corner of sec. 22, T. 75 N., R. 39 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A—7 to 16 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; medium acid; clear smooth boundary.
AB—16 to 24 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.
Bw1—24 to 36 inches; brown (10YR 4/3) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; slightly acid; clear smooth boundary.
Bw2—36 to 46 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; slightly acid; gradual smooth boundary.
Bw3—46 to 56 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; slightly acid; gradual smooth boundary.
BC—56 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) mottles; weak medium and coarse prismatic structure parting to weak medium subangular blocky; friable; slightly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The thickness of the mollic epipedon ranges from 10 to 24 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is silty clay loam, but silt loam is within the range. The content of clay in this horizon is 25 to 35 percent. The B horizon has value of 3 to 5 and chroma of 2 to 4. The content of clay in this horizon is 30 to 34 percent. The BC horizon has value of 4 or 5 and chroma of 2 to 6. It is silt loam or silty clay loam.

The moderately eroded Marshall soils in this county are taxadjuncts to the series because the dark surface soil is thinner than is required for a mollic epipedon.

McPaul Series

The McPaul series consists of moderately well drained, moderately permeable soils in upland drainageways. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of McPaul silt loam, 0 to 2 percent slopes, in an area of cropland; 2,240 feet east and 240 feet south of the northwest corner of sec. 26, T. 76 N., R. 44 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.
C—8 to 60 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; appears massive but has weak bedding planes; very friable; slight effervescence; mildly alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer. The C horizon has chroma of 2 or 3. The content of clay in the control section ranges from 10 to 18 percent.

Minden Series

The Minden series consists of somewhat poorly drained, moderately permeable soils on loess-covered stream benches. These soils formed in loess. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Minden silty clay loam, 0 to 2 percent slopes, in an area of cropland; 650 feet south and 450 feet east of the northwest corner of sec. 11, T. 75 N., R. 40 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; slightly acid; clear smooth boundary.
A—8 to 18 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to moderate medium granular; friable; slightly acid; clear smooth boundary.
AB—18 to 23 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
Bw1—23 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.
Bw2—30 to 36 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct strong brown (7.5YR 5/6) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.
Bw3—36 to 55 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6 and 5/4) mottles; moderate medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C—55 to 60 inches; mottled grayish brown (2.5Y 5/2), dark grayish brown (2.5Y 4/2), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6) silty clay loam; massive; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The mollic epipedon is 14 to 24 inches thick.

The A horizon has value of 2 or 3. The content of clay in this horizon ranges from 24 to 32 percent. The B horizon has value of 4 or 5. It has few and common yellowish brown (10YR 5/4 and 5/6) and strong brown (7.5YR 5/6) mottles. The content of clay in this horizon ranges from 29 to 35 percent. The C horizon has mottles with hue of 2.5Y, 7.5YR, and 10YR.

Modale Series

The Modale series consists of moderately well drained soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Permeability is moderate in the upper part of the profile and slow in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Modale silt loam, 0 to 2 percent slopes, in an area of cropland; 1,340 feet east and 700 feet north of the southwest corner of sec. 12, T. 77 N., R. 45 W.

Ap—0 to 7 inches; very dark grayish brown (2.5Y 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—7 to 24 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; few fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; massive with some horizontal cleavage; very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

2C2—24 to 60 inches; very dark grayish brown (2.5Y 3/2) and dark grayish brown (10YR and 2.5Y 4/2) silty clay; dark gray (N 4/0) coatings on faces of some peds; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium angular blocky structure; very firm; strong effervescence; moderately alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer. The depth of the 2C horizon ranges from 18 to 30 inches.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. The C horizon has chroma of 2 to 4. It is silt loam or very fine sandy loam. The content of clay in this horizon is 10 to 18 percent. The 2C horizon has value of 3 to 5 and chroma of 0 to 2. It is clay or silty clay in which the content of clay is 50 to 60 percent.

Monona Series

The Monona series consists of well drained, moderately permeable soils on uplands and high stream benches. These soils formed in loess. The native vegetation was prairie grasses. Slopes range from 0 to 40 percent.

Typical pedon of Monona silt loam, 2 to 5 percent slopes, in an area of cropland; 2,060 feet east and 130 feet north of the southwest corner of sec. 20, T. 75 N., R. 42 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A—7 to 14 inches; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

Bw1—14 to 24 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw2—24 to 31 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

C1—31 to 54 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; neutral; gradual smooth boundary.

C2—54 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint yellowish brown (10YR 5/6) and few fine distinct grayish brown (2.5Y 5/2) mottles; massive; neutral.

The thickness of the solum ranges from 20 to 42 inches. The depth to carbonates typically is more than 48 inches, but in some pedons it is 24 to 48 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has value of 3 to 5. The content of clay generally decreases with increasing depth. Some pedons have a thin layer of silty clay loam in the lower part of the A horizon or the upper part of the B horizon.

The moderately eroded and severely eroded Monona soils in this county are taxadjuncts to the series because the dark surface soil is thinner than is required for a mollic epipedon.

Moville Series

The Moville series consists of somewhat poorly drained soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Permeability is moderate in the upper part of the profile

and very slow in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Moville silt loam, 0 to 2 percent slopes, in an area of cropland; 1,100 feet east and 2,300 feet south of the northwest corner of sec. 28, T. 74 N., R. 43 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure parting to moderate very fine granular; very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—6 to 26 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; common fine distinct brown (7.5YR 4/4) mottles; weak fine granular structure; very friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

2Ab1—26 to 36 inches; black (10YR 2/1) silty clay; strong fine subangular blocky structure; firm; some silt from horizon above in cracks; slight effervescence; mildly alkaline; clear smooth boundary.

2Ab2—36 to 46 inches; black (N 2/0) silty clay; strong fine and very fine subangular blocky structure; very firm; small snail shells and accumulations (calcium carbonate); strong effervescence; moderately alkaline; gradual smooth boundary.

2Bgb1—46 to 50 inches; very dark gray (N 3/0) and dark gray (N 4/0) silty clay; strong fine subangular blocky structure; very firm; strong effervescence; moderately alkaline; gradual smooth boundary.

2Bgb2—50 to 60 inches; dark gray (5Y 4/1) and gray (5Y 5/1) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; appears massive but has distinct bedding planes; very firm; many small accumulations (calcium carbonate); violent effervescence; strongly alkaline.

The thickness of the solum is 5 to 10 inches. It is the same as the thickness of the surface layer. The depth to the 2Ab horizon ranges from 18 to 30 inches.

The Ap horizon has value of 3 or 4. The C horizon has value of 4 to 6 and chroma of 2 or 3. The content of clay in this horizon ranges from 10 to 18 percent. The 2Ab horizon has value of 2 or 3 and chroma of 0 or 1. It is silty clay or clay in which the content of clay is 50 to 60 percent. The 2Bb horizon has value of 3 to 6. It is silty clay or clay.

Napier Series

The Napier series consists of well drained, moderately permeable soils on low foot slopes near the larger streams and in narrow upland drainageways. These soils formed in local alluvium. The native vegetation was prairie grasses. Slopes range from 2 to 14 percent.

Typical pedon of Napier silt loam, 2 to 5 percent slopes, in an area of cropland; 2,510 feet north and 1,420 feet east of the southwest corner of sec. 29., T. 74 N., R. 42 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and very fine granular structure; friable; many roots and pores; neutral; abrupt smooth boundary.

A—8 to 30 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak very fine subangular blocky structure; friable; many roots and pores; neutral; abrupt smooth boundary.

Bw1—30 to 38 inches; dark brown (10YR 3/3) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw2—38 to 50 inches; brown (10YR 4/3) silt loam; weak very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

C—50 to 60 inches; brown (10YR 4/3) silt loam; massive; friable; neutral.

The thickness of the solum ranges from 36 to 60 inches. The thickness of the mollic epipedon ranges from 24 to 40 inches. The content of clay is 20 to 27 percent throughout the profile.

The A horizon has chroma of 1 or 2. The B horizon has chroma of 2 or 3. The C horizon has value of 4 or 5 and chroma of 3 or 4.

Nevin Series

The Nevin series consists of somewhat poorly drained, moderately permeable soils on alluvial terraces. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Nevin silty clay loam, 0 to 2 percent slopes, in a cultivated field; 2,400 feet north and 200 feet west of the southeast corner of sec. 36, T. 75 N., R. 38 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium and fine granular structure; friable; slightly acid; clear smooth boundary.

A1—8 to 15 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular and weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

A2—15 to 20 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

A3—20 to 26 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine

subangular blocky structure; friable; slightly acid; gradual smooth boundary.

BA—26 to 31 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) kneaded; very dark gray (10YR 3/1) coatings on faces of peds; weak medium and fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Btg1—31 to 36 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate medium and fine subangular blocky structure; friable; common faint very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg2—36 to 42 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct strong brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common faint very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.

BCg—42 to 51 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6), many medium distinct grayish brown (10YR 5/2), and few fine prominent yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; friable; common fine dark concretions (iron and manganese oxides); slightly acid; diffuse smooth boundary.

C—51 to 60 inches; mottled brown (10YR 4/3) and dark grayish brown (10YR 4/2) silty clay loam; massive; friable; common fine dark concretions (iron and manganese oxides); slightly acid.

The thickness of the solum ranges from 36 to 60 inches. The A horizon is silt loam or silty clay loam in which the content of clay is 26 to 29 percent. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3 and has mottles with higher value and chroma. The content of clay in this horizon is 30 to 35 percent. The C horizon has value of 4 or 5 and chroma of 2 to 4.

Nishna Series

The Nishna series consists of poorly drained, slowly permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Nishna silty clay loam, 0 to 2 percent slopes, in an area of cropland; 800 feet north and 100 feet east of the southwest corner of sec. 7, T. 76 N., R. 39 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A1—7 to 19 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate medium subangular blocky structure; firm; strong effervescence; moderately alkaline; gradual smooth boundary.

A2—19 to 27 inches; black (N 2/0) silty clay, dark gray (N 4/0) dry; moderate medium subangular blocky structure; very firm; strong effervescence; moderately alkaline; gradual smooth boundary.

Bg—27 to 38 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very firm; strong effervescence; moderately alkaline; gradual smooth boundary.

Cg—38 to 60 inches; dark gray (10YR 4/1) silty clay; weak medium subangular blocky structure; very firm; strong effervescence; moderately alkaline.

The thickness of the solum and the thickness of the mollic epipedon range from 24 to 46 inches. The A horizon is neutral in hue or has hue of 10YR. It has value of 2 or 3. Some pedons have 6 to 18 inches of stratified silt loam overwash, which has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. The B horizon is neutral in hue or has hue of 10YR or 5Y. It has value of 2 or 3 and chroma of 0 or 1. The content of clay in the control section is 38 to 46 percent. The C horizon has hue of 10YR or 5Y or is neutral in hue. It has value of 3 or 4 and chroma of 0 or 1.

Nodaway Series

The Nodaway series consists of moderately well drained, moderately permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Nodaway silt loam, 0 to 2 percent slopes, in an area of cropland; 500 feet east and 2,300 feet south of the northwest corner of sec. 19, T. 77 N., R. 41 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

C—9 to 60 inches; stratified very dark grayish brown (10YR 3/2), dark brown (10YR 4/3), and brown (10YR 5/3) silt loam; massive; friable; neutral.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer.

The A horizon has chroma of 1 or 2. It is 7 to 9 inches thick. The C horizon has chroma of 1 to 4. It has thin strata of silty clay loam or thin lenses of sand in some pedons.

Onawa Series

The Onawa series consists of somewhat poorly drained soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Permeability is slow in the upper part of the profile and moderate in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Onawa silty clay, 0 to 2 percent slopes, in an area of cropland; 1,900 feet east and 740 feet south of the northwest corner of sec. 13, T. 77 N., R. 45 W.

Ap—0 to 8 inches; very dark grayish brown (2.5Y 3/2) silty clay (about 50 percent clay), grayish brown (2.5Y 5/2) dry; weak fine granular structure; firm; slight effervescence; mildly alkaline; abrupt smooth boundary.

Cg1—8 to 26 inches; dark gray (5Y 4/1) silty clay (about 54 percent clay); common fine prominent brown (7.5YR 4/4) mottles; thin strata of brown (10YR 4/3) silty clay; moderate fine angular blocky structure; very firm; slight effervescence; mildly alkaline; abrupt smooth boundary.

2Cg2—26 to 60 inches; stratified grayish brown (2.5Y 5/2), dark grayish brown (2.5Y 4/2), gray (5Y 5/1), and olive gray (5Y 5/2) silt loam (about 13 percent clay); few fine distinct yellowish brown (10YR 5/6) and dark brown (7.5Y 4/4) mottles; appears massive but has weak bedding planes; very friable; strong effervescence; moderately alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer. The depth to the 2C horizon ranges from 18 to 30 inches.

The Ap horizon has chroma of 1 or 2. The Cg1 horizon has value of 4 or 5 and chroma of 2 or less. It is silty clay or clay in which the content of clay is 50 to 60 percent. The 2Cg2 horizon has chroma of 2 or less. It is dominantly silt loam, but the range includes loam and very fine sandy loam.

Percival Series

The Percival series consists of somewhat poorly drained soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Permeability is slow in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Percival silty clay, 0 to 2 percent slopes, in an area of cropland; 300 feet west and 2,100 feet south of the northeast corner of sec. 14, T. 77 N., R. 45 W.

Ap—0 to 7 inches; very dark grayish brown (2.5Y 3/2) silty clay, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; firm; slight effervescence; mildly alkaline; abrupt smooth boundary.

Cg1—7 to 19 inches; stratified dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; some dark gray (5Y 4/1) coatings on faces of peds; weak and moderate fine and very fine angular and subangular blocky structure; firm; slight effervescence; mildly alkaline; abrupt smooth boundary.

2Cg2—19 to 60 inches; stratified grayish brown (2.5Y 5/2) loamy sand and fine sand; single grained; loose; strong effervescence; mildly alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer.

The Ap and Cg horizons have chroma of 1 or 2. The Cg horizon is silty clay or clay in which the content of clay is 50 to 60 percent. The 2C horizon has value of 5 or 6. It is dominantly fine sand or loamy sand but may have thin strata of other textures averaging less than 10 percent clay.

Rawles Series

The Rawles series consists of moderately well drained, moderately permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Rawles silt loam, 0 to 2 percent slopes, in an area of cropland; 330 feet west and 100 feet south of the northeast corner of sec. 23, T. 76 N., R. 44 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—8 to 23 inches; stratified very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silt loam; appears massive but has weak bedding planes; friable; slight effervescence; mildly alkaline; clear smooth boundary.

2Ab1—23 to 43 inches; black (10YR 2/1) silt loam; weak medium granular structure; friable; mildly alkaline; clear smooth boundary.

2Ab2—43 to 60 inches; black (10YR 2/1) silty clay loam; moderate medium subangular blocky structure parting to moderate medium granular; friable; neutral.

The depth to the 2Ab horizon ranges from 20 to 30 inches. The A horizon has chroma of 2 or 3. The C horizon has strata of different colors. It has value of 3 to 5. The content of clay in the A and C horizons is 18 to 27 percent. The 2Ab horizon has value of 2 or 3 and

chroma of 1 or 2. The content of clay in this horizon is 22 to 32 percent.

Salix Series

The Salix series consists of moderately well drained, moderately permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Salix silty clay loam, 0 to 2 percent slopes, in an area of cropland; 800 feet east and 1,700 feet north of the southwest corner of sec. 15, T. 77 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (about 36 percent clay), dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

AB—8 to 16 inches; black (10YR 2/1) silty clay loam (about 34 percent clay), dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; gradual smooth boundary.

Bw—16 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam (about 34 percent clay), dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; gradual smooth boundary.

BC1—22 to 28 inches; dark grayish brown (10YR 4/2) silt loam (about 25 percent clay); few fine faint dark yellowish brown (10YR 4/4) mottles; very weak fine and very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

BC2—28 to 34 inches; dark grayish brown (2.5Y 4/2) silt loam (about 19 percent clay); few fine faint dark yellowish brown (10YR 4/4) mottles; very weak fine and very fine subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual smooth boundary.

C1—34 to 42 inches; brown (10YR 4/3) silt loam (about 13 percent clay); common fine faint light brownish gray (10YR 6/2) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very friable; slight effervescence; mildly alkaline; gradual smooth boundary.

C2—42 to 60 inches; grayish brown (2.5Y 5/2) and brown (10YR 5/3) silt loam (about 15 percent clay); common fine faint light brownish gray (10YR 6/2) and gray (10YR 6/1) and few fine faint yellowish brown (10YR 5/4 and 5/6) mottles; massive; very friable; a stratum of silty clay between depths of 52 and 56 inches; few fine soft accumulations (calcium carbonate); slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 36 inches. The depth to free carbonates ranges from 24 to 38 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam or silt loam. The B horizon has value of 3 to 5 and chroma of 2 or 3. The content of clay in this horizon is 28 to 38 percent. The C horizon is silt loam to very fine sandy loam.

Sarpy Series

The Sarpy series consists of excessively drained, rapidly permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 3 percent.

Typical pedon of Sarpy loamy fine sand, 0 to 3 percent slopes, in an area of cropland; 900 feet east and 1,100 feet south of the northwest corner of sec. 24, T. 74 N., R. 44 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; single grained; loose; many roots; slight effervescence; mildly alkaline; clear smooth boundary.

C1—6 to 10 inches; dark grayish brown (10YR 4/2) loamy fine sand, grayish brown (10YR 5/2) dry; single grained; loose; slight effervescence; mildly alkaline; clear smooth boundary.

C2—10 to 20 inches; grayish brown (2.5Y 5/2) fine sand, light brownish gray (10YR 6/2) dry; single grained; loose; strong effervescence; mildly alkaline; diffuse smooth boundary.

C3—20 to 60 inches; stratified grayish brown (2.5Y 5/2) fine sand, light brownish gray (10YR 6/2) dry; single grained; loose; strong effervescence; moderately alkaline.

The thickness of the solum is 6 to 10 inches. It is the same as the thickness of the surface layer.

The Ap horizon has value of 3 to 5 and chroma of 1 to 3. It is sand, loamy sand, loamy fine sand, fine sand, or fine sandy loam. The C horizon has chroma of 2 to 4. It is loamy fine sand or fine sand.

Shelby Series

The Shelby series consists of moderately well drained, moderately slowly permeable soils on uplands. These soils formed in glacial till. The native vegetation was prairie grasses. Slopes range from 9 to 18 percent.

The Shelby soils in this county are taxadjuncts to the series because they do not have a mollic epipedon.

Typical pedon of Shelby clay loam, 9 to 14 percent slopes, moderately eroded, in an area of cropland; 660 feet east and 1,122 feet north of the southwest corner of sec. 13, T. 77 N., R. 39 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; mixed with streaks and pockets of brown (10YR 4/3)

subsoil material; weak medium granular structure; friable; slightly acid; abrupt smooth boundary.
Bt1—7 to 16 inches; brown (10YR 4/3) clay loam; moderate medium subangular blocky structure; firm; many faint dark brown (10YR 3/3) clay films on faces of peds; slightly acid; clear smooth boundary.
Bt2—16 to 30 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium subangular blocky structure; firm; common faint brown (10YR 4/3) clay films on faces of peds; slightly acid; clear smooth boundary.
Bt3—30 to 39 inches; dark yellowish brown (10YR 4/4) clay loam; few medium distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; common faint brown (10YR 4/3) clay films on faces of peds; slightly acid; clear smooth boundary.
Bt4—39 to 50 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; common faint brown (10YR 4/3) clay films on faces of peds; slightly acid; gradual smooth boundary.
C—50 to 60 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. The depth to carbonates ranges from 30 to 60 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam or clay loam. The B horizon has value of 4 or 5. It is dominantly clay loam but has thin strata of sandy clay loam, loamy sand, or sandy loam in some pedons. The content of clay in this horizon is 32 to 35 percent. The C horizon has value of 4 or 5 and chroma of 3 to 6.

Steinauer Series

The Steinauer series consists of well drained, moderately slowly permeable soils on uplands. These soils formed in glacial till. The native vegetation was prairie grasses. Slopes range from 9 to 18 percent.

Typical pedon of Steinauer clay loam, 9 to 14 percent slopes, moderately eroded, in an area of cropland; 1,000 feet north and 160 feet west of the southeast corner of sec. 18, T. 74 N., R. 42 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, grayish brown (10YR 5/2) dry; mixed with streaks and pockets of yellowish brown (10YR 5/4) material from the horizon below; weak medium granular structure; firm; few fine accumulations (calcium carbonate); strong effervescence; moderately alkaline; abrupt smooth boundary.
AC—6 to 11 inches; yellowish brown (10YR 5/4) clay loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; firm; some organic stains on faces of peds; few fine accumulations (calcium carbonate); strong effervescence; moderately alkaline; clear smooth boundary.
C1—11 to 23 inches; yellowish brown (10YR 5/4) clay loam; massive; firm; few small pebbles; few accumulations (calcium carbonate); strong effervescence; moderately alkaline; gradual smooth boundary.
C2—23 to 60 inches; yellowish brown (10YR 5/4) clay loam; common fine prominent grayish brown (2.5Y 5/2) and few fine faint yellowish brown (10YR 5/6) mottles, which increase in size and number with increasing depth; massive; firm; many small pebbles; many hard and soft accumulations (calcium carbonate); strong effervescence; moderately alkaline.

The thickness of the solum ranges from 4 to 21 inches. Free carbonates are near the surface in some pedons but are as much as about 14 inches from the surface in other pedons.

The A horizon has value of 4 or 5 and chroma of 1 to 4. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is loam or clay loam.

Zook Series

The Zook series consists of poorly drained, slowly permeable soils on bottom land. These soils formed in alluvium. The native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Zook silty clay loam, 0 to 2 percent slopes, in an area of cropland; 500 feet east and 800 feet north of the southwest corner of sec. 20, T. 77 N., R. 39 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam (about 35 percent clay), very dark gray (10YR 3/1) dry; weak medium granular structure; friable; medium acid; abrupt smooth boundary.
A1—7 to 19 inches; black (10YR 2/1) silty clay loam (about 36 percent clay), very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate medium granular; friable; slightly acid; clear smooth boundary.
A2—19 to 40 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; strong coarse prismatic structure parting to strong coarse subangular blocky; very firm; slightly acid; clear smooth boundary.
Bg—40 to 56 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; strong coarse prismatic structure parting to strong medium angular blocky; very firm; slightly acid; gradual smooth boundary.

Cg—56 to 60 inches; dark gray (10YR 4/1) silty clay; few medium distinct olive (5Y 5/4 or 5/6) mottles; massive; very firm; slightly acid.

The thickness of the solum ranges from 36 to 60 inches. The thickness of the mollic epipedon ranges from 30 to 60 inches.

The A horizon is neutral in hue or has hue of 10YR. It has chroma of 0 to 1. It is silty clay or silty clay loam. Some pedons have 6 to 18 inches of stratified silt loam overwash, which has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. The B and C horizons are neutral in hue or have hue of 10YR or 5Y. They have value of 3 or 4 and chroma of 0 or 1. They are silty clay loam or silty clay in which the content of clay is 36 to 45 percent.

Formation of the Soils

This section describes the factors that affect soil formation in Pottawattamie County. It also describes the processes of soil formation.

Factors of Soil Formation

Soils form through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the 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. Human activities also affect soil formation.

Climate and plant and animal life are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into 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 the transformation of the parent material into a soil. Generally, a long period is needed for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

The soils in Pottawattamie County formed in loess, alluvium, and glacial till. Cretaceous sandstone, limestone, and shale are exposed at the base of the bluffs west of Griswold, but they have had little or no effect on the soils in this area.

Loess is the most extensive parent material in the county. It is yellowish brown, wind-deposited material that consists largely of silt particles and small amounts of clay and sand. Most of the upland soils formed in Wisconsin Loess. Ida, Monona, Marshall, and Exira soils are the most extensive of these soils.

Hamburg soils are on bluffs adjacent to the valley of the Missouri River. The wind probably carried most of the Wisconsin Loess from the flood plain along the Missouri River to the uplands during the Wisconsin glacial period, about 25,000 to 14,000 years ago. The thickness of the loess and the differences among the soils that formed in it are related to the distance from the river. The loess is as much as about 100 feet thick on the bluffs in the western part of the county. In the eastern part, it thins to about 30 feet. In some areas, mainly on steep hillsides adjacent to stream valleys, it has been removed by geologic erosion. In these areas glacial till or Loveland Loess is exposed.

The loess in the southeastern and southern parts of Iowa thins out and becomes finer textured than that in the western part. A marked change in texture is evident in Pottawattamie County. Marshall soils, which are in the eastern part of the county, are higher in content of clay than Hamburg soils, which are in the western part.

The older Loveland Loess is exposed in some areas on side slopes. It was deposited during the Illinoian glacial episode. A reddish paleosol formed in this loess during the Sangamon interglacial period. It was subsequently covered by the Wisconsin Loess. Malvern soils formed in areas where the paleosol was exposed by geologic erosion. The loess in western Iowa has been analyzed in a number of studies (*3, 4, 5, 7, 11, 13, 14, 18*).

Alluvium is the second most extensive parent material in the county. The soils that formed in this material make up about one-third of the total acreage in the county. They are in a large area along the Missouri River, in areas along the Nishnabotna River, and in small areas along upland streams and drainageways. Alluvium is sediment deposited by water along the major streams and along narrow upland drainageways. It ranges from sand to clay because of variations in the material from which it was derived and the manner in which it was deposited.

The soils that formed in alluvium are in two broad groups. One group formed in alluvium that has been in place long enough to have been affected by the soil-forming processes. Examples are Luton, Blencoe, Colo, Keg, Salix, Lakeport, and Cooper soils. The second group formed in recent alluvium. Examples are Sarpy, Haynie, McPaul, Onawa, Blake, and Albaton soils. Because of the accumulation of organic matter, the first group is darker in the upper part than the second group and is dark to a greater depth.

The texture of the soils that formed in alluvium varies widely. Luton and Albaton soils formed entirely in clayey alluvium. Sarpy soils are loamy and sandy throughout.

Keg, Haynie, McPaul, and Kennebec soils are dominantly silt loam throughout. Colo, Nevin, and Lakeport soils are dominantly silty clay loam throughout. Some of the soils have layers of different texture. Examples are Blencoe, Blake, Onawa, Modale, and Percival soils.

Nevin soils are on low stream benches or second bottoms along the Nishnabotna River. They are not subject to flooding. They have a profile that is more strongly expressed than that of the soils that formed in alluvium on first bottoms, which are subject to flooding.

Some alluvial material, called local alluvium, has been transported only a short distance. Such alluvium retains many characteristics of the soils in the areas from which it eroded. Judson and Napier soils, for example, generally are at the base of slopes and are lower on the landscape than the soils that formed in loess. Castana soils formed partly in colluvium, which was moved downslope by the action of gravity. All of the soils at the base of slopes are similar in texture to the soils upslope.

Glacial till is the parent material of only a few soils in the county. Thick deposits of till are throughout the uplands, but most are covered by loess. The till is exposed mainly on upland hillsides near the West Nishnabotna River, where the loess has been removed by erosion.

Most of the glacial till was probably deposited during the Kansan Glaciation. A few exposures may be from the earlier Nebraskan Glaciation. The unweathered till is a heterogeneous mixture. It is firm, calcareous clay loam that contains pebbles, boulders, and sand as well as silt and clay. It shows little evidence of sorting or stratification. The mineral composition also is heterogeneous and is similar to that of particles in unweathered loess.

Some soils formed on the Kansan till plain during the Yarmouth and Sangamon interglacial stages, before the Wisconsin Loess was deposited. They are called Yarmouth-Sangamon paleosols. The nearly level soils on this plain are strongly weathered and have a gray, plastic subsoil called gumbotil (*12*). Clarinda soils are an example. The gumbotil is several feet thick and very slowly permeable.

A widespread erosion surface has cut below the Yarmouth-Sangamon paleosol into Kansan Till and older deposits. It generally is characterized by a stone line or subjacent sediment and is surmounted by pedisediment. Paleosols formed in the pedisediment, stone line, and subjacent till. This surface is of Late Sangamon age. The paleosols are less strongly weathered, more reddish, and not so thick as those in the nearly level areas. Adair soils are an example of soils that formed in the paleosols.

The soils that formed in the Kansan Till during the Yarmouth and Sangamon periods were covered by Wisconsin Loess. Geologic erosion has removed the loess from some slopes and has exposed the paleosol. In other areas erosion has removed all of the paleosol and has exposed till that is only slightly weathered at the surface. Shelby and Steinauer soils formed in this till.

Plant and Animal Life

Several kinds of living organisms affect soil formation. Burrowing animals, worms, crayfish, and micro-organisms, for example, influence soil properties. Differences in the kind of vegetation, however, commonly cause the most marked differences among soils.

Tall grasses were the dominant vegetation when Pottawattamie County was settled. Trees grew in places, mainly in steep areas within a few miles of the valley of the Missouri River and in areas along streams. The thickest stands were on the north- and east-facing slopes.

Because grasses have many roots and tops that decay, soils that formed on prairies typically have a thicker dark surface layer than the soils that formed under trees. The organic matter in the soils that formed under trees is derived principally from fallen leaves. These soils generally are more acid than the soils that formed under grasses. Marshall and Monona soils are typical prairie soils. The stands of trees on these soils have not been in place long enough to affect soil formation significantly.

Climate

The soils in Pottawattamie County formed under a variety of climatic conditions. About 13,000 to 10,500 years ago, the climate in central Iowa was cool and the vegetation was dominantly conifers (*17*). During the period beginning about 10,500 years ago and ending about 8,000 years ago, a warming trend changed the vegetation from conifers to mixed hardwoods. Beginning about 8,000 years ago, the climate became warmer and drier and herbaceous prairie vegetation became dominant. Probably about 3,000 years ago, a change from a dry to a more moist climate began (*9*). Most of the soils in the county formed under the influence of this midcontinental, subhumid climate.

Because it is nearly uniform throughout the county, the climate has not resulted in major differences among the soils. The effects of the climate, however, are modified by local conditions in or near the soil. For example, most of the water received by the very steep Hamburg soils on bluffs runs off or rapidly penetrates the surface. As a result, the microclimate is warmer and drier than is typical in the nearby areas. It also is warmer and drier on south- and west-facing slopes than on north-and east-facing slopes. As a result, natural stands of trees are more likely to grow well on the north- and east-facing slopes. The poorly drained or very poorly drained soils in depressions or other low areas are wetter and cooler than the soils in most of the surrounding areas.

Changes in the temperature activate the weathering of parent material by water and air. As the parent material weathers, changes caused by physical and chemical actions take place. Rainfall affects the amount of leaching in the soil and the kinds of plants on the soil. Temperature and other climatic factors indirectly affect soil formation through their effect on the plant and animal life on and in the soil.

Relief

Relief is an important factor of soil formation because of its effect on drainage, runoff, depth to the water table, and erosion. Slope ranges from nearly level to very steep in Pottawattamie County. A difference in relief is the main reason for the differing properties among some of the soils in the county.

The influence of relief is evident in the color of horizons, the thickness of the solum, and the development of horizons. For example, Ida and Monona soils formed in similar parent material but have different characteristics, mainly because of relief. Some of the water received by the well drained Monona soils runs off the surface. The more sloping Ida soils are in areas where water runs off the surface so rapidly and erosion occurs at such a rapid rate that little soil formation takes place. As a result, the surface layer of the Monona soils is thicker and darker than that of the Ida soils. Monona soils are leached of carbonates, but Ida soils are calcareous at or near the surface.

Slope affects the thickness of the solum and the depth to carbonates. In Monona, Shelby, and other soils that have a wide range in slope, for example, the depth to carbonates and the thickness of the solum decrease as the slope increases and as the surface becomes more convex.

Relief affects the color of the B horizon through its effect on drainage and soil aeration. The B horizon of well drained soils generally is brown because iron compounds are well distributed throughout the horizon and are oxidized. In soils where drainage is restricted, however, the B horizon is grayish and mottled. For example, the very poorly drained Luton soils on the bottom land along the Missouri River have a dark gray and gray subsoil. In contrast, the well drained Keg soils at the slightly higher elevations have a brownish subsoil.

Time

Time enables relief, climate, and plant and animal life to change the parent material. If these factors continue to operate for a long period, similar kinds of soil form in widely different kinds of parent material. Soil formation, however, generally is interrupted by geologic events that expose new parent material. In Pottawattamie County the bedrock was covered by glacial drift from two glaciers—the Nebraskan and the Kansan. Later, Loveland Loess was deposited, and then Wisconsin Loess (fig. 11).

Adair and Clarinda soils have the most strongly weathered subsoil in the county (*12*). They formed in Kansan Till, which began to weather in the Late Sangamon period and then was covered by Wisconsin Loess. More recently, the upper part of this ancient subsoil was again exposed to weathering when the loess was removed by erosion.

About 90 percent of the soils in Pottawattamie County are less than 14,000 years old. According to radiocarbon dates, loess deposition began about 25,000 years ago and continued to about 14,000 years ago. Based on these dates, the surface of the nearly level, loess-mantled divides in Iowa is about 14,000 years old. In much of Iowa, including Pottawattamie County, geologic erosion has beveled and in places removed material on side slopes and deposited new sediments downslope (*12*). The soil material on the surface of the nearly level upland divides is older than that on the slopes that truncate the divides. Thus, the soils on these side slopes are less than 14,000 years old.

The sediments stripped from the side slopes accumulated downslope as local alluvium. The age of soil material on the side slopes can be determined by dating the alluvial fill at the base of the slopes. The alluvium in some stream valleys in western Iowa is less than 1,800 years old (*3*). Studies of Adair County, in southwestern Iowa, indicate that the base of the alluvial fill is about 6,800 years old (*12*). The soil material on the surface of the side slopes is as young as or younger than the alluvial fill. Judson, Napier, and Kennebec are examples of soils that formed in this kind of alluvium.

Some of the soils on the bottom land along the Missouri River formed in alluvium that has been deposited since settlement. Other soils, such as Salix and Keg soils, are older. They have not been flooded since before they were plowed by the first settlers. The difference in the time that the soil-forming factors have been active is reflected in the characteristics of the soils.

Human Activities

Important changes take place in the soil after it is drained and cultivated. Changes caused by water erosion generally are the most significant. In many of the cultivated soils in the county, much of the surface layer has been lost through water erosion. In places gullies have formed. Tilling the surface layer alters the structure of the soil. Less obvious are the chemical changes brought about by applications of lime and fertilizer and the changes in microbial activity and organic matter content that result from removing the native vegetation and growing crops.

Human activities have strongly affected the formation of McPaul and Moville soils on bottom land. These originally dark soils have been covered by a new parent material, which is light colored and calcareous. This

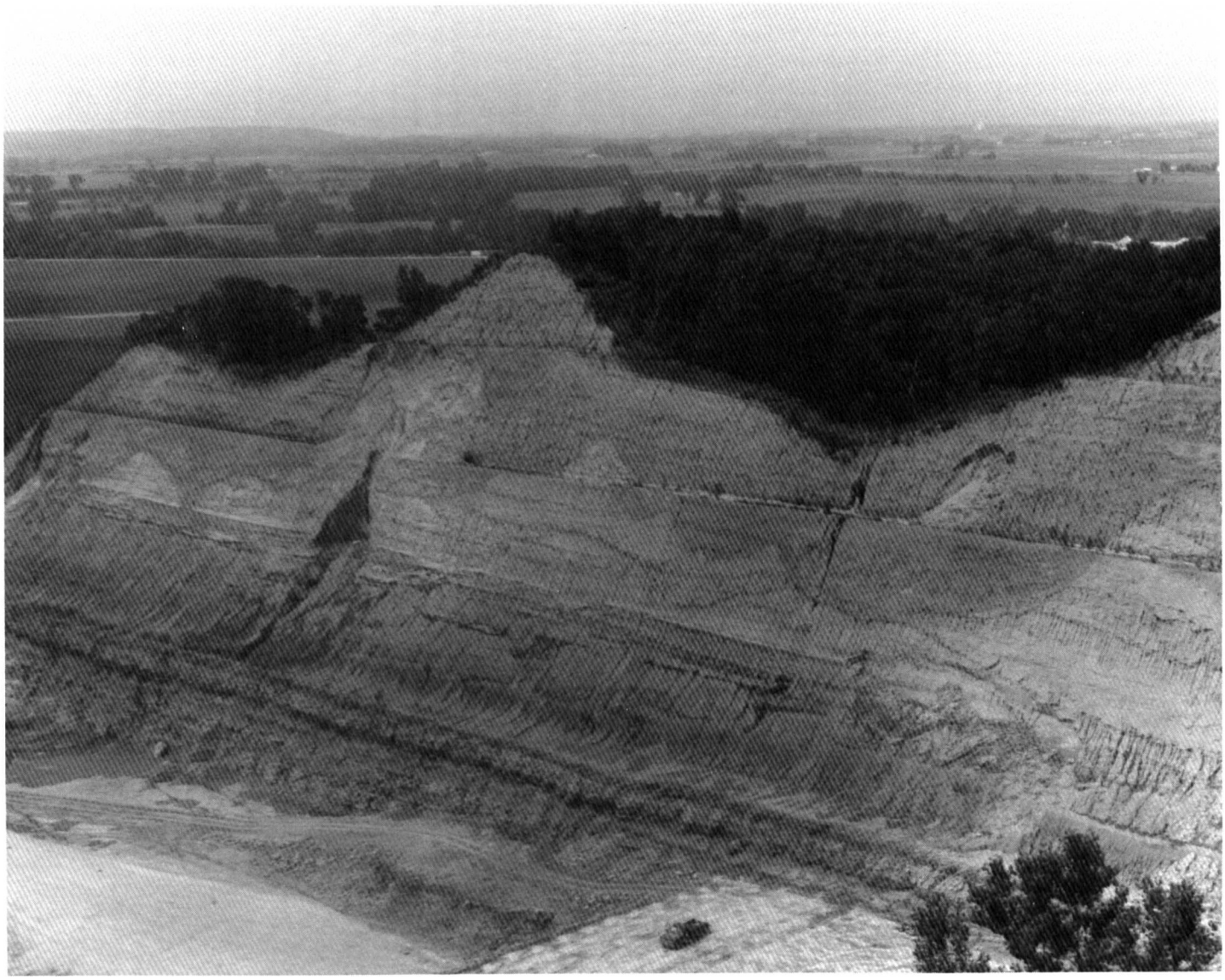


Figure 11.—Different loess deposits over glacial till in a limestone quarry.

material eroded from the uplands, largely because of farming.

Processes of Soil Formation

Horizon differentiation is caused by at least four processes. These processes are additions, removals, transfers, and transformations. Each of these affects many substances in the soil. Examples are the addition, removal, transfer, or transformation of organic matter, soluble salts, carbonates, sesquioxides, or silicate clay minerals.

Generally, these processes promote horizon differentiation, but some tend to retard it. These processes and the changes they bring about proceed simultaneously in soils. The ultimate nature of the profile is governed by the balance of those changes within the profile.

In Pottawattamie County the soils on flood plains are divided into two broad groups, based mainly on the additions of organic matter. The soils that have a thick, dark surface layer are separated from those that do not. The dark color, or lack of it, is the most obvious difference between the Luton and Albaton soils, between

the Keg and Haynie soils, and between the Blencoe and Onawa soils. In some soils on uplands, the dark surface layer is the only soil feature that reflects the processes of soil formation. Examples are Ida and Steinauer soils.

The removal of substances from parts of the soil profile accounts for some of the most obvious differences among soils in the county. An example is the downward movement of calcium carbonates that results from leaching. In Ida and Steinauer soils, little calcium carbonate has been removed. These soils are calcareous at or near the surface. No B horizon has formed in these soils. In contrast, leaching has removed calcium carbonates from the upper part of Monona and Shelby soils. This removal, along with other processes, has resulted in the differentiation of a B horizon.

The transfer of substances from one horizon to another is evident in the soils of Pottawattamie County. Phosphorus is removed from the B horizon by plant roots, is transferred to the parts of the plant growing above the ground, and then is added to the surface layer in the plant residue.

The translocation of silicate clay minerals helps to differentiate horizons. Clay minerals from the A horizon are carried downward in suspension in percolating water. They accumulate in the B horizon in pores and root channels and as clay films on the faces of peds. Adair and Bremer are examples of soils that are markedly affected by this process. In other soils, the content of clay in the A horizon is not markedly different from that in the B horizon and other evidence of clay movement is minimal.

Another kind of transfer in Luton, Albaton, and other very clayey soils is caused by the formation of cracks brought about by shrinking and swelling. Because of the cracks, some of the material from the surface layer is incorporated into lower parts of the profile.

Transformations are physical and chemical. The weathering of soil particles to smaller sizes is an example of a physical transformation. The reduction of iron, a process called gleying, is a chemical transformation. It is common in poorly drained or very poorly drained soils, such as Colo and Luton soils. These soils are saturated for long periods. Their grayish colors are evidence of gleying.

Another kind of transformation is the weathering of a primary apatite mineral in the parent material to a secondary phosphorus compound. Apparently, the pH level must decline to about 7 before much of this weathering can take place. This process accounts for differences in the supply of available phosphorus among soils that formed in similar kinds of calcareous parent material. For example, Ida soils are calcareous and have a very low supply of available phosphorus. In contrast, Monona soils, which have been leached and are about neutral, have a higher supply of available phosphorus.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Daniels, Raymond B., and Robert H. Jordan. 1966. Physiographic history and the soils, entrenched stream systems, and gullies, Harrison County, Iowa. U.S. Dep. Agric. Tech. Bull. 1348, 116 pp., illus.

(4) Davidson, D.T., and others. (n.d.) Geologic and engineering properties of Pleistocene materials in Iowa. Iowa Eng. Exp. Stn. Bull. 191, Iowa Highw. Res. Board Bull. 20, Joint Publ. 250, illus.

(5) Godfrey, C.L., and Frank F. Riecken. 1957. Solubility of phosphorus in some genetically related loess-derived soils. Soil Sci. Soc. Am. Proc. 21: 232-235.

(6) Goodman, A.L., Peter Hanson, and Harold W. Reid. 1916. Soil survey of Pottawattamie County, Iowa. U.S. Dep. Agric., Bur. of Soils, 30 pp., illus.

(7) Hutton, Curtis E. 1947. Studies of loess-derived soils in southwestern Iowa. Soil Sci. Soc. Am. Proc. 12: 424-431, illus.

(8) Iowa Department of Agriculture, Division of Agricultural Statistics. 1985. Iowa agricultural statistics for 1984. 177 pp.

(9) McComb, A.L., W.E. Loomis, and F.F. Riecken. 1961. Effect of vegetation on soils in the forest-prairie region. Rec. Adv. Bot., Univ. Toronto Press, pp. 1627-1631.

(10) Pottawattamie County History Book Committee. 1978. Pottawattamie County, Iowa, a collection of historical sketches and family histories. Taylor Publishing Co., 533 pp., illus.

(11) Ruhe, Robert V. 1969. Quaternary landscapes in Iowa. Iowa State Univ. Press, 255 pp., illus.

(12) Ruhe, Robert V., R.B. Daniels, and J.G. Cady. 1967. Landscape evolution and soil formation in southwestern Iowa. U.S. Dep. Agric. Tech. Bull. 1349, 242 pp., illus.

(13) Ulrich, Rudolph. 1950. Some physical changes accompanying prairie, wisenboden, and planosol soil profile development from Peorian loess in southwestern Iowa. Soil Sci. Soc. Am. Proc. 14: 287-295, illus.

(14) Ulrich, Rudolph. 1951. Some chemical changes accompanying profile formation of the nearly level soils developed from Peorian loess in southwestern Iowa. Soil Sci. Soc. Am. Proc. 14: 324-329, illus.

(15) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(16) 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.

(17) Walker, Patrick H. 1966. Postglacial erosion and environment changes in central Iowa. Soil and Water Conserv. 21: 21-23.

(18) White, E.M., J.E. McClelland, C.L. Coultas, and R.C. Prill. 1959. Soil survey of Monona County, Iowa. U.S. Dep. Agric., Soil Conserv. Serv., 41 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

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.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

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.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. 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.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

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.

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.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

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.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:
O horizon.—An organic layer of fresh and decaying plant residue.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.
Cr horizon.—Soft, consolidated bedrock beneath the soil.
R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered

but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. 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.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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.

Percolation. The downward movement of water through 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.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

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 substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

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.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

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 about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These

changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Oakland, Iowa)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	29.9	8.3	19.1	56	-24	0	0.77	0.27	1.17	3	7.1
February---	36.3	14.7	25.5	64	-20	7	.98	.28	1.54	3	6.1
March------	47.1	24.9	36.0	80	-6	33	1.95	.71	2.97	5	5.6
April------	64.0	37.9	51.0	89	15	124	2.96	1.73	4.05	6	1.0
May--------	74.4	49.1	61.8	92	26	373	3.87	2.42	5.18	8	.0
June-------	83.1	58.6	70.9	99	40	627	4.81	2.60	6.75	7	.0
July-------	86.5	63.0	74.8	99	44	769	3.75	1.50	5.64	6	.0
August-----	84.3	60.5	72.4	96	42	694	4.45	2.23	6.37	7	.0
September--	76.8	51.2	64.0	94	29	420	3.85	1.64	5.72	6	.0
October----	66.5	39.7	53.1	89	17	172	2.31	.61	3.67	4	.3
November---	49.3	26.7	38.0	74	0	8	1.33	.26	2.16	3	2.2
December---	36.0	15.6	25.8	62	-17	0	.89	.32	1.36	3	5.3
Yearly:											
Average--	61.2	37.5	49.4	---	---	---	---	---	---	---	---
Extreme--	---	---	---	100	-25	---	---	---	---	---	---
Total----	---	---	---	---	---	3,227	31.92	26.63	37.00	61	27.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Oakland, Iowa)

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--	Apr. 27	May 10	May 17
2 years in 10 later than--	Apr. 22	May 5	May 13
5 years in 10 later than--	Apr. 12	Apr. 26	May 7
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 6	Sept. 26	Sept. 14
2 years in 10 earlier than--	Oct. 11	Sept. 30	Sept. 19
5 years in 10 earlier than--	Oct. 19	Oct. 9	Sept. 29

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Oakland, Iowa)

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	174	146	130
8 years in 10	179	152	135
5 years in 10	189	166	144
2 years in 10	199	179	154
1 year in 10	204	185	159

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1C	Ida silt loam, 5 to 9 percent slopes	206	*
1C3	Ida silt loam, 5 to 9 percent slopes, severely eroded	3,599	0.6
1D	Ida silt loam, 9 to 14 percent slopes	405	0.1
1D3	Ida silt loam, 9 to 14 percent slopes, severely eroded	20,525	3.3
1E	Ida silt loam, 14 to 20 percent slopes	1,725	0.3
1E3	Ida silt loam, 14 to 20 percent slopes, severely eroded	42,405	6.9
1F	Ida silt loam, 20 to 30 percent slopes	3,875	0.6
1F3	Ida silt loam, 20 to 30 percent slopes, severely eroded	5,580	0.9
1G	Ida silt loam, 30 to 40 percent slopes	1,255	0.2
2G	Hamburg silt loam, 40 to 75 percent slopes	3,615	0.6
3E	Castana silt loam, 9 to 20 percent slopes	520	0.1
8B	Judson silt loam, 2 to 5 percent slopes	30,670	5.1
8C	Judson silt loam, 5 to 9 percent slopes	4,995	0.8
9	Marshall silty clay loam, 0 to 2 percent slopes	2,755	0.4
9B	Marshall silty clay loam, 2 to 5 percent slopes	44,335	7.3
9C	Marshall silty clay loam, 5 to 9 percent slopes	4,920	0.8
9C2	Marshall silty clay loam, 5 to 9 percent slopes, moderately eroded	16,080	2.7
9D	Marshall silty clay loam, 9 to 14 percent slopes	745	0.1
9D2	Marshall silty clay loam, 9 to 14 percent slopes, moderately eroded	7,055	1.1
10	Monona silt loam, 0 to 2 percent slopes	490	0.1
10B	Monona silt loam, 2 to 5 percent slopes	12,240	2.0
10C	Monona silt loam, 5 to 9 percent slopes	7,565	1.2
10C2	Monona silt loam, 5 to 9 percent slopes, moderately eroded	22,260	3.6
10C3	Monona silt loam, 5 to 9 percent slopes, severely eroded	1,675	0.3
10D	Monona silt loam, 9 to 14 percent slopes	1,265	0.2
10D2	Monona silt loam, 9 to 14 percent slopes, moderately eroded	40,780	6.6
10D3	Monona silt loam, 9 to 14 percent slopes, severely eroded	5,595	0.9
10E	Monona silt loam, 14 to 20 percent slopes	920	0.1
10E2	Monona silt loam, 14 to 20 percent slopes, moderately eroded	2,780	0.5
10E3	Monona silt loam, 14 to 20 percent slopes, severely eroded	2,595	0.4
10F	Monona silt loam, 20 to 30 percent slopes	880	0.1
10G	Monona silt loam, 30 to 40 percent slopes	815	0.1
11B	Ackmore-Colo-Judson complex, 0 to 5 percent slopes	50,815	8.3
12B	Napier silt loam, 2 to 5 percent slopes	43,410	7.0
12C	Napier silt loam, 5 to 9 percent slopes	12,827	2.1
12D	Napier silt loam, 9 to 14 percent slopes	1,365	0.2
22C3	Dow silt loam, 5 to 9 percent slopes, severely eroded	265	*
22D3	Dow silt loam, 9 to 14 percent slopes, severely eroded	1,145	0.2
22E3	Dow silt loam, 14 to 20 percent slopes, severely eroded	280	*
24D2	Shelby clay loam, 9 to 14 percent slopes, moderately eroded	2,775	0.5
24E2	Shelby clay loam, 14 to 18 percent slopes, moderately eroded	1,105	0.2
24E3	Shelby clay loam, 14 to 18 percent slopes, severely eroded	240	*
33D2	Steinauer clay loam, 9 to 14 percent slopes, moderately eroded	890	0.1
33E2	Steinauer clay loam, 14 to 18 percent slopes, moderately eroded	1,225	0.2
36	Salix silty clay loam, 0 to 2 percent slopes	1,155	0.2
43	Bremer silty clay loam, 0 to 2 percent slopes	2,160	0.4
44	Blencoe silty clay, 0 to 2 percent slopes	530	0.1
46	Keg silt loam, 0 to 2 percent slopes	1,115	0.2
54	Zook silty clay loam, 0 to 2 percent slopes	8,115	1.3
54+	Zook silt loam, overwash, 0 to 2 percent slopes	2,545	0.4
60D2	Malvern silty clay loam, 9 to 14 percent slopes, moderately eroded	1,030	0.2
66	Luton silty clay, 0 to 2 percent slopes	4,205	0.7
66+	Luton silt loam, overwash, 0 to 2 percent slopes	860	0.1
70	McPaul silt loam, 0 to 2 percent slopes	9,520	1.5
76C	Ladoga silt loam, 5 to 9 percent slopes	420	0.1
76D	Ladoga silt loam, 9 to 14 percent slopes	270	*
76F	Ladoga silt loam, 14 to 25 percent slopes	900	0.1
88	Nevin silty clay loam, 0 to 2 percent slopes	1,310	0.2
93D2	Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded	5,875	1.0
93D3	Shelby-Adair complex, 9 to 14 percent slopes, severely eroded	820	0.1
99C2	Exira silty clay loam, 5 to 9 percent slopes, moderately eroded	6,275	1.0
99D2	Exira silty clay loam, 9 to 14 percent slopes, moderately eroded	52,445	8.5
99D3	Exira silty clay loam, 9 to 14 percent slopes, severely eroded	3,070	0.5

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
99E2	Exira silty clay loam, 14 to 20 percent slopes, moderately eroded	1,420	0.2
99E3	Exira silty clay loam, 14 to 20 percent slopes, severely eroded	1,010	0.2
133	Colo silty clay loam, 0 to 2 percent slopes	3,125	0.5
133+	Colo silt loam, overwash, 0 to 2 percent slopes	4,215	0.7
137	Haynie silt loam, 0 to 2 percent slopes	7,875	1.3
144	Blake silty clay loam, 0 to 2 percent slopes	2,460	0.4
146	Onawa silty clay, 0 to 2 percent slopes	3,715	0.6
149	Modale silt loam, 0 to 2 percent slopes	1,780	0.3
156	Albaton silty clay, 0 to 2 percent slopes	8,295	1.3
156+	Albaton silt loam, overwash, 0 to 2 percent slopes	620	0.1
179F	Gara loam, 10 to 24 percent slopes	1,360	0.2
192C2	Adair silty clay loam, 5 to 9 percent slopes, moderately eroded	135	*
192D2	Adair silty clay loam, 9 to 14 percent slopes, moderately eroded	1,430	0.2
212	Kennebec silt loam, 0 to 2 percent slopes	4,410	0.7
212+	Kennebec silt loam, overwash, 0 to 2 percent slopes	2,525	0.4
220	Nodaway silt loam, 0 to 2 percent slopes	13,310	2.3
222D2	Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded	725	0.1
234	Nishna silty clay loam, 0 to 2 percent slopes	770	0.1
237	Sarpy loamy fine sand, 0 to 3 percent slopes	3,850	0.6
255	Cooper silty clay loam, 0 to 2 percent slopes	2,935	0.5
275	Moville silt loam, 0 to 2 percent slopes	500	0.1
430	Ackmore silt loam, 0 to 2 percent slopes	9,240	1.5
436	Lakeport silty clay loam, 0 to 2 percent slopes	1,050	0.2
509	Marshall silty clay loam, benches, 0 to 2 percent slopes	2,175	0.4
509B	Marshall silty clay loam, benches, 2 to 5 percent slopes	1,080	0.2
509C2	Marshall silty clay loam, benches, 5 to 9 percent slopes, moderately eroded	915	0.1
510	Monona silt loam, benches, 0 to 2 percent slopes	245	*
510B	Monona silt loam, benches, 2 to 5 percent slopes	170	*
510C2	Monona silt loam, benches, 5 to 9 percent slopes, moderately eroded	200	*
514	Grable silt loam, 0 to 2 percent slopes	1,540	0.2
515	Percival silty clay, 0 to 2 percent slopes	2,185	0.4
670	Rawles silt loam, 0 to 2 percent slopes	1,280	0.2
717C	Napier-Gullied land complex, 2 to 10 percent slopes	508	0.1
1233	Corley silt loam, 0 to 2 percent slopes	205	*
1299	Minden silty clay loam, 0 to 2 percent slopes	680	0.1
4001C	Ida-Urban land complex, 3 to 9 percent slopes	385	0.1
4001D	Ida-Urban land complex, 9 to 14 percent slopes	280	*
4001E	Ida-Urban land complex, 14 to 20 percent slopes	545	0.1
4012B	Napier-Urban land complex, 2 to 5 percent slopes	585	0.1
4046	Keg-Urban land complex, 0 to 2 percent slopes	2,280	0.4
4156	Albaton-Urban land complex, 0 to 2 percent slopes	465	0.1
4170C	Castana-Urban land complex, 5 to 9 percent slopes	720	0.1
4237	Sarpy-Urban land complex, 1 to 3 percent slopes	1,005	0.2
4255	Cooper-Urban land complex, 0 to 2 percent slopes	1,495	0.2
5030	Pits, quarries	310	0.1
5040	Orthents, loamy	580	0.1
5053	Psammaquents, frequently flooded	495	0.1
5080	Orthents-Dumps complex	270	*
	Water	5,008	0.8
	Total	616,448	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
8B	Judson silt loam, 2 to 5 percent slopes
9	Marshall silty clay loam, 0 to 2 percent slopes
9B	Marshall silty clay loam, 2 to 5 percent slopes
10	Monona silt loam, 0 to 2 percent slopes
10B	Monona silt loam, 2 to 5 percent slopes
11B	Ackmore-Colo-Judson complex, 0 to 5 percent slopes (where drained)
12B	Napier silt loam, 2 to 5 percent slopes
36	Salix silty clay loam, 0 to 2 percent slopes
43	Bremer silty clay loam, 0 to 2 percent slopes (where drained)
44	Blencoe silty clay, 0 to 2 percent slopes (where drained)
46	Keg silt loam, 0 to 2 percent slopes
54	Zook silty clay loam, 0 to 2 percent slopes (where drained)
54+	Zook silt loam, overwash, 0 to 2 percent slopes (where drained)
70	McPaul silt loam, 0 to 2 percent slopes
88	Nevin silty clay loam, 0 to 2 percent slopes
133	Colo silty clay loam, 0 to 2 percent slopes (where drained)
133+	Colo silt loam, overwash, 0 to 2 percent slopes (where drained)
137	Haynie silt loam, 0 to 2 percent slopes
144	Blake silty clay loam, 0 to 2 percent slopes
146	Onawa silty clay, 0 to 2 percent slopes
149	Modale silt loam, 0 to 2 percent slopes
212	Kennebec silt loam, 0 to 2 percent slopes
212+	Kennebec silt loam, overwash, 0 to 2 percent slopes
220	Nodaway silt loam, 0 to 2 percent slopes
234	Nishna silty clay loam, 0 to 2 percent slopes (where drained)
255	Cooper silty clay loam, 0 to 2 percent slopes
275	Moville silt loam, 0 to 2 percent slopes
430	Ackmore silt loam, 0 to 2 percent slopes
436	Lakeport silty clay loam, 0 to 2 percent slopes
509	Marshall silty clay loam, benches, 0 to 2 percent slopes
509B	Marshall silty clay loam, benches, 2 to 5 percent slopes
510	Monona silt loam, benches, 0 to 2 percent slopes
510B	Monona silt loam, benches, 2 to 5 percent slopes
514	Grable silt loam, 0 to 2 percent slopes
670	Rawles silt loam, 0 to 2 percent slopes
1233	Corley silt loam, 0 to 2 percent slopes (where drained)
1299	Minden silty clay loam, 0 to 2 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES 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	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
1C---------- Ida	IIIe	124	42	68	5.2	3.3	5.0	5.1
1C3---------- Ida	IIIe	111	37	61	4.7	2.7	4.7	4.8
1D---------- Ida	IIIe	115	39	63	4.8	2.7	4.5	4.6
1D3---------- Ida	IIIe	102	34	56	4.3	2.3	4.0	4.3
1E---------- Ida	IVe	98	33	54	4.1	1.6	3.5	3.8
1E3---------- Ida	IVe	85	28	47	3.6	1.3	3.0	3.5
1F---------- Ida	VIe	---	---	---	2.9	1.3	2.8	2.8
1F3---------- Ida	VIe	---	---	---	2.0	1.2	2.8	2.5
1G---------- Ida	VIIe	---	---	---	---	1.2	---	---
2G---------- Hamburg	VIIe	---	---	---	---	---	2.5	---
3E---------- Castana	IVe	93	31	51	3.9	2.3	3.8	4.0
8B---------- Judson	IIe	149	53	95	6.7	4.2	7.3	8.6
8C---------- Judson	IIIe	144	52	92	6.5	4.1	7.1	8.3
9---------- Marshall	I	150	51	84	6.4	3.8	6.5	7.6
9B---------- Marshall	IIe	147	50	83	6.3	3.8	6.3	7.5
9C---------- Marshall	IIIe	142	49	80	6.1	3.5	6.1	7.1
9C2---------- Marshall	IIIe	138	47	78	6.0	3.3	5.9	7.0
9D---------- Marshall	IIIe	133	46	75	5.7	3.3	5.5	6.5
9D2---------- Marshall	IIIe	129	44	73	5.5	3.0	5.3	6.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
10--Monona	I	145	49	80	6.1	3.8	6.0	7.0
10B--Monona	IIe	142	48	78	6.0	3.7	5.8	6.8
10C--Monona	IIIe	137	46	75	5.7	3.7	5.4	6.4
10C2--Monona	IIIe	133	45	73	5.6	3.7	5.3	6.3
10C3--Monona	IVe	124	42	68	5.2	3.4	4.9	5.7
10D--Monona	IIIe	128	43	70	5.4	3.3	4.8	5.6
10D2--Monona	IVe	124	42	68	5.2	3.3	4.8	5.6
10D3--Monona	IVe	115	39	63	4.8	2.7	4.5	4.8
10E, 10E2--Monona	IVe	111	37	61	4.7	2.6	4.2	4.7
10E3--Monona	IVe	98	33	59	4.1	2.5	4.0	4.5
10F--Monona	VIe	---	---	---	3.4	1.8	3.2	3.6
10G--Monona	VIIe	---	---	---	3.0	1.6	3.0	3.2
11B--Ackmore-Colo-Judson	IIw	137	47	87	4.8	4.0	6.3	7.6
12B--Napier	IIe	130	44	72	5.5	3.8	6.3	7.3
12C--Napier	IIIe	125	42	69	5.3	3.8	6.0	7.0
12D--Napier	IIIe	116	39	64	4.8	3.7	5.5	6.3
22C3--Dow	IIIe	97	32	53	4.1	2.7	4.5	4.6
22D3--Dow	IVe	88	29	48	3.9	2.3	3.8	4.0
22E3--Dow	IVe	71	24	39	3.0	1.7	2.8	3.0
24D2--Shelby	IIIe	115	39	58	4.8	3.3	4.9	5.6
24E2--Shelby	IVe	98	33	49	4.1	2.1	4.0	4.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
24E3---------- Shelby	VIe	---	---	---	3.1	1.7	3.6	4.3
33D2---------- Steinauer	IIIe	102	38	77	4.3	2.5	4.8	5.0
33E2---------- Steinauer	IVe	85	32	64	3.6	2.2	3.8	---
36---------- Salix	I	145	49	80	6.1	4.2	6.8	4.5
43---------- Bremer	IIw	139	47	83	4.2	4.0	6.3	7.5
44---------- Blencoe	IIw	120	40	66	4.8	3.7	5.0	6.0
46---------- Keg	I	152	51	84	6.4	4.2	7.0	7.5
54, 54+---------- Zook	IIw	126	42	76	3.8	4.0	4.0	4.8
60D2---------- Malvern	IVe	91	30	50	3.6	3.2	4.2	5.0
66---------- Luton	IIIw	80	27	44	2.4	2.5	4.1	4.3
66+---------- Luton	IIIw	100	34	55	3.0	2.6	4.4	4.8
70---------- McPaul	I	133	45	73	5.6	3.7	5.8	6.1
76C---------- Ladoga	IIIe	143	48	79	6.0	4.0	6.5	7.5
76D---------- Ladoga	IIIe	134	45	74	5.6	3.8	5.9	7.0
76F---------- Ladoga	VIe	---	---	55	4.7	3.3	4.6	5.4
88---------- Nevin	I	163	55	98	6.5	4.0	8.0	8.0
93D2---------- Shelby-Adair	IVe	75	33	49	4.0	2.6	4.0	4.8
93D3---------- Shelby-Adair	IVe	66	24	36	3.0	2.2	3.4	4.1
99C2---------- Exira	IIIe	133	46	75	5.7	3.3	6.3	7.5
99D2---------- Exira	IIIe	124	43	70	5.3	3.0	5.5	5.9
99D3---------- Exira	IVe	115	40	65	5.0	3.0	5.0	5.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
99E2---------- Exira	IVe	107	36	59	4.6	2.8	4.8	5.6
99E3---------- Exira	IVe	98	33	54	4.2	2.4	4.2	5.2
133---------- Colo	IIw	136	46	82	4.2	4.2	5.5	7.0
133+---------- Colo	IIw	140	47	92	4.3	4.2	5.8	7.0
137---------- Haynie	IIw	126	42	---	5.3	3.7	5.7	6.0
144---------- Blake	IIw	126	41	67	4.7	3.5	5.0	6.0
146---------- Onawa	IIw	120	40	66	3.6	3.7	5.3	5.6
149---------- Modale	I	126	42	69	5.0	3.7	5.5	6.5
156---------- Albaton	IIIw	100	34	55	3.0	3.3	4.0	5.1
156+---------- Albaton	IIIw	105	35	58	3.2	3.5	4.5	5.5
179F---------- Gara	VIe	---	---	---	3.9	1.7	3.3	4.1
192C2---------- Adair	IIIe	85	28	43	3.4	2.3	3.5	4.5
192D2---------- Adair	IVe	76	25	38	3.0	1.9	2.9	3.8
212, 212+------- Kennebec	I	155	54	97	6.8	4.2	7.1	8.5
220---------- Nodaway	IIw	153	51	92	6.4	4.0	6.5	7.6
222D2---------- Clarinda	IVe	66	22	33	2.0	1.7	2.9	3.0
234---------- Nishna	IIIw	110	37	61	3.3	3.7	5.3	6.0
237---------- Sarpy	IVs	---	---	30	1.5	1.2	1.8	2.0
255---------- Cooper	IIw	70	37	69	3.7	3.7	5.8	6.1
275---------- Moville	IIw	127	43	70	5.1	3.7	5.5	6.1

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
430---------- Ackmore	IIw	141	47	85	4.2	3.8	6.3	7.5
436---------- Lakeport	I	138	46	76	5.5	3.7	6.3	6.6
509---------- Marshall	I	153	51	84	6.4	3.8	6.5	7.6
509B---------- Marshall	IIe	150	50	83	6.3	3.8	6.3	7.5
509C2---------- Marshall	IIIe	141	47	78	6.0	3.3	5.9	7.0
510---------- Monona	I	145	49	80	6.1	3.8	6.0	7.0
510B---------- Monona	IIe	142	48	78	6.0	3.7	5.8	6.8
510C2---------- Monona	IIIe	133	45	73	5.6	3.7	5.3	6.3
514---------- Grable	IIs	103	35	57	4.3	2.7	4.5	5.3
515---------- Percival	IIw	100	34	55	4.0	2.3	3.8	4.3
670---------- Rawles	IIw	110	37	60	5.0	3.9	5.1	5.4
717C**---------- Napier-Gullied land	VIIe	---	---	---	---	---	---	---
1233---------- Corley	IIw	130	44	72	3.9	3.7	5.5	6.0
1299---------- Minden	I	161	54	89	6.4	4.3	6.8	7.3
4001C**, 4001D**, 4001E**. Ida-Urban land								
4012B**. Napier-Urban land								
4046**. Keg-Urban land								
4156**. Albaton-Urban land								

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Grass-legume hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
4170C**. Castana-Urban land								
4237**. Sarpy-Urban land								
4255**. Cooper-Urban land								
5030**. Pits								
5040. Orthents								
5053. Psammaquents								
5080**. Orthents-Dumps								

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1C, 1C3, 1D, 1D3, 1E, 1E3, 1F, 1F3, 1G---------- Ida	Tatarian honeysuckle, fragrant sumac.	Siberian peashrub	Honeylocust, northern catalpa, osageorange, Russian-olive, eastern redcedar, green ash, black locust, bur oak.	---	---
2G---------- Hamburg	Tatarian honeysuckle, fragrant sumac.	Siberian peashrub	Eastern redcedar, honeylocust, green ash, Russian-olive, bur oak, osageorange, northern catalpa, black locust.	Siberian elm------	---
3E---------- Castana	Tatarian honeysuckle, fragrant sumac.	Siberian peashrub	Eastern redcedar, honeylocust, Russian-olive, green ash, northern catalpa, bur oak, osageorange, black locust.	Siberian elm------	---
8B, 8C---------- Judson	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Hackberry, bur oak, green ash, Russian-olive, eastern redcedar.	Honeylocust, Austrian pine, eastern white pine.	---
9, 9B, 9C, 9C2, 9D, 9D2---------- Marshall	---	Autumn-olive, lilac, Amur maple, Amur honeysuckle.	Eastern redcedar, Russian-olive, hackberry, bur oak, green ash.	Austrian pine, eastern white pine, honeylocust.	---
10, 10B, 10C, 10C2, 10C3, 10D, 10D2, 10D3, 10E, 10E2, 10E3, 10F, 10G---------- Monona	---	Autumn-olive, lilac, Amur maple, Amur honeysuckle.	Bur oak, hackberry, green ash, Russian-olive, eastern redcedar.	Honeylocust, eastern white pine, Austrian pine.	---
11B*: Ackmore----------	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
11B*: Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, blue spruce, white fir, northern white-cedar, Washington hawthorn.	Eastern white pine	Pin oak.
Judson	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Hackberry, bur oak, green ash, Russian-olive, eastern redcedar.	Honeylocust, Austrian pine, eastern white pine.	---
12B, 12C, 12D----- Napier	---	Lilac, Amur honeysuckle, autumn-olive, Amur maple.	Bur oak, eastern redcedar, Russian-olive, hackberry, green ash.	Austrian pine, honeylocust, eastern white pine.	---
22C3, 22D3, 22E3-- Dow	Silver buffaloberry, American plum.	Russian-olive, hackberry, Tatarian honeysuckle, Rocky Mountain juniper, Siberian peashrub, eastern redcedar.	Honeylocust, green ash, Siberian elm, ponderosa pine.	---	---
24D2, 24E2, 24E3-- Shelby	---	Autumn-olive, lilac, Amur honeysuckle, Amur maple.	Eastern redcedar, Russian-olive, hackberry, bur oak, green ash.	Austrian pine, eastern white pine, honeylocust.	---
33D2---------- Steinauer	Fragrant sumac, Tatarian honeysuckle.	Siberian peashrub	Russian-olive, eastern redcedar, bur oak, black locust, osageorange, green ash, honeylocust, northern catalpa.	---	---
33E2. Steinauer					
36---------- Salix	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar, green ash, bur oak, Russian-olive, hackberry.	Austrian pine, eastern white pine, honeylocust.	---
43---------- Bremer	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Austrian pine, honeylocust, green ash, silver maple, golden willow, northern red oak.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
44---------- Blencoe	---	Lilac, Amur maple, Amur honeysuckle, autumn-olive.	Eastern redcedar	Austrian pine, green ash, pin oak, eastern white pine, honeylocust, hackberry.	Eastern cottonwood.
46---------- Keg	---	Lilac, autumn-olive, Amur honeysuckle, Amur maple.	Eastern redcedar	Pin oak, honeylocust, green ash, eastern cottonwood, eastern white pine, hackberry, Austrian pine.	---
54, 54+---------- Zook	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Honeylocust, golden willow, green ash, northern red oak, silver maple, Austrian pine.	Eastern cottonwood.
60D2---------- Malvern	Lilac----------	Amur honeysuckle, Siberian peashrub, Manchurian crabapple, autumn-olive.	Austrian pine, eastern redcedar, jack pine, Russian-olive, green ash, hackberry.	Honeylocust-------	---
66, 66+---------- Luton	Redosier dogwood	Common chokecherry, American plum.	Hackberry, eastern redcedar.	Silver maple, Austrian pine, golden willow, green ash, honeylocust, northern red oak.	Eastern cottonwood.
70---------- McPaul	Blackhaw----------	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, osageorange, eastern redcedar, Washington hawthorn.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
76C, 76D, 76F----- Ladoga	---	Lilac, Amur honeysuckle, autumn-olive, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
88---------- Nevin	---	Amur honeysuckle, lilac, autumn-olive, Amur maple.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, pin oak.	Eastern cottonwood.
93D2*, 93D3*: Shelby----------	---	Autumn-olive, lilac, Amur honeysuckle, Amur maple.	Eastern redcedar, Russian-olive, hackberry, bur oak, green ash.	Austrian pine, eastern white pine, honeylocust.	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
93D2*, 93D3*: Adair	Lilac	Amur honeysuckle, Manchurian crabapple, autumn-olive, Siberian crabapple.	Austrian pine, eastern redcedar, green ash, jack pine, Russian-olive, hackberry.	Honeylocust	---
99C2, 99D2, 99D3, 99E2, 99E3--- Exira	---	Lilac, Amur honeysuckle, Amur maple, autumn-olive.	Eastern redcedar, green ash, hackberry, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
133, 133+--- Colo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, blue spruce, white fir, northern white-cedar, Washington hawthorn.	Eastern white pine	Pin oak.
137--- Haynie	Blackhaw---	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, osageorange, eastern redcedar, Washington hawthorn.	Green ash, hackberry, honeylocust, bur oak.	Eastern cottonwood.
144--- Blake	Blackhaw---	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, osageorange, eastern redcedar, Washington hawthorn.	Bur oak, green ash, hackberry, honeylocust.	Eastern cottonwood.
146--- Onawa	Blackhaw---	Tatarian honeysuckle, Siberian peashrub.	Osageorange, eastern redcedar, Russian-olive, Washington hawthorn.	Hackberry, bur oak, green ash, honeylocust.	Eastern cottonwood.
149--- Modale	Blackhaw---	Tatarian honeysuckle, Siberian peashrub.	Osageorange, Russian-olive, eastern redcedar, Washington hawthorn.	Honeylocust, bur oak, green ash, hackberry.	Eastern cottonwood.
156, 156+--- Albaton	Blackhaw---	Siberian peashrub, Tatarian honeysuckle.	Osageorange, Russian-olive, eastern redcedar, Washington hawthorn.	Hackberry, bur oak, honeylocust.	Eastern cottonwood, green ash.
179F--- Gara	---	Autumn-olive, lilac, Amur honeysuckle, Amur maple.	Bur oak, eastern redcedar, green ash, Russian-olive, hackberry.	Honeylocust, eastern white pine, Austrian pine.	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
192C2, 192D2----- Adair	Lilac----------	Amur honeysuckle, Manchurian crabapple, autumn-olive, Siberian crabapple.	Austrian pine, eastern redcedar, green ash, jack pine, Russian-olive, hackberry.	Honeylocust-------	---
212, 212+--------- Kennebec	---	Amur maple, Amur honeysuckle, lilac, autumn-olive.	Eastern redcedar	Austrian pine, hackberry, pin oak, green ash, honeylocust.	Eastern white pine, eastern cottonwood.
220---------- Nodaway	---	Amur honeysuckle, autumn-olive, Amur maple, lilac.	Eastern redcedar	Austrian pine, hackberry, honeylocust, green ash, eastern white pine, pin oak.	Eastern cottonwood.
222D2---------- Clarinda	Lilac----------	Manchurian crabapple, Amur honeysuckle, Siberian peashrub, autumn-olive.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian-olive.	Honeylocust-------	---
234---------- Nishna	Lilac----------	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, eastern redcedar, blue spruce, ponderosa pine, hackberry.	Honeylocust, green ash, golden willow.	Eastern cottonwood.
237---------- Sarpy	Blackhaw----------	Tatarian honeysuckle, Siberian peashrub, Washington hawthorn.	Eastern redcedar, Russian-olive, osageorange.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
255---------- Cooper	---	Lilac, Amur honeysuckle, autumn-olive, Amur maple.	Eastern redcedar	Pin oak, Austrian pine, eastern white pine, green ash, hackberry, honeylocust.	Eastern cottonwood.
275---------- Moville	Blackhaw----------	Siberian peashrub, Tatarian honeysuckle.	Washington hawthorn, Russian-olive, osageorange, eastern redcedar.	Bur oak, green ash, hackberry, honeylocust.	Eastern cottonwood.
430---------- Ackmore	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
436---------- Lakeport	Peking cotoneaster	Siberian peashrub, lilac, American plum.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, honeylocust, hackberry, green ash.	Eastern cottonwood.
509, 509B, 509C2-- Marshall	---	Autumn-olive, lilac, Amur maple, Amur honeysuckle.	Eastern redcedar, Russian-olive, hackberry, bur oak, green ash.	Austrian pine, eastern white pine, honeylocust.	---
510, 510B, 510C2-- Monona	---	Autumn-olive, lilac, Amur maple, Amur honeysuckle.	Bur oak, hackberry, green ash, Russian-olive, eastern redcedar.	Honeylocust, eastern white pine, Austrian pine.	---
514---------- Grable	Blackhaw----------	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, osageorange, Washington hawthorn, eastern redcedar.	Honeylocust, bur oak, green ash, hackberry.	Eastern cottonwood.
515---------- Percival	Blackhaw----------	Tatarian honeysuckle, Siberian peashrub.	Russian-olive, osageorange, eastern redcedar, Washington hawthorn.	Honeylocust, green ash, bur oak, hackberry.	Eastern cottonwood.
670---------- Rawles	Blackhaw----------	Siberian peashrub	Washington hawthorn, osageorange, Russian-olive, eastern redcedar.	Bur oak, honeylocust, green ash, hackberry, bur oak.	Eastern cottonwood.
717C*: Napier----------	---	Lilac, Amur honeysuckle, autumn-olive, Amur maple.	Bur oak, eastern redcedar, Russian-olive, hackberry, green ash.	Austrian pine, honeylocust, eastern white pine.	---
Gullied land.					
1233---------- Corley	Redosier dogwood	Common chokecherry, American plum.	Hackberry, eastern redcedar.	Silver maple, honeylocust, golden willow, green ash, Austrian pine, northern red oak.	Eastern cottonwood.
1299---------- Minden	---	Lilac, autumn-olive, Amur honeysuckle, Amur maple.	Eastern redcedar	Green ash, eastern white pine, Austrian pine, pin oak, hackberry, honeylocust.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
4001C*, 4001D*, 4001E*:					
Ida	Tatarian honeysuckle, fragrant sumac.	Siberian peashrub	Honeylocust, northern catalpa, osageorange, Russian-olive, eastern redcedar, green ash, black locust, bur oak.	---	---
Urban land.					
4012B*:					
Napier	---	Lilac, Amur honeysuckle, autumn-olive, Amur maple.	Bur oak, eastern redcedar, Russian-olive, hackberry, green ash.	Austrian pine, honeylocust, eastern white pine.	---
Urban land.					
4046*:					
Keg	---	Lilac, autumn-olive, Amur honeysuckle, Amur maple.	Eastern redcedar	Pin oak, honeylocust, green ash, eastern cottonwood, eastern white pine, hackberry, Austrian pine.	---
Urban land.					
4156*:					
Albaton	Blackhaw	Siberian peashrub, Tatarian honeysuckle.	Osageorange, Russian-olive, eastern redcedar, Washington hawthorn.	Hackberry, bur oak, honeylocust.	Eastern cottonwood, green ash.
Urban land.					
4170C*:					
Castana	Tatarian honeysuckle, fragrant sumac.	Siberian peashrub	Eastern redcedar, honeylocust, Russian-olive, green ash, northern catalpa, bur oak, osageorange, black locust.	Siberian elm	---
Urban land.					
4237*:					
Sarpy	Blackhaw	Tatarian honeysuckle, Siberian peashrub, Washington hawthorn.	Eastern redcedar, Russian-olive, osageorange.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
4237*: Urban land.					
4255*: Cooper	---	Lilac, Amur honeysuckle, autumn-olive, Amur maple.	Eastern redcedar	Pin oak, Austrian pine, eastern white pine, green ash, hackberry, honeylocust.	Eastern cottonwood.
Urban land.					
5030*. Pits					
5040. Orthents					
5053. Psammaquents					
5080*: Orthents.					
Dumps.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1C, 1C3---------- Ida	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
1D, 1D3---------- Ida	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
1E, 1E3---------- Ida	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
1F, 1F3, 1G---------- Ida	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
2G---------- Hamburg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
3E---------- Castana	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
8B---------- Judson	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
8C---------- Judson	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
9---------- Marshall	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
9B---------- Marshall	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
9C, 9C2---------- Marshall	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
9D, 9D2---------- Marshall	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
10---------- Monona	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
10B---------- Monona	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
10C, 10C2, 10C3------- Monona	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
10D, 10D2, 10D3------- Monona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
10E, 10E2, 10E3------- Monona	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
10F, 10G---------- Monona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
11B*: Ackmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Judson	Slight	Slight	Moderate: slope.	Slight	Slight.
12B Napier	Slight	Slight	Moderate: slope.	Slight	Slight.
12C Napier	Slight	Slight	Severe: slope.	Slight	Slight.
12D Napier	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
22C3 Dow	Slight	Slight	Severe: slope.	Slight	Slight.
22D3 Dow	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
22E3 Dow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
24D2 Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
24E2, 24E3 Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
33D2 Steinauer	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
33E2 Steinauer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
36 Salix	Severe: flooding.	Slight	Slight	Slight	Slight.
43 Bremer	Severe: wetness, flooding.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
44 Blencoe	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
46 Keg	Severe: flooding.	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
54, 54+ Zook	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
60D2 Malvern	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
66 Luton	Severe: flooding, wetness, percs slowly.	Severe: too clayey, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
66+ Luton	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, flooding.
70 McPaul	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
76C Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
76D Ladoga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
76F Ladoga	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
88 Nevin	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
93D2*, 93D3*: Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Adair	Severe: wetness.	Moderate: wetness, slope, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
99C2 Exira	Slight	Slight	Severe: slope.	Slight	Slight.
99D2, 99D3 Exira	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
99E2, 99E3 Exira	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
133, 133+ Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
137 Haynie	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
144--- Blake	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight---	Moderate: flooding.
146--- Onawa	Severe: flooding, too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too sandy.	Severe: too clayey.
149--- Modale	Severe: flooding, percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness, flooding.
156--- Albaton	Severe: flooding, wetness, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: too clayey.	Severe: too clayey.
156+--- Albaton	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, flooding.
179F--- Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
192C2--- Adair	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
192D2--- Adair	Severe: wetness.	Moderate: wetness, slope, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
212, 212+--- Kennebec	Severe: flooding.	Slight---	Moderate: flooding.	Slight---	Moderate: flooding.
220--- Nodaway	Severe: flooding.	Slight---	Moderate: flooding.	Slight---	Moderate: flooding.
222D2--- Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
234--- Nishna	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
237--- Sarpy	Severe: flooding.	Slight---	Slight---	Slight---	Moderate: droughty.
255--- Cooper	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight---	Slight.
275--- Moville	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, flooding.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
430--- Ackmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
436--- Lakeport	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight---	Slight.
509--- Marshall	Slight---	Slight---	Slight---	Slight---	Slight.
509B--- Marshall	Slight---	Slight---	Moderate: slope.	Slight---	Slight.
509C2--- Marshall	Slight---	Slight---	Severe: slope.	Slight---	Slight.
510--- Monona	Slight---	Slight---	Slight---	Slight---	Slight.
510B--- Monona	Slight---	Slight---	Moderate: slope.	Slight---	Slight.
510C2--- Monona	Slight---	Slight---	Severe: slope.	Slight---	Slight.
514--- Grable	Severe: flooding.	Slight---	Moderate: flooding.	Slight---	Moderate: flooding.
515--- Percival	Severe: flooding, too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
670--- Rawles	Severe: flooding.	Slight---	Moderate: flooding.	Slight---	Moderate: flooding.
717C*: Napier---	Slight---	Slight---	Severe: slope.	Slight---	Slight.
Gullied land.					
1233--- Corley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1299--- Minden	Slight---	Slight---	Slight---	Slight---	Slight.
4001C*: Ida---	Slight---	Slight---	Severe: slope.	Slight---	Slight.
Urban land.					
4001D*: Ida---	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Urban land.					

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
4001E*: Ida	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Urban land.					
4012B*: Napier	Slight	Slight	Moderate: slope.	Slight	Slight.
Urban land.					
4046*: Keg	Severe: flooding.	Slight	Slight	Slight	Slight.
Urban land.					
4156*: Albaton	Severe: flooding, wetness, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: too clayey.	Severe: too clayey.
Urban land.					
4170C*: Castana	Slight	Slight	Severe: slope.	Slight	Slight.
Urban land.					
4237*: Sarpy	Severe: flooding.	Slight	Moderate: slope.	Slight	Moderate: droughty.
Urban land.					
4255*: Cooper	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
Urban land.					
5030*. Pits					
5040. Orthents					
5053. Psammaquents					
5080*: Orthents.					
Dumps.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1C, 1C3, 1D, 1D3---Ida	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1E, 1E3----------Ida	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
1F, 1F3----------Ida	Poor	Fair	Good	Poor	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
1G----------Ida	Very poor.	Very poor.	Good	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
2G----------Hamburg	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
3E----------Castana	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
8B----------Judson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
8C----------Judson	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
9, 9B----------Marshall	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
9C, 9C2, 9D, 9D2---Marshall	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
10, 10B----------Monona	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
10C, 10C2, 10C3, 10D, 10D2, 10D3---Monona	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
10E, 10E2, 10E3----Monona	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
10F----------Monona	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
10G----------Monona	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
11B*:										
Ackmore-----------	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Colo--------------	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
Judson------------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
12B----------Napier	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
12C, 12D---------- Napier	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
22C3, 22D3, 22E3--- Dow	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
24D2---------- Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
24E2, 24E3--------- Shelby	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
33D2, 33E2--------- Steinauer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
36---------- Salix	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
43---------- Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
44---------- Blencoe	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
46---------- Keg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
54, 54+---------- Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
60D2---------- Malvern	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
66, 66+---------- Luton	Fair	Fair	Fair	Poor	Very poor.	Good	Good	Fair	Poor	Good.
70---------- McPaul	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
76C, 76D---------- Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
76F---------- Ladoga	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
88---------- Nevin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
93D2*, 93D3*: Shelby----------	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Adair----------	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
99C2, 99D2, 99D3, 99E2, 99E3-------- Exira	Good	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
133, 133+---------- Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
137---------- Haynie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
144---------- Blake	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
146---------- Onawa	Fair	Fair	Fair	Poor	Very poor.	Good	Good	Fair	Poor	Good.
149---------- Modale	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
156, 156+---------- Albaton	Fair	Fair	Fair	Poor	Very poor.	Good	Good	Fair	Poor	Good.
179F---------- Gara	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
192C2, 192D2------- Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
212, 212+---------- Kennebec	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
220---------- Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
222D2---------- Clarinda	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
234---------- Nishna	Fair	Fair	Fair	Poor	Very poor.	Good	Good	Fair	Poor	Good.
237---------- Sarpy	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
255---------- Cooper	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
275---------- Moville	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
430---------- Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
436---------- Lakeport	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
509, 509B---------- Marshall	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
509C2---------- Marshall	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
510, 510B---------- Monona	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
510C2---------- Monona	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
514---------- Grable	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.
515---------- Percival	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair	Fair.
670---------- Rawles	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
717C*: Napier----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Gullied land.										
1233---------- Corley	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
1299---------- Minden	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
4001C*, 4001D*: Ida----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.										
4001E*: Ida----------	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Urban land.										
4012B*: Napier----------	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.										
4046*: Keg----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Urban land.										
4156*: Albaton----------	Fair	Fair	Fair	Poor	Very poor.	Good	Good	Fair	Poor	Good.
Urban land.										
4170C*: Castana----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.										
4237*: Sarpy----------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
4237*: Urban land.										
4255*: Cooper	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Urban land.										
5030*. Pits										
5040. Orthents										
5053. Psammaquents										
5080*: Orthents.										
Dumps.										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1C, 1C3---------- Ida	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: frost action.	Slight.
1D, 1D3---------- Ida	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
1E, 1E3, 1F, 1F3, 1G---------- Ida	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
2G---------- Hamburg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
3E---------- Castana	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action, low strength.	Severe: slope.
8B---------- Judson	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
8C---------- Judson	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
9, 9B---------- Marshall	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
9C, 9C2---------- Marshall	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
9D, 9D2---------- Marshall	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
10, 10B---------- Monona	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
10C, 10C2, 10C3--- Monona	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength, frost action.	Slight.
10D, 10D2, 10D3--- Monona	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
10E, 10E2, 10E3, 10F, 10G--------- Monona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
11B*:						
Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
12B Napier	Slight	Slight	Slight	Slight	Severe: low strength, frost action.	Slight.
12C Napier	Slight	Slight	Slight	Moderate: slope.	Severe: low strength, frost action.	Slight.
12D Napier	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
22C3 Dow	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.	Slight.
22D3 Dow	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
22E3 Dow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope.	Severe: slope.
24D2 Shelby	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
24E2, 24E3 Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
33D2 Steinauer	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
33E2 Steinauer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
36 Salix	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
43 Bremer	Severe: wetness.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: shrink-swell, low strength.	Moderate: wetness.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
44---------- Blencoe	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Severe: too clayey.
46---------- Keg	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
54, 54+---------- Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
60D2---------- Malvern	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness, slope.
66---------- Luton	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: too clayey.
66+---------- Luton	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Moderate: wetness, flooding.
70---------- McPaul	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
76C---------- Ladoga	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
76D---------- Ladoga	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
76F---------- Ladoga	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
88---------- Nevin	Severe: wetness.	Severe: flooding.	Severe: wetness, flooding.	Severe: flooding.	Severe: frost action, low strength.	Slight.
93D2*, 93D3*: Shelby----------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Adair----------	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
99C2---------- Exira	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
99D2, 99D3-------- Exira	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
99E2, 99E3-------- Exira	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, frost action, slope.	Severe: slope.
133, 133+--------- Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
137---------- Haynie	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
144---------- Blake	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
146---------- Onawa	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Severe: too clayey.
149---------- Modale	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
156---------- Albaton	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: too clayey.
156+---------- Albaton	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Moderate: wetness, flooding.
179F---------- Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
192C2---------- Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: low strength, frost action.	Moderate: wetness.
192D2---------- Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
212, 212+--------- Kennebec	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
220--------------- Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
222D2------------- Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: wetness, slope.
234--------------- Nishna	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: wetness, flooding.
237--------------- Sarpy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty
255--------------- Cooper	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness, shrink-swell.	Severe: flooding.	Severe: low strength, frost action.	Slight.
275--------------- Moville	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
430--------------- Ackmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
436--------------- Lakeport	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Slight.
509, 509B--------- Marshall	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
509C2------------- Marshall	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strengtn, frost action.	Slight.
510, 510B--------- Monona	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
510C2------------- Monona	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength, frost action.	Slight.
514--------------- Grable	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
515---------- Percival	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: too clayey.
670---------- Rawles	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
717C*: Napier----------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength, frost action.	Slight.
Gullied land.						
1233---------- Corley	Severe: ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
1299---------- Minden	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
4001C*: Ida----------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: frost action.	Slight.
Urban land.						
4001D*: Ida----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
Urban land.						
4001E*: Ida----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Urban land.						
4012B*: Napier----------	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength, frost action.	Slight.
Urban land.						
4046*: Keg----------	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
Urban land.						

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
4156*:						
Albaton	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Urban land.						
4170C*:						
Castana	Slight	Slight	Slight	Moderate: slope.	Severe: frost action, low strength.	Slight.
Urban land.						
4237*:						
Sarpy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
Urban land.						
4255*:						
Cooper	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness, shrink-swell.	Severe: flooding.	Severe: low strength, frost action.	Slight.
Urban land.						
5030*.						
Pits						
5040.						
Orthents						
5053.						
Psammaquents						
5080*:						
Orthents.						
Dumps.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1C, 1C3---------- Ida	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
1D, 1D3---------- Ida	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
1E, 1E3, 1F, 1F3, 1G---------- Ida	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
2G---------- Hamburg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
3E---------- Castana	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
8B---------- Judson	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
8C---------- Judson	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
9---------- Marshall	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Good.
9B---------- Marshall	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
9C, 9C2---------- Marshall	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
9D, 9D2---------- Marshall	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
10---------- Monona	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Good.
10B---------- Monona	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
10C, 10C2, 10C3----- Monona	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
10D, 10D2, 10D3----- Monona	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
10E, 10E2, 10E3, 10F, 10G---------- Monona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11B*: Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness, hard to pack.
Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Judson	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
12B Napier	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
12C Napier	Slight	Severe: slope.	Slight	Slight	Good.
12D Napier	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
22C3 Dow	Slight	Severe: slope.	Slight	Slight	Good.
22D3 Dow	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
22E3 Dow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
24D2 Shelby	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
24E2, 24E3 Shelby	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
33D2 Steinauer	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
33E2 Steinauer	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
36 Salix	Moderate: flooding, wetness.	Moderate: seepage, wetness.	Severe: wetness.	Moderate: flooding, wetness.	Good.
43 Bremer	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
44 Blencoe	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
46---------- Keg	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
54, 54+---------- Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
60D2---------- Malvern	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
66, 66+---------- Luton	Severe: flooding, wetness, percs slowly.	Slight----------	Severe: flooding, wetness, too clayey.	Severe: wetness, flooding.	Poor: wetness, too clayey, hard to pack.
70---------- McPaul	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
76C---------- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
76D---------- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
76F---------- Ladoga	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
88---------- Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
93D2*, 93D3*: Shelby----------	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
Adair----------	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
99C2---------- Exira	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
99D2, 99D3---------- Exira	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
99E2, 99E3---------- Exira	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
133, 133+---------- Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
137---------- Haynie	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
144---------- Blake	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
146---------- Onawa	Severe: wetness.	Severe: wetness, seepage.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness.
149---------- Modale	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack.
156, 156+---------- Albaton	Severe: flooding, wetness, percs slowly.	Severe: wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
179F---------- Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
192C2, 192D2-------- Adair	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
212, 212+---------- Kennebec	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
220---------- Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
222D2---------- Clarinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
234---------- Nishna	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
237---------- Sarpy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
255---------- Cooper	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
275---------- Moville	Severe: flooding, wetness, percs slowly.	Slight----------	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, wetness, hard to pack.
430---------- Ackmore	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
436 Lakeport	Severe: wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
509 Marshall	Slight	Moderate: seepage.	Slight	Slight	Good.
509B Marshall	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
509C2 Marshall	Slight	Severe: slope.	Slight	Slight	Good.
510 Monona	Slight	Moderate: seepage.	Slight	Slight	Good.
510B Monona	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
510C2 Monona	Slight	Severe: slope.	Slight	Slight	Good.
514 Grable	Severe: flooding, poor filter.	Severe: seepage.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
515 Percival	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
670 Rawles	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
717C*: Napier	Slight	Severe: slope.	Slight	Slight	Good.
Gullied land.					
1233 Corley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack, ponding.
1299 Minden	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
4001C*: Ida	Slight	Severe: slope.	Slight	Slight	Good.
Urban land.					
4001D*: Ida	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
4001D*: Urban land.					
4001E*: Ida	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Urban land.					
4012B*: Napier	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Urban land.					
4046*: Keg	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Urban land.					
4156*: Albaton	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Urban land.					
4170C*: Castana	Slight	Severe: slope.	Slight	Slight	Good.
Urban land.					
4237*: Sarpy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Urban land.					
4255*: Cooper	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
Urban land.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1C, 1C3---------- Ida	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
1D, 1D3---------- Ida	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
1E, 1E3---------- Ida	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
1F, 1F3, 1G---------- Ida	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
2G---------- Hamburg	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
3E---------- Castana	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
8B, 8C---------- Judson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
9, 9B, 9C, 9C2-------- Marshall	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
9D, 9D2---------- Marshall	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
10, 10B, 10C, 10C2, 10C3---------- Monona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
10D, 10D2, 10D3------- Monona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
10E, 10E2, 10E3------- Monona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
10F, 10G---------- Monona	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
11B*: Ackmore----------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
Colo----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Judson----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
12B, 12C---------- Napier	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
12D---------- Napier	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
22C3---------- Dow	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
22D3---------- Dow	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
22E3---------- Dow	Fair: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
24D2---------- Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
24E2, 24E3---------- Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
33D2---------- Steinauer	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
33E2---------- Steinauer	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
36---------- Salix	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
43---------- Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
44---------- Blencoe	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
46---------- Keg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
54, 54+---------- Zook	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
60D2---------- Malvern	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
66---------- Luton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
66+---------- Luton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
70---------- McPaul	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
76C, 76D---------- Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
76F---------- Ladoga	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
88---------- Nevin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
93D2*, 93D3*: Shelby----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Adair----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
99C2---------- Exira	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
99D2, 99D3---------- Exira	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
99E2, 99E3---------- Exira	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
133, 133+---------- Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
137---------- Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
144---------- Blake	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
146---------- Onawa	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
149---------- Modale	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
156---------- Albaton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
156+---------- Albaton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
179F---------- Gara	Poor: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
192C2, 192D2---------- Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
212, 212+---------- Kennebec	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
220---------- Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
222D2---------- Clarinda	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
234---------- Nishna	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
237---------- Sarpy	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
255---------- Cooper	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
275---------- Moville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
430---------- Ackmore	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
436---------- Lakeport	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
509, 509B, 509C2------ Marshall	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
510, 510B, 510C2------ Monona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
514---------- Grable	Good----------	Probable----------	Improbable: too sandy.	Fair: thin layer.
515---------- Percival	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: too clayey.
670---------- Rawles	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
717C*: Napier----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Gullied land.				
1233---------- Corley	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1299---------- Minden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
4001C*: Ida----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
4001D*:				
Ida	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Urban land.				
4001E*:				
Ida	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Urban land.				
4012B*:				
Napier	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
4046*:				
Keg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
4156*:				
Albaton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				
4170C*:				
Castana	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
4237*:				
Sarpy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Urban land.				
4255*:				
Cooper	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Urban land.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
1C, 1C3---------- Ida	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
1D, 1D3, 1E, 1E3, 1F, 1F3, 1G------ Ida	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
2G---------- Hamburg	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
3E---------- Castana	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
8B, 8C---------- Judson	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
9---------- Marshall	Moderate: seepage.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
9B, 9C, 9C2------- Marshall	Moderate: seepage, slope.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
9D, 9D2---------- Marshall	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Erodes easily, slope.	Slope, erodes easily.
10---------- Monona	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
10B, 10C, 10C2, 10C3---------- Monona	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
10D, 10D2, 10D3, 10E, 10E2, 10E3, 10F, 10G--------- Monona	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
11B*: Ackmore----------	Moderate: seepage.	Severe: hard to pack, wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, erodes easily.	Wetness, erodes easily.
Colo----------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
Judson----------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
12B, 12C---------- Napier	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
12D---------- Napier	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
22C3---------- Dow	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
22D3, 22E3-------- Dow	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
24D2, 24E2, 24E3-- Shelby	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope----------	Slope.
33D2, 33E2-------- Steinauer	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope----------	Slope.
36---------- Salix	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Not needed-----	Not needed.
43---------- Bremer	Slight---------	Severe: wetness, hard to pack.	Severe: slow refill.	Frost action---	Wetness--------	Wetness.
44---------- Blencoe	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
46---------- Keg	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
54, 54+---------- Zook	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
60D2---------- Malvern	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
66, 66+---------- Luton	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Not needed-----	Not needed.
70---------- McPaul	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
76C---------- Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
76D, 76F---------- Ladoga	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
88---------- Nevin	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action---	Erodes easily, wetness.	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
93D2*, 93D3*: Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope, frost action.	Slope, wetness.	Wetness, slope.
99C2 Exira	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
99D2, 99D3, 99E2, 99E3 Exira	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
133, 133+ Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
137 Haynie	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
144 Blake	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Flooding, frost action.	Erodes easily, wetness.	Erodes easily.
146 Onawa	Severe: seepage.	Severe: piping.	Severe: slow refill.	Frost action, percs slowly.	Not needed	Not needed.
149 Modale	Moderate: seepage.	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
156, 156+ Albaton	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Not needed	Not needed.
179F Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
192C2 Adair	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope, frost action.	Wetness	Wetness.
192D2 Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope, frost action.	Slope, wetness.	Wetness, slope.
212, 212+ Kennebec	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable	Favorable.
220 Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
222D2 Clarinda	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
234---------- Nishna	Slight---------	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
237---------- Sarpy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
255---------- Cooper	Moderate: seepage.	Severe: hard to pack.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly.
275---------- Moville	Slight---------	Severe: wetness, hard to pack.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
430---------- Ackmore	Moderate: seepage.	Severe: hard to pack, wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, erodes easily.	Wetness, erodes easily.
436---------- Lakeport	Moderate: seepage.	Moderate: hard to pack, wetness.	Moderate: deep to water, slow refill.	Frost action---	Wetness--------	Favorable.
509---------- Marshall	Moderate: seepage.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
509B, 509C2------- Marshall	Moderate: seepage, slope.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
510---------- Monona	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
510B, 510C2------- Monona	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
514---------- Grable	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Erodes easily, too sandy.	Erodes easily.
515---------- Percival	Severe: seepage.	Severe: seepage, piping.	Severe: slow refill, cutbanks cave.	Percs slowly, flooding, cutbanks cave.	Wetness, too sandy.	Droughty, percs slowly.
670---------- Rawles	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
717C*: Napier----------	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Gullied land.						
1233---------- Corley	Moderate: seepage.	Severe: ponding.	Moderate: slow refill.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
1299---------- Minden	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
4001C*:						
Ida	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Urban land.						
4001D*, 4001E*:						
Ida	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Urban land.						
4012B*:						
Napier	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Urban land.						
4046*:						
Keg	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Urban land.						
4156*:						
Albaton	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly	Not needed	Not needed.
Urban land.						
4170C*:						
Castana	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Urban land.						
4237*:						
Sarpy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
Urban land.						
4255*:						
Cooper	Moderate: seepage.	Severe: hard to pack.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly.
Urban land.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1C, 1C3, 1D, 1D3, 1E, 1E3, 1F, 1F3, 1G--- Ida	0-60	Silt loam---	ML, CL	A-4, A-6	0	100	100	95-100	95-100	30-40	5-15
2G--- Hamburg	0-4	Silt loam---	CL-ML, ML	A-4	0	100	100	100	95-100	<25	NP-5
	4-60	Silt loam, very fine sandy loam, silt.	CL-ML, ML	A-4	0	100	100	100	95-100	<25	NP-5
3E--- Castana	0-14	Silt loam---	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
	14-60	Silt loam---	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
8B, 8C--- Judson	0-7	Silt loam---	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
	7-55	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	30-50	15-25
	55-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
9, 9B, 9C--- Marshall	0-24	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
	24-56	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	56-60	Silt loam, silty clay loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
9C2--- Marshall	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
	7-38	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	38-60	Silt loam, silty clay loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
9D--- Marshall	0-24	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
	24-56	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	56-60	Silt loam, silty clay loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
9D2--- Marshall	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
	7-38	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	38-60	Silt loam, silty clay loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
10, 10B, 10C--- Monona	0-14	Silt loam---	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	14-31	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	31-60	Silt loam---	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
10C2, 10C3--- Monona	0-7	Silt loam---	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	7-24	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	24-60	Silt loam---	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
10D--- Monona	0-14	Silt loam---	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	14-31	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	31-60	Silt loam---	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
10D2, 10D3--- Monona	0-7	Silt loam---	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	7-24	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	24-60	Silt loam---	CL	A-6	0	100	100	95-100	95-100	30-40	10-20

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
10E----------	0-14	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
Monona	14-31	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	31-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
10E2, 10E3-------	0-7	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
Monona	7-24	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	24-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
10F, 10G---------	0-14	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
Monona	14-31	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	31-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
11B*:											
Ackmore---------	0-28	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	28-60	Silty clay loam, silt loam.	CH, CL, MH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
Colo----------	0-34	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	34-48	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Judson----------	0-7	Silt loam--------	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
	7-30	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	30-50	15-25
	30-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
12B, 12C, 12D----	0-30	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
Napier	30-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
22C3, 22D3, 22E3-	0-8	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-15
Dow	8-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-15
24D2, 24E2, 24E3-	0-7	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
Shelby	7-50	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	50-60	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
33D2, 33E2-------	0-6	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-90	30-50	15-25
Steinauer	6-11	Clay loam--------	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	70-90	30-55	12-30
	11-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	90-100	60-75	20-45	10-26
36----------	0-16	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	40-60	20-35
Salix	16-22	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-50	20-30
	22-60	Silt loam, loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	95-100	90-100	30-40	5-15
43----------	0-20	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-40
Bremer	20-60	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-65	20-35
44----------	0-22	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	30-50
Blencoe	22-26	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	90-100	41-60	20-30
	26-60	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	85-100	30-40	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
46----------	0-35	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
Keg	35-60	Silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
54----------	0-19	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
Zook	19-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
54+----------	0-15	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
Zook	15-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
60D2----------	0-7	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
Malvern	7-36	Silty clay-------	CH	A-7	0	100	100	100	95-100	55-80	30-45
	36-60	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
66----------	0-24	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
Luton	24-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
66+----------	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Luton	9-24	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
	24-60	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
70----------	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
McPaul											
76C, 76D, 76F----	0-12	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
Ladoga	12-42	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	42-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
88----------	0-26	Silty clay loam	CL, OL	A-6, A-7	0	100	100	100	90-95	35-45	10-20
Nevin	26-51	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	51-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
93D2*, 93D3*:											
Shelby----------	0-7	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
	7-50	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	50-60	Clay loam--------	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
Adair----------	0-9	Silty clay loam	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
	9-42	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
99C2, 99D2, 99D3,											
99E2, 99E3------	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
Exira	7-34	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	34-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
133----------	0-34	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
Colo	34-48	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
133+----------	0-15	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
Colo	15-38	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	38-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
137----------	0-7	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	85-100	70-100	25-40	5-15
Haynie	7-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	85-100	25-35	5-15
144----------	0-7	Silty clay loam	CL	A-7, A-6	0	100	100	90-100	85-95	35-50	15-30
Blake	7-26	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-95	30-50	10-30
	26-60	Silt loam, loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	80-90	75-90	30-40	5-15
146----------	0-8	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
Onawa	8-26	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
	26-60	Silt loam, very fine sandy loam, loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
149----------	0-24	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	70-90	25-40	8-18
Modale	24-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	65-85	40-60
156----------	0-9	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
Albaton	9-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
156+----------	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Albaton	12-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
179F----------	0-14	Loam----------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
Gara	14-46	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	46-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
192C2, 192D2-----	0-9	Silty clay loam	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
Adair	9-42	Silty clay loam, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	42-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
212----------	0-56	Silt loam--------	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
Kennebec	56-60	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	90-100	25-40	5-15
212+----------	0-18	Silt loam--------	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
Kennebec	18-60	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	90-100	25-40	5-15
220----------	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Nodaway											
222D2----------	0-7	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
Clarinda	7-50	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	50-60	Clay, silty clay, silty clay loam.	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
234----------	0-19	Silty clay loam	CH, MH	A-7	0	100	100	95-100	90-100	55-65	25-35
Nishna	19-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	60-70	30-40

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
237----------	0-6	Loamy fine sand	SM	A-2-4	0	100	100	60-80	15-35	---	NP
Sarpy	6-60	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	100	100	60-80	2-35	---	NP
255----------	0-16	Silty clay loam	CL	A-7	0	100	100	95-100	85-100	40-50	20-30
Cooper	16-24	Silty clay loam	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
	24-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	35-50
275----------	0-26	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	30-40	8-18
Moville	26-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	65-85	40-60
430----------	0-28	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
Ackmore	28-60	Silty clay loam, silt loam.	CH, CL, MH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
436----------	0-20	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	40-60	20-35
Lakeport	20-48	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-100	40-60	20-35
	48-60	Silt loam, loam, clay loam.	CL	A-6	0	100	100	90-100	85-95	25-40	10-20
509, 509B--------	0-16	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
Marshall	16-56	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	56-60	Silt loam, silty clay loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
509C2----------	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
Marshall	7-38	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	38-60	Silt loam, silty clay loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
510, 510B--------	0-14	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
Monona	14-31	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	31-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
510C2----------	0-7	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
Monona	7-24	Silt loam, silty clay loam.	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	24-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
514----------	0-8	Silt loam--------	CL	A-4, A-6	0	100	100	80-95	50-75	25-40	8-20
Grable	8-22	Silt loam, very fine sandy loam.	CL	A-4, A-6	0	100	100	80-95	50-75	25-40	8-20
	22-60	Fine sand, loamy sand, sand.	SM, SM-SC, SP-SM	A-2, A-3	0	100	100	65-80	5-35	<20	NP-5
515----------	0-7	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
Percival	7-19	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	35-60
	19-60	Stratified fine sand to loamy fine sand.	SM, SM-SC, SP-SM	A-2	0	100	100	80-95	12-30	<20	NP-5
670----------	0-23	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	90-100	25-40	5-15
Rawles	23-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	90-100	30-45	10-20
717C*:											
Napier----------	0-30	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
	30-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
717C*:											
Gullied land.											
1233----------	0-33	Silt loam--------	CL	A-6, A-7	0	100	100	100	95-100	30-45	15-25
Corley	33-60	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	35-55	20-30
1299----------	0-23	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
Minden	23-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
4001C*, 4001D*, 4001E*:											
Ida----------	0-60	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	95-100	30-40	5-15
Urban land.											
4012B*:											
Napier----------	0-30	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
	30-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
Urban land.											
4046*:											
Keg----------	0-35	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
	35-60	Silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
Urban land.											
4156*:											
Albaton---------	0-9	Silty clay-------	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
	9-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	40-60
Urban land.											
4170C*:											
Castana---------	0-14	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
	14-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	8-20
Urban land.											
4237*:											
Sarpy----------	0-8	Loamy fine sand	SM	A-2-4	0	100	100	60-80	15-35	---	NP
	8-60	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	100	100	60-80	2-35	---	NP
Urban land.											
4255*:											
Cooper----------	0-16	Silty clay loam	CL	A-7	0	100	100	95-100	85-100	40-50	20-30
	16-33	Silty clay loam	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
	33-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	35-50
Urban land.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
1C, 1C3, 1D, 1D3, 1E, 1E3, 1F, 1F3, 1G---------	0-60	18-25	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low-------	0.43	5-4	4L	.5-1
Ida											
2G----------	0-4	6-12	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.43	5	4L	.5-2
Hamburg	4-60	6-12	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
3E----------	0-14	18-22	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low-------	0.32	5	4L	2-3
Castana	14-60	18-24	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
8B, 8C----------	0-7	25-32	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.28	5	7	4-5
Judson	7-55	30-35	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.43			
	55-60	25-32	0.6-2.0	0.21-0.23	6.1-7.8	<2	Moderate	0.43			
9, 9B, 9C--------	0-24	27-35	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.32	5	7	3-4
Marshall	24-56	27-34	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.43			
	56-60	22-30	0.6-2.0	0.20-0.22	6.6-7.3	<2	Moderate	0.43			
9C2---------	0-7	27-35	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.32	5	7	2-3
Marshall	7-38	27-34	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.43			
	38-60	22-30	0.6-2.0	0.20-0.22	6.6-7.3	<2	Moderate	0.43			
9D----------	0-24	27-35	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.32	5	7	3-4
Marshall	24-56	27-34	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.43			
	56-60	22-30	0.6-2.0	0.20-0.22	6.6-7.3	<2	Moderate	0.43			
9D2---------	0-7	27-35	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.32	5	7	2-3
Marshall	7-38	27-34	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.43			
	38-60	22-30	0.6-2.0	0.20-0.22	6.6-7.3	<2	Moderate	0.43			
10, 10B, 10C-----	0-14	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	3-4
Monona	14-31	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	31-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
10C2, 10C3-------	0-7	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5-4	6	1-3
Monona	7-24	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	24-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
10D----------	0-14	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	3-4
Monona	14-31	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	31-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
10D2, 10D3-------	0-7	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5-4	6	1-3
Monona	7-24	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	24-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
10E----------	0-14	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	3-4
Monona	14-31	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	31-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
10E2, 10E3-------	0-7	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5-4	6	1-3
Monona	7-24	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	24-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
10F, 10G---------	0-14	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	3-4
Monona	14-31	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	31-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
11B*:											
Ackmore	0-28	25-30	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.37	5	6	2-4
	28-60	26-35	0.6-2.0	0.18-0.20	5.6-7.8	<2	High	0.37			
Colo	0-34	27-32	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.28	5	7	5-7
	34-48	30-35	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.28			
	48-60	25-35	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.28			
Judson	0-7	25-32	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.28	5	7	4-5
	7-30	30-35	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.43			
	30-60	25-32	0.6-2.0	0.21-0.23	6.1-7.8	<2	Moderate	0.43			
12B, 12C, 12D-	0-30	20-27	0.6-2.0	0.22-0.24	6.1-7.3	<2	Low	0.32	5	6	3-4
Napier	30-60	20-27	0.6-2.0	0.20-0.22	6.1-8.4	<2	Low	0.43			
22C3, 22D3, 22E3-	0-8	18-25	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low	0.43	4	4L	.5-1
Dow	8-60	18-25	0.6-2.0	0.20-0.22	7.9-8.4	<2	Low	0.43			
24D2, 24E2, 24E3-	0-7	27-35	0.2-0.6	0.16-0.18	5.1-7.3	<2	Moderate	0.28	4	6	.5-2
Shelby	7-50	30-35	0.2-0.6	0.16-0.18	5.1-7.3	<2	Moderate	0.28			
	50-60	30-35	0.2-0.6	0.16-0.18	6.6-8.4	<2	Moderate	0.37			
33D2, 33E2	0-6	27-32	0.2-0.6	0.17-0.19	7.4-8.4	<2	Moderate	0.32	5	4L	.5-1
Steinauer	6-11	27-32	0.2-0.6	0.15-0.17	7.9-8.4	<2	Moderate	0.32			
	11-60	16-30	0.2-2.0	0.14-0.19	7.9-8.4	<2	Moderate	0.32			
36	0-16	26-30	0.6-2.0	0.21-0.23	6.1-7.8	<2	Moderate	0.28	5	7	3-4
Salix	16-22	28-38	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.43			
	22-60	16-22	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low	0.43			
43	0-20	25-32	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.28	5	7	5-7
Bremer	20-60	35-42	0.2-0.6	0.15-0.17	5.6-6.5	<2	High	0.28			
44	0-22	38-55	0.06-0.2	0.12-0.14	6.1-7.8	<2	High	0.28	5	4	3-5
Blencoe	22-26	35-50	0.06-0.2	0.18-0.20	6.6-7.8	<2	High	0.43			
	26-60	18-24	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.43			
46	0-35	20-26	0.6-2.0	0.21-0.23	6.1-7.8	<2	Low	0.28	5	6	2-4
Keg	35-60	18-22	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.43			
54	0-19	32-38	0.2-0.6	0.21-0.23	5.6-7.3	<2	High	0.28	5	7	5-7
Zook	19-60	36-45	0.06-0.2	0.11-0.13	5.6-7.8	<2	High	0.28			
54+	0-15	20-26	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.28	5	6	5-7
Zook	15-60	36-45	0.06-0.2	0.11-0.13	5.6-7.8	<2	High	0.28			
60D2	0-7	28-34	0.2-0.6	0.21-0.23	5.6-7.3	<2	Moderate	0.37	3	7	1-2
Malvern	7-36	40-50	0.06-0.2	0.12-0.14	6.1-7.3	<2	High	0.37			
	36-60	28-38	0.2-0.6	0.18-0.20	6.1-7.3	<2	Moderate	0.37			
66	0-24	40-60	<0.06	0.12-0.14	6.6-7.8	<2	High	0.28	5	4	3-5
Luton	24-60	40-60	<0.06	0.11-0.13	6.6-8.4	<2	High	0.28			
66+	0-9	20-27	0.6-2.0	0.22-0.24	6.6-7.8	<2	Moderate	0.28	5	6	1-3
Luton	9-24	50-60	<0.06	0.12-0.14	6.6-7.8	<2	High	0.28			
	24-60	40-60	<0.06	0.11-0.13	6.6-8.4	<2	High	0.28			
70	0-60	10-18	0.6-2.0	0.21-0.23	7.4-8.4	<2	Low	0.37	5	4L	1-2
McPaul											

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
76C, 76D, 76F----	0-12	18-35	0.6-2.0	0.22-0.24	6.1-7.3	<2	Low-------	0.32	5	6	2-3
Ladoga	12-42	36-42	0.2-0.6	0.18-0.20	5.1-6.5	<2	Moderate	0.43			
	42-60	24-32	0.6-2.0	0.18-0.20	5.1-6.5	<2	Moderate	0.43			
88----------	0-26	26-29	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.32	5	7	4-6
Nevin	26-51	30-35	0.6-2.0	0.18-0.20	6.1-6.5	<2	Moderate	0.43			
	51-60	25-36	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.43			
93D2*, 93D3*:											
Shelby----------	0-7	27-35	0.2-0.6	0.16-0.18	5.1-7.3	<2	Moderate	0.28	4	6	1-2
	7-50	30-35	0.2-0.6	0.16-0.18	5.1-7.3	<2	Moderate	0.28			
	50-60	30-35	0.2-0.6	0.16-0.18	6.6-8.4	<2	Moderate	0.37			
Adair----------	0-9	27-35	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate	0.32	2	6	1-2
	9-42	38-50	0.06-0.2	0.13-0.16	5.1-6.5	<2	High------	0.32			
	42-60	30-38	0.2-0.6	0.14-0.16	5.6-7.8	<2	Moderate	0.32			
99C2, 99D2, 99D3,											
99E2, 99E3------	0-7	28-34	0.6-2.0	0.21-0.23	5.6-6.5	<2	Moderate	0.32	5-4	7	1-2
Exira	7-34	25-35	0.6-2.0	0.18-0.20	5.6-6.5	<2	Moderate	0.43			
	34-60	20-30	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
133----------	0-34	27-32	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.28	5	7	5-7
Colo	34-48	30-35	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.28			
	48-60	25-35	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.28			
133+----------	0-15	20-26	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.28	5	6	3-5
Colo	15-38	30-35	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.28			
	38-60	25-35	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.28			
137----------	0-7	15-25	0.6-2.0	0.18-0.23	6.6-8.4	<2	Low-------	0.37	5	4L	1-3
Haynie	7-60	15-18	0.6-2.0	0.18-0.23	7.4-8.4	<2	Low-------	0.37			
144----------	0-7	27-35	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.37	5	4L	1-3
Blake	7-26	22-35	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.37			
	26-60	10-20	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.37			
146----------	0-8	38-55	0.2-0.6	0.12-0.14	7.4-8.4	<2	High------	0.32	5	4	2-3
Onawa	8-26	50-60	0.06-0.2	0.12-0.14	7.4-8.4	<2	High------	0.32			
	26-60	12-18	0.6-6.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
149----------	0-24	10-18	0.6-2.0	0.21-0.23	7.4-8.4	<2	Moderate	0.37	5	4L	1-3
Modale	24-60	50-60	<0.2	0.11-0.13	7.4-8.4	<2	High------	0.28			
156----------	0-9	40-60	<0.2	0.11-0.13	7.4-8.4	<2	High------	0.28	5	4	2-3
Albaton	9-60	50-60	<0.06	0.11-0.13	7.4-8.4	<2	High------	0.28			
156+----------	0-12	24-27	0.6-2.0	0.22-0.24	7.4-8.4	<2	Moderate	0.28	5	4L	1-2
Albaton	12-60	50-60	<0.06	0.11-0.13	7.4-8.4	<2	High------	0.28			
179F----------	0-14	24-27	0.6-2.0	0.20-0.22	5.6-7.3	<2	Moderate	0.28	5	6	2-3
Gara	14-46	25-38	0.2-0.6	0.16-0.18	4.5-6.5	<2	Moderate	0.28			
	46-60	24-38	0.2-0.6	0.16-0.18	5.6-8.4	<2	Moderate	0.37			
192C2, 192D2-----	0-9	27-35	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate	0.32	2	6	1-2
Adair	9-42	38-50	0.06-0.2	0.13-0.16	5.1-7.3	<2	High------	0.32			
	42-60	30-38	0.2-0.6	0.14-0.16	5.6-7.8	<2	Moderate	0.32			
212----------	0-56	22-30	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	5-6
Kennebec	56-60	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
212+----------	0-18	22-30	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	5-6
Kennebec	18-60	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
220----------	0-60	18-28	0.6-2.0	0.20-0.23	6.1-7.3	<2	Moderate	0.37	5	6	2-3
Nodaway											
222D2----------	0-7	30-38	0.2-0.6	0.17-0.19	5.1-7.3	<2	Moderate	0.37	3	7	3-4
Clarinda	7-50	40-60	<0.06	0.14-0.16	5.1-7.3	<2	High------	0.37			
	50-60	35-60	<0.06	0.14-0.16	5.6-7.3	<2	High------	0.37			
234----------	0-19	36-40	0.06-0.2	0.12-0.14	7.4-8.4	<2	High------	0.37	5	7	4-6
Nishna	19-60	38-46	0.06-0.2	0.11-0.13	7.4-8.4	<2	High------	0.28			
237----------	0-6	2-5	>6.0	0.05-0.09	6.6-8.4	<2	Low-------	0.15	5	2	<1
Sarpy	6-60	2-5	>6.0	0.05-0.09	6.6-8.4	<2	Low-------	0.15			
255----------	0-16	27-34	0.6-2.0	0.19-0.21	6.1-7.8	<2	Moderate	0.28	5	7	3-4
Cooper	16-24	27-34	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28			
	24-60	40-60	0.06-0.2	0.11-0.13	6.6-8.4	<2	High------	0.28			
275----------	0-26	10-18	0.6-2.0	0.21-0.23	7.4-8.4	<2	Low-------	0.32	5	4L	1-3
Moville	26-60	50-60	<0.06	0.11-0.13	6.6-9.0	<2	High------	0.32			
430----------	0-28	25-27	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.37	5	6	2-4
Ackmore	28-60	26-35	0.6-2.0	0.18-0.20	5.6-7.8	<2	High------	0.37			
436----------	0-20	35-38	0.2-0.6	0.18-0.20	6.1-7.3	<2	High------	0.28	5	4	3-4
Lakeport	20-48	35-42	0.2-0.6	0.17-0.19	6.6-7.8	<2	High------	0.28			
	48-60	18-30	0.6-2.0	0.17-0.19	7.4-8.4	<2	Moderate	0.43			
509, 509B----------	0-16	27-35	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.32	5	7	3-4
Marshall	16-56	27-34	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.43			
	56-60	22-30	0.6-2.0	0.20-0.22	6.6-7.3	<2	Moderate	0.43			
509C2----------	0-7	27-35	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.32	5	7	2-3
Marshall	7-38	27-34	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.43			
	38-60	22-30	0.6-2.0	0.20-0.22	6.6-7.3	<2	Moderate	0.43			
510, 510B----------	0-14	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	3-4
Monona	14-31	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	31-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
510C2----------	0-7	20-27	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.32	5	6	2-3
Monona	7-24	24-28	0.6-2.0	0.20-0.22	6.1-7.3	<2	Moderate	0.43			
	24-60	18-24	0.6-2.0	0.20-0.22	6.6-8.4	<2	Moderate	0.43			
514----------	0-8	18-27	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low-------	0.32	4	4L	1-3
Grable	8-22	12-16	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
	22-60	2-10	6.0-20	0.02-0.07	7.4-8.4	<2	Low-------	0.15			
515----------	0-7	40-60	0.06-0.2	0.10-0.12	7.4-8.4	<2	High------	0.28	4	4	1-3
Percival	7-19	40-60	0.06-0.2	0.10-0.12	7.4-8.4	<2	High------	0.28			
	19-60	2-12	6.0-20	0.02-0.04	7.4-8.4	<2	Low-------	0.15			
670----------	0-23	18-27	0.6-2.0	0.21-0.23	6.6-8.4	<2	Moderate	0.32	5	4L	1-3
Rawles	23-60	22-32	0.6-2.0	0.19-0.21	6.1-7.8	<2	Moderate	0.32			
717C*:											
Napier----------	0-30	20-27	0.6-2.0	0.22-0.24	6.1-7.3	<2	Low-------	0.32	5	6	3-4
	30-60	20-27	0.6-2.0	0.20-0.22	6.1-8.4	<2	Low-------	0.43			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
717C*:											
Gullied land.											
1233----------	0-33	20-27	0.6-2.0	0.22-0.24	5.1-7.3	<2	Moderate	0.28	5	6	3-5
Corley	33-60	26-32	0.6-2.0	0.18-0.20	5.1-6.5	<2	High------	0.43			
1299----------	0-23	27-32	0.6-2.0	0.21-0.23	5.6-7.3	<2	Moderate	0.28	5	7	4-5
Minden	23-60	29-35	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.43			
4001C*, 4001D*, 4001E*:											
Ida----------	0-60	18-25	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low-------	0.43	5	4L	.5-1
Urban land.											
4012B*:											
Napier----------	0-30	20-27	0.6-2.0	0.22-0.24	6.1-7.3	<2	Low-------	0.32	5	6	3-4
	30-60	20-27	0.6-2.0	0.20-0.22	6.1-8.4	<2	Low-------	0.43			
Urban land.											
4046*:											
Keg----------	0-35	20-26	0.6-2.0	0.21-0.23	6.1-7.3	<2	Low-------	0.28	5	6	2-4
	35-60	18-22	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
Urban land.											
4156*:											
Albaton---------	0-9	40-60	<0.2	0.11-0.13	7.4-8.4	<2	High------	0.28	5	4	2-3
	9-60	50-60	<0.06	0.11-0.13	7.4-8.4	<2	High------	0.28			
Urban land.											
4170C*:											
Castana---------	0-14	18-22	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low-------	0.32	5	4L	2-3
	14-60	18-24	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
Urban land.											
4237*:											
Sarpy----------	0-8	2-5	>6.0	0.05-0.09	6.6-8.4	<2	Low-------	0.15	5	2	<1
	8-60	2-5	>6.0	0.05-0.09	6.6-8.4	<2	Low-------	0.15			
Urban land.											
4255*:											
Cooper----------	0-16	27-34	0.6-2.0	0.19-0.21	6.1-7.8	<2	Moderate	0.28	5	7	3-4
	16-33	27-34	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28			
	33-60	40-60	0.06-0.2	0.11-0.13	6.6-8.4	<2	High------	0.28			
Urban land.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
1C, 1C3, 1D, 1D3, 1E, 1E3, 1F, 1F3, 1G---------- Ida	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
2G---------- Hamburg	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
3E---------- Castana	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
8B, 8C---------- Judson	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Low.
9, 9B, 9C, 9C2, 9D, 9D2---------- Marshall	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
10, 10B, 10C, 10C2, 10C3, 10D, 10D2, 10D3, 10E, 10E2, 10E3, 10F, 10G---------- Monona	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
11B*: Ackmore----------	B	Occasional	Very brief to brief.	Sep-Jun	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Low.
Colo----------	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
Judson----------	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Low.
12B, 12C, 12D----- Napier	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
22C3, 22D3, 22E3-- Dow	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
24D2, 24E2, 24E3-- Shelby	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
33D2, 33E2-------- Steinauer	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
36---------- Salix	B	Rare--------	---	---	4.0-6.0	Apparent	Nov-Jul	High-----	Moderate	Low.
43---------- Bremer	C	Rare--------	---	---	1.0-2.0	Apparent	Nov-Jul	High-----	Moderate	Moderate.
44---------- Blencoe	D	Rare--------	---	---	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
46---------- Keg	B	Rare---------	---	---	>6.0	---	---	High-----	Low------	Low.
54, 54+---------- Zook	C/D	Occasional	Brief to long.	Feb-Nov	0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
60D2---------- Malvern	C	None---------	---	---	1.0-3.0	Perched	Nov-Jul	High-----	High-----	Moderate.
66, 66+---------- Luton	D	Occasional	Brief-----	Mar-Jun	1.0-3.0	Apparent	Nov-Jul	Moderate	High-----	Low.
70---------- McPaul	B	Occasional	Very brief	Feb-Nov	>6.0	---	---	High-----	Low------	Low.
76C, 76D, 76F----- Ladoga	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
88---------- Nevin	B	Rare---------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Low.
93D2*, 93D3*:										
Shelby----------	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Adair----------	C	None---------	---	---	1.0-3.0	Perched	Nov-Jul	High-----	High-----	Moderate.
99C2, 99D2, 99D3, 99E2, 99E3------- Exira	B	None---------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
133, 133+--------- Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
137---------- Haynie	B	Occasional	Very brief	Feb-Nov	>6.0	---	---	High-----	Low------	Low.
144---------- Blake	B	Occasional	Very brief to long.	Feb-Nov	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Low.
146---------- Onawa	D	Rare---------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Low.
149---------- Modale	C	Occasional	Brief-----	Feb-Nov	1.5-3.0	Apparent	Nov-Jul	High-----	High-----	Low.
156, 156+--------- Albaton	D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	Moderate	High-----	Low.
179F---------- Gara	C	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
192C2, 192D2------ Adair	C	None---------	---	---	1.0-3.0	Perched	Nov-Jul	High-----	High-----	Moderate.
212, 212+--------- Kennebec	B	Occasional	Brief-----	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	High-----	Moderate	Low.
220---------- Nodaway	B	Occasional	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	High-----	Moderate	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
222D2---------- Clarinda	D	None--------	---	---	1.0-3.0	Perched	Nov-Jul	High-----	High-----	Moderate.
234---------- Nishna	C/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	Moderate	High-----	Low.
237---------- Sarpy	A	Rare--------	---	---	>6.0	---	---	Low------	Low------	Low.
255---------- Cooper	B	Rare--------	---	---	2.0-5.0	Apparent	Nov-Jul	High-----	High-----	Low.
275---------- Moville	C	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Low.
430---------- Ackmore	B	Occasional	Very brief to brief.	Sep-Jun	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Low.
436---------- Lakeport	B	Rare--------	---	---	2.0-4.0	Apparent	Nov-Jun	High-----	High-----	Low.
509, 509B, 509C2-- Marshall	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
510, 510B, 510C2-- Monona	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
514---------- Grable	B	Occasional	Very brief	Feb-Nov	>6.0	---	---	Low------	Low------	Low.
515---------- Percival	C	Occasional	Very brief	Feb-Nov	2.0-4.0	Apparent	Nov-Jul	Moderate	High-----	Low.
670---------- Rawles	B	Occasional	Brief-----	Feb-Nov	>6.0	---	---	High-----	Moderate	Low.
717C*: Napier----------	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
Gullied land.										
1233---------- Corley	B/D	None--------	---	---	+1-1.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
1299---------- Minden	B	None--------	---	---	3.0-5.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
4001C*, 4001D*, 4001E*: Ida----------	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
Urban land.										
4012B*: Napier----------	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
Urban land.										
4046*: Keg----------	B	Rare--------	---	---	>6.0	---	---	High-----	Low------	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
4046*: Urban land.										
4156*: Albaton----------	D	Rare--------	---	---	1.0-3.0	Apparent	Nov-Jul	Moderate	High-----	Low.
Urban land.										
4170C*: Castana----------	B	None--------	---	---	>6.0	---	---	High-----	Low------	Low.
Urban land.										
4237*: Sarpy----------	A	Rare--------	---	---	>6.0	---	---	Low------	Low------	Low.
Urban land.										
4255*: Cooper----------	B	Rare--------	---	---	2.0-5.0	Apparent	Nov-Jul	High-----	High-----	Low.
Urban land.										
5030*. Pits										
5040. Orthents										
5053. Psammaquents										
5080*: Orthents.										
Dumps.										

* See description of the map unit for composition and behavior characteristics of the map unit.

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
Ackmore	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
*Adair	Fine, montmorillonitic, mesic Aquic Argiudolls
Albaton	Fine, montmorillonitic (calcareous), mesic Vertic Fluvaquents
Blake	Fine-silty, mixed (calcareous), mesic Aquic Udifluvents
Blencoe	Clayey over loamy, montmorillonitic, mesic Aquic Hapludolls
Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
Castana	Fine-silty, mixed, mesic Entic Hapludolls
*Clarinda	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Cooper	Fine-silty over clayey, mixed, mesic Fluvaquentic Hapludolls
Corley	Fine-silty, mixed, mesic Argiaquic Argialbolls
Dow	Fine-silty, mixed (calcareous), mesic Typic Udorthents
*Exira	Fine-silty, mixed, mesic Typic Hapludolls
Gara	Fine-loamy, mixed, mesic Mollic Hapludalfs
Grable	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), mesic Mollic Udifluvents
Hamburg	Coarse-silty, mixed (calcareous), mesic Typic Udorthents
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
Ida	Fine-silty, mixed (calcareous), mesic Typic Udorthents
Judson	Fine-silty, mixed, mesic Cumulic Hapludolls
Keg	Fine-silty, mixed, mesic Typic Hapludolls
Kennebec	Fine-silty, mixed, mesic Cumulic Hapludolls
Ladoga	Fine, montmorillonitic, mesic Mollic Hapludalfs
Lakeport	Fine, montmorillonitic, mesic Aquic Hapludolls
Luton	Fine, montmorillonitic, mesic Vertic Haplaquolls
*Malvern	Fine, montmorillonitic, mesic Aquic Argiudolls
Marshall	Fine-silty, mixed, mesic Typic Hapludolls
McPaul	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
Minden	Fine-silty, mixed, mesic Aquic Hapludolls
Modale	Coarse-silty over clayey, mixed (calcareous), mesic Aquic Udifluvents
Monona	Fine-silty, mixed, mesic Typic Hapludolls
Moville	Coarse-silty over clayey, mixed (calcareous), mesic Aeric Fluvaquents
Napier	Fine-silty, mixed, mesic Cumulic Hapludolls
Nevin	Fine-silty, mixed, mesic Aquic Argiudolls
Nishna	Fine, montmorillonitic (calcareous), mesic Cumulic Haplaquolls
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Onawa	Clayey over loamy, montmorillonitic (calcareous), mesic Aquic Udifluvents
Orthents	Loamy, mixed, mesic Typic Udorthents
Percival	Clayey over sandy or sandy-skeletal, montmorillonitic (calcareous), mesic Aquic Udifluvents
Psammaquents	Sandy, mixed, mesic Typic Psammaquents
Rawles	Fine-silty, mixed (calcareous), mesic Mollic Udifluvents
Salix	Fine-silty, mixed, mesic Typic Hapludolls
Sarpy	Mixed, mesic Typic Udipsamments
*Shelby	Fine-loamy, mixed, mesic Typic Argiudolls
Steinauer	Fine-loamy, mixed (calcareous), mesic Typic Udorthents
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

☆U.S. GOVERNMENT PRINTING OFFICE : 1989 O - 252-065 : QL 3

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.