United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
the Minnesota Agricultural
Experiment Station

Soil Survey of Rice County, Minnesota

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How To Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is 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.

The **detailed soil 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**. Note the number of the map sheet, and turn to that sheet.

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

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for other 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 Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1995. Soil names and descriptions were approved in 1996. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1996. This survey was made cooperatively by the Natural Resources Conservation Service and the Minnesota Agricultural Experiment Station. It is part of the technical assistance furnished to the Rice County Soil and Water Conservation District.

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.

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Cover: Crop residue management in an area of the Kilkenny-Derrynane-Lerdal general soil map unit. This practice reduces the hazard of water erosion in the survey area.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

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Foreword

This soil survey contains information that can be used in land-planning programs in Rice 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 Natural Resources Conservation Service.

William Hunt
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Rice County, Minnesota—Part I

By John F. Beck, Natural Resources Conservation Service

Fieldwork by John F. Beck, George A. Poch, Kenneth D. Matzdorf, and
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United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
the Minnesota Agricultural Experiment Station

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; 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 biological activity.

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

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate 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-vegetation-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, soil reaction, 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. Soil taxonomy, 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 interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are 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 are 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 predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on any 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.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

This soil survey updates the survey of Rice County, Minnesota, published in 1975 (USDA, 1975). It provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the Survey Area

Tom Coffman, district conservationist, Natural Resources Conservation Service, helped prepare this section.

Rice County is in a transitional area between south-central and southeastern Minnesota (fig. 1). The northern and western two-thirds of the county is more recently glaciated and is hilly with many potholes. The native vegetation was mixed hardwoods and wetlands. The southern and eastern parts of the county consist of an older landscape. Slopes are long, and the landscape is dissected by drainageways and has no depressions. The native vegetation was mainly tall prairie grass, except for the Big Woods area near Nerstrand and scattered areas of oak savanna.

The total area of the county is 316,800 acres. Of this total, 9,400 acres is lakes. In 1995, the county had 215,000 acres of tillable land. Acreages of crops for 1995 included 85,000 acres of corn, 54,000 acres of soybeans, 33,000 acres in the CRP and RIM programs, 31,000 acres of legume and legume/grass hay, and 12,000 acres of small grain crops.

In 1990, the population of Rice County was 49,183. This figure represents an increase of 7 percent during the decade from 1980 to 1990. Faribault, which is the county seat, had a population of 17,085. Northfield, a community 10 miles northeast of Faribault, had a population of 14,684.

The county was first settled in 1826 by Alexander Faribault, a French fur trader who established a trading post near Cannon Lake. The county was named after Henry M. Rice, who was the first United States senator from Minnesota. Rice County was officially established in 1855. The city of Northfield was founded in 1855 by John W. North. In 1856, the townsites of Cannon City and Morristown were platted. Other early townsites were Wheatland, Warsaw, Walcott, Shieldsville, Dundas, and Millersburg.

There are three major watersheds in the county. The Cannon River originates at Shields Lake. About 82 percent of the county drains into the Cannon River. The northwestern part of the county drains into the Minnesota River, and the southeastern part drains into the Zumbro River.

Geology of Rice County

Carrie Patterson, geologist, Minnesota Geological Survey, helped prepare this section.

The western two-thirds of Rice County is covered by deposits of the late-Wisconsin Des Moines lobe.

Figure 1.—Location of Rice County in Minnesota.

This ice lobe was a relatively short-lived, late extension of the Laurentide Ice Sheet. Most of the Des Moines lobe deposits in Rice County are 14,000 years old or younger, but a narrow fringe along the eastern extent of the ice advance may be older (20,000 to 30,000 years old).

The eastern part of the county was free of ice during the late Wisconsin and was subject to erosion and deposition by meltwater streams and periglacial processes, such as strong winds. This area had been glaciated previously, however, probably in the Illinoian and/or pre-Illinoian (more than 130,000 years before present). The area has been undergoing erosion since then and has a dissected landscape with a well developed stream network. Upland areas are covered with a thin layer of loess, a silty, windblown sediment. In some areas the loess is thicker.

The Des Moines lobe advanced at a time when the climate was already beginning to warm. It was most likely a thin (200 to 300 meters), low-profile ice lobe that moved quickly on a bed of deforming, saturated sediment. It stopped, perhaps when the necessary subglacial water drained away, and began to stagnate. It did not have an active retreat phase. More than one advance of ice followed a path similar to that of the Des Moines lobe. Subsequent advances, depending on their timing and limit, would have advanced into stagnating ice. This type of ice dynamic and the resulting landforms are analogous to modern surging glaciers.

The resulting glacial landscape in Rice County is complex. The limit of advance is marked by an inconspicuous terminal moraine that consists of till and sorted sediment. A broad, possibly multi-aged zone of ice stagnation features that occurs immediately within the moraine is the more obvious demarcation of the ice margin. It is best developed west of Interstate 35 (in areas of associations 1 and 2, described under the heading “General Soil Map Units”). This region is characterized by flat-topped circular hills and other hummocks that formed as glacial sediment on the stagnant ice slumped into lows in the ice surface. Some of the low areas held water, and the sediments were sorted as they were deposited. Other areas were dry, and the resulting deposits look more like till. An individual hill may contain a complex mixture of water-sorted sediment (ice-walled lake sediment) and till-like, debris-flow sediment. Deposits vary from one hill to another, even though the landforms developed in a similar way.

Other landforms were simultaneously developing beneath the stagnating ice. These landforms are commonly partially buried by supraglacial sediment. An indistinct subglacial channel network can be discerned by tracing lowlands, buried deposits of sand and gravel, and eskers.

There are four main geomorphic regions in the county, three of which are related to the advance and stagnation of the Des Moines lobe. The fourth is associated with the earlier glaciation. These regions are described in the following paragraphs.

1. Flat to rolling till plains that include the older, eastern fringe of the Des Moines lobe, stream-eroded till, and end moraine areas (associations 4, 5, 6, and 7).
2. Hummocky, high-relief, ice-stagnation topography of the Des Moines lobe. This area is characterized by flat-topped, circular hills, closed depressions, and a poorly developed drainage network (associations 1 and 2).
3. Meltwater streams of varying ages. Sediments are generally sand and gravel that fine up into more silty stream sediment. Older streams may have a loess cap (association 10).
4. An older, eroded, dissected landscape of till with a loess cover. In some areas, shallow bedrock controls the topography (associations 3, 8, and 9).

Climate

The three tables at the end of this section provide climate data for the survey area as recorded at Faribault in the period 1961 to 1990.

In winter, the average temperature is 15.3 degrees F and the average daily minimum temperature is 5.5 degrees. The lowest temperature on record, which occurred at Faribault on January 9, 1977, was -40 degrees. In summer, the average temperature is 69.4 degrees and the average daily maximum temperature is 81.3 degrees. The highest temperature, which occurred at Faribault on August 1, 1988, was 104 degrees.

Growing degree days 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 31 inches. Of this, 19.17 inches, or about 62 percent, usually falls in May through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall on record was 5.35 inches at Faribault on July 21, 1951. Thunderstorms occur on about 38 days each year, and most occur between June and August.

The average seasonal snowfall is 45.8 inches. The greatest snow depth at any one time during the period of record was 33 inches recorded on February 5, 1969. An average of 92 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 15.0 inches recorded on January 23, 1982.

The average relative humidity in midafternoon is about 59 percent. Humidity is higher at night, and the average at dawn is about 78 percent. The sun shines about 69 percent of the time possible in summer and 52 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, between 11 and 12 miles per hour, from March to May.

Temperature and Precipitation

(Recorded in the period 1961-90 at Faribault, Minnesota)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	21.6	1.3	11.4	48	-30	0	0.94	0.32	1.44	3	9.5
February---	27.5	6.6	17.0	52	-28	0	.87	.32	1.43	2	8.8
March------	39.8	20.6	30.2	71	-11	7	2.01	1.03	2.87	4	9.6
April------	56.9	34.3	45.6	85	11	70	2.91	1.62	4.04	6	3.0
May--------	70.0	45.7	57.9	91	26	273	3.69	2.45	4.82	7	.0
June-------	79.5	55.2	67.3	96	37	521	3.57	2.23	4.78	7	.0
July-------	83.7	60.1	71.9	98	44	679	4.21	2.26	5.93	5	.0
August-----	80.6	57.5	69.0	96	41	588	4.05	2.06	5.79	6	.0
September--	71.9	48.6	60.2	92	29	319	3.65	1.85	5.21	6	.0
October----	60.2	37.6	48.9	84	17	106	2.38	.97	3.57	4	.2
November---	41.9	24.3	33.1	67	-3	6	1.59	.48	2.49	4	4.1
December---	26.3	8.6	17.4	53	-22	0	1.14	.52	1.67	3	10.6
Yearly:											
Average---	55.0	33.4	44.2	---	---	---	---	---	---	---	---
Extreme---	104	-40	---	99	-32	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,569	31.00	25.98	35.76	57	45.8

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Faribault, Minnesota)

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. 29	May 9	May 23
2 years in 10 later than--	Apr. 24	May 5	May 18
5 years in 10 later than--	Apr. 14	Apr. 26	May 7
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 4	Sept. 26	Sept. 14
2 years in 10 earlier than--	Oct. 10	Oct. 1	Sept. 19
5 years in 10 earlier than--	Oct. 22	Oct. 10	Sept. 29

Growing Season

(Recorded in the period 1961-90 at Faribault, Minnesota)

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	162	146	122
8 years in 10	171	152	129
5 years in 10	189	165	144
2 years in 10	207	178	159
1 year in 10	216	185	166

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit 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 or miscellaneous areas can be identified on the map. Likewise, areas that 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 map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Lester-Hamel-Le Sueur Association

Setting

Landform: Moraines
Slope range: 0 to 25 percent

Composition

Percent of the survey area: 26
Extent of the components in the association (fig. 2):
Lester and similar soils—50 percent
Hamel and similar soils—20 percent
Le Sueur and similar soils—15 percent
Minor soils—15 percent

Soil Properties and Qualities

Lester

Drainage class: Well drained
Parent material: Till
Surface texture: Loam

Hamel

Drainage class: Poorly drained
Parent material: Alluvium or colluvium and till
Surface texture: Loam

Le Sueur

Drainage class: Moderately well drained
Parent material: Till
Surface texture: Clay loam

Minor Soils

- Hayden and similar soils
- Cordova and similar soils
- Dundas and similar soils
- Terril and similar soils

2. Kilkenny-Derrynane-Lerdal Association

Setting

Landform: Moraines
Slope range: 1 to 25 percent

Composition

Percent of the survey area: 20
Extent of the components in the association (fig. 3):
Kilkenny and similar soils—50 percent
Derrynane and similar soils—20 percent
Lerdal and similar soils—15 percent
Minor soils—15 percent

Soil Properties and Qualities

Kilkenny

Drainage class: Moderately well drained
Parent material: Glaciolacustrine deposits and till
Surface texture: Clay loam

Derrynane

Drainage class: Poorly drained

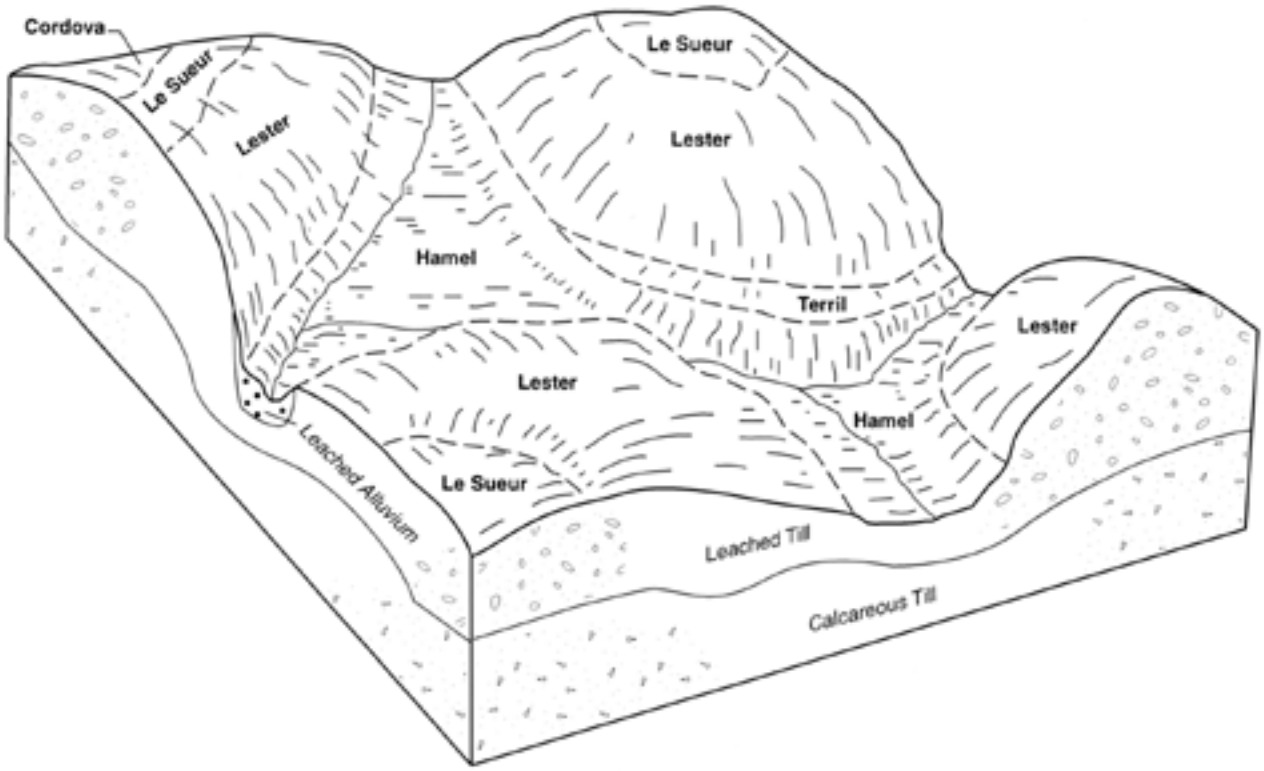

Figure 2.—Typical pattern of soils and underlying material in the Lester-Hamel-Le Sueur association.

Parent material: Alluvium or colluvium and till
Surface texture: Clay loam

Lerdal

Drainage class: Somewhat poorly drained
Parent material: Glaciolacustrine deposits and till
Surface texture: Clay loam

Minor Soils

- Mazaska and similar soils
- Okoboji and similar soils
- Muskego and similar soils
- Shields and similar soils

3. Racine-Littleton-Lindstrom Association

Setting

Landform: Moraines
Slope range: 1 to 18 percent

Composition

Percent of the survey area: 5

Extent of the components in the association:
Racine and similar soils—40 percent
Littleton and similar soils—30 percent
Lindstrom and similar soils—25 percent
Minor soils—5 percent

Soil Properties and Qualities

Racine

Drainage class: Well drained
Parent material: Glaciolacustrine deposits and till
Surface texture: Silt loam

Littleton

Drainage class: Somewhat poorly drained
Parent material: Alluvium or colluvium and till
Surface texture: Silt loam

Lindstrom

Drainage class: Well drained
Parent material: Alluvium or colluvium
Surface texture: Silt loam

Minor Soils

- Blooming and similar soils

- Moland and similar soils
- Garwin and similar soils
- Brodale and similar soils
- Eyota and similar soils
- Copaston and similar soils

4. Clarion-Nicollet-Webster Association

Setting

Landform: Moraines
Slope range: 0 to 5 percent

Composition

Percent of the survey area: 4
Extent of the components in the association:
Clarion and similar soils—40 percent
Nicollet and similar soils—25 percent
Webster and similar soils—20 percent
Minor soils—15 percent

Soil Properties and Qualities

Clarion

Drainage class: Well drained
Parent material: Till
Surface texture: Loam

Nicollet

Drainage class: Somewhat poorly drained
Parent material: Till
Surface texture: Clay loam

Webster

Drainage class: Poorly drained
Parent material: Till
Surface texture: Clay loam

Minor Soils

- Storden and similar soils
- Le Sueur and similar soils

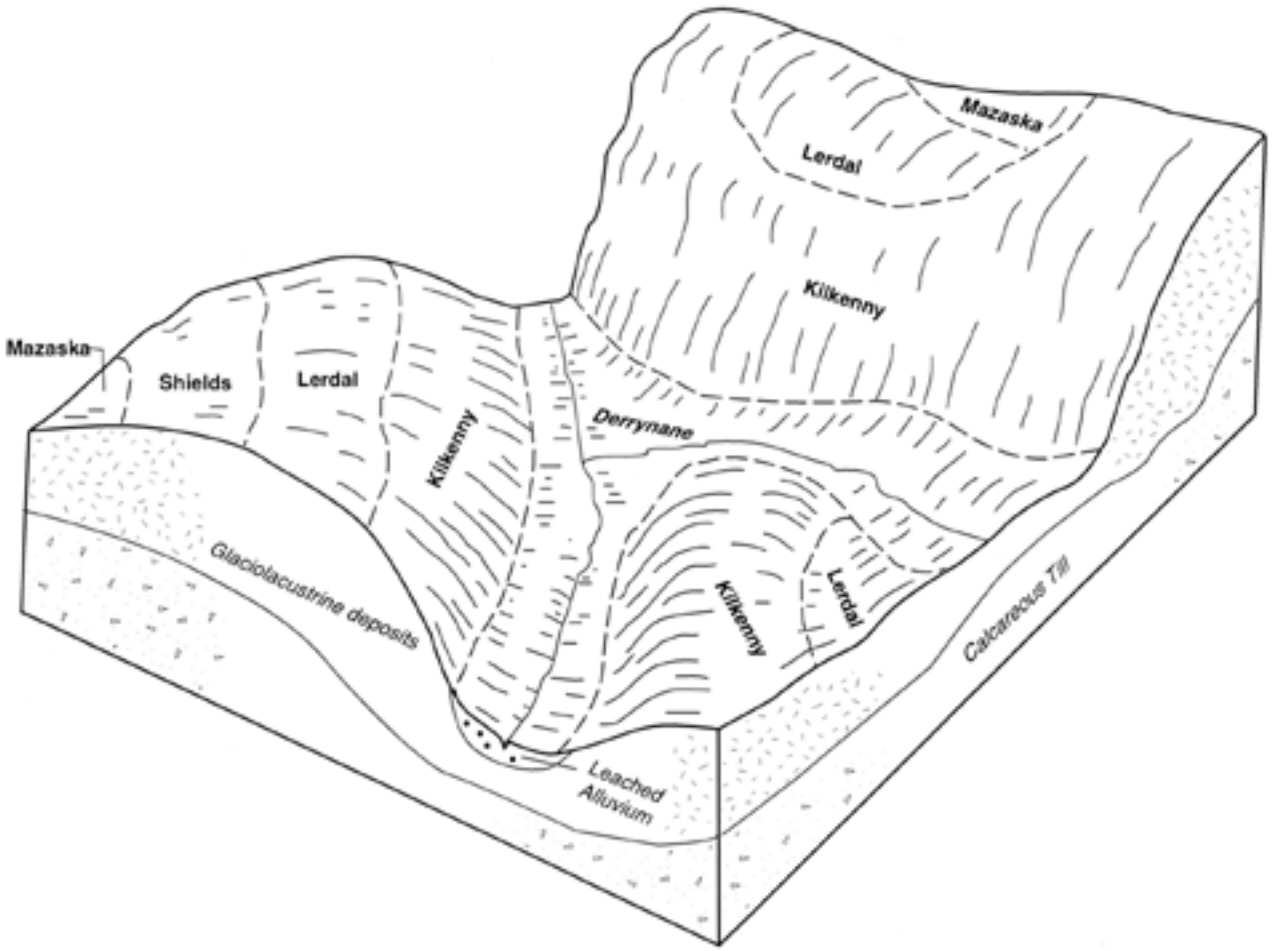

Figure 3.—Typical pattern of soils and underlying material in the Kilkenny-Derrynane-Lerdal association.

- Hamel and similar soils
- Glencoe and similar soils
- Shields and similar soils
- Derrynane and similar soils
- Okoboji and similar soils

5. Moland-Merton-Maxcreek Association

Setting

Landform: Moraines
Slope range: 0 to 4 percent

Composition

Percent of the survey area: 8
Extent of the components in the association:
Moland and similar soils—45 percent
Merton and similar soils—30 percent
Maxcreek and similar soils—20 percent
Minor soils—5 percent

Soil Properties and Qualities

Moland

Drainage class: Well drained
Parent material: Eolian deposits over till
Surface texture: Silt loam

Merton

Drainage class: Somewhat poorly drained
Parent material: Eolian deposits over till
Surface texture: Silt loam

Maxcreek

Drainage class: Poorly drained
Parent material: Glaciolacustrine deposits and till
Surface texture: Silty clay loam

Minor Soils

- Blooming and similar soils
- Racine and similar soils
- Maxfield and similar soils

6. Hayden-Le Sueur-Dundas Association

Setting

Landform: Moraines
Slope range: 1 to 25 percent

Composition

Percent of the survey area: 8
Extent of the components in the association (fig. 4):
Hayden and similar soils—35 percent
Le Sueur and similar soils—25 percent
Dundas and similar soils—25 percent
Minor soils—15 percent

Soil Properties and Qualities

Hayden

Drainage class: Well drained
Parent material: Till
Surface texture: Loam

Le Sueur

Drainage class: Moderately well drained
Parent material: Till
Surface texture: Loam

Dundas

Drainage class: Somewhat poorly drained
Parent material: Till
Surface texture: Silt loam

Minor Soils

- Lester and similar soils
- Hamel and similar soils
- Terril and similar soils
- Glencoe and similar soils
- Brodale and similar soils
- Eyota and similar soils
- Copaston and similar soils

7. Hayden-Hamel Association

Setting

Landform: Moraines
Slope range: 0 to 25 percent

Composition

Percent of the survey area: 8
Extent of the components in the association:
Hayden and similar soils—50 percent
Hamel and similar soils—35 percent
Minor soils—15 percent

Soil Properties and Qualities

Hayden

Drainage class: Well drained
Parent material: Till
Surface texture: Loam

Hamel

Drainage class: Poorly drained
Parent material: Alluvium or colluvium and till
Surface texture: Loam

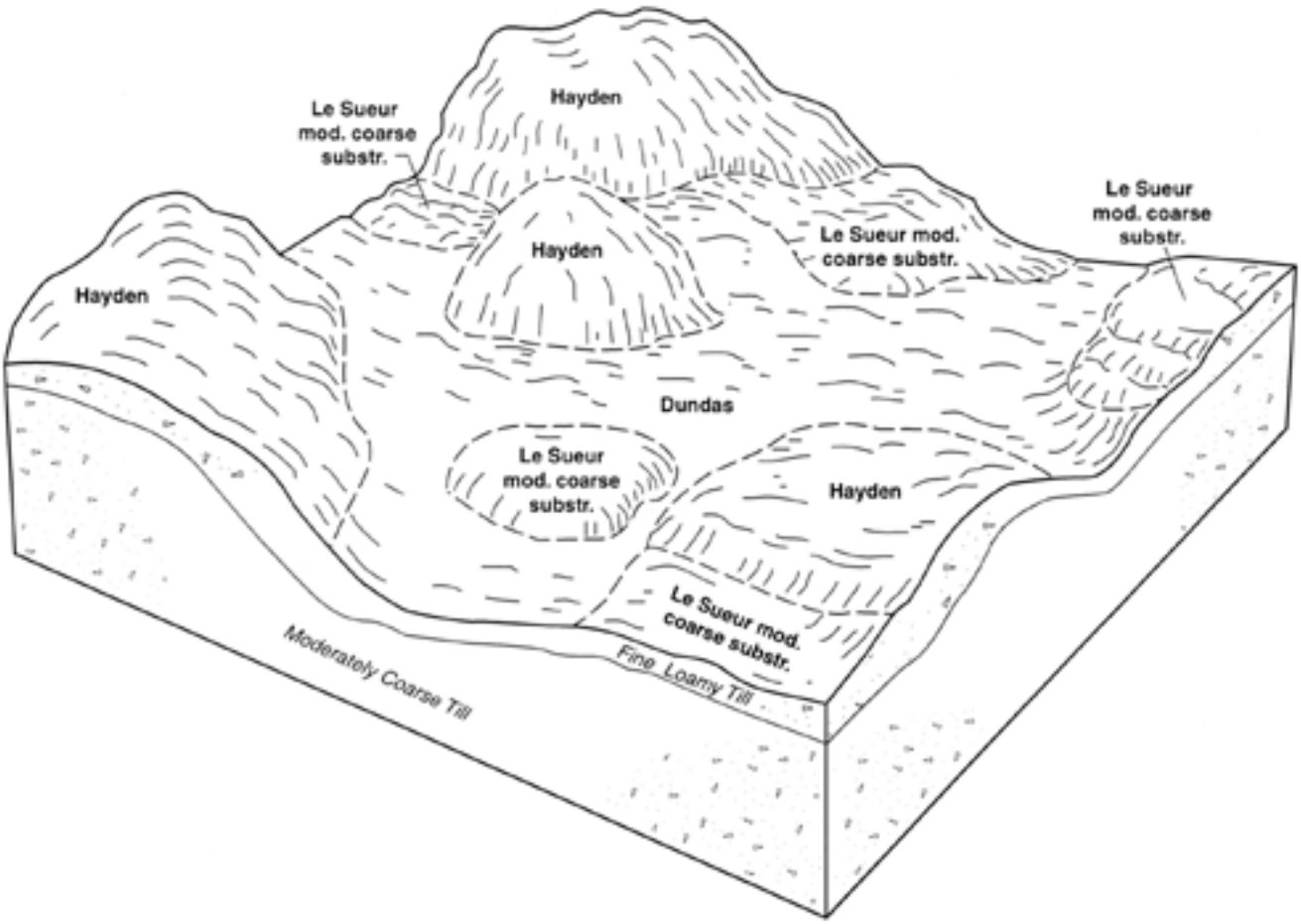

Figure 4.—Typical pattern of soils and underlying material in the Hayden-Le Sueur-Dundas association.

Minor Soils

- Lester and similar soils
- Storden and similar soils
- Le Sueur and similar soils
- Glencoe and similar soils
- Klossner and similar soils

8. Racine-Kenyon-Nerwoods Association

Setting

Landform: Moraines
Slope range: 1 to 18 percent

Composition:

Percent of the survey area: 8
Extent of the components in the association (fig. 5):
Racine and similar soils—50 percent
Kenyon and similar soils—25 percent
Nerwoods and similar soils—20 percent
Minor soils—5 percent

Soil Properties and Qualities

Racine

Drainage class: Well drained
Parent material: Glaciolacustrine deposits and till
Surface texture: Silt loam

Kenyon

Drainage class: Moderately well drained
Parent material: Glaciolacustrine sediments and till
Surface texture: Silt loam

Nerwoods

Drainage class: Somewhat poorly drained
Parent material: Alluvium or colluvium and till
Surface texture: Loam

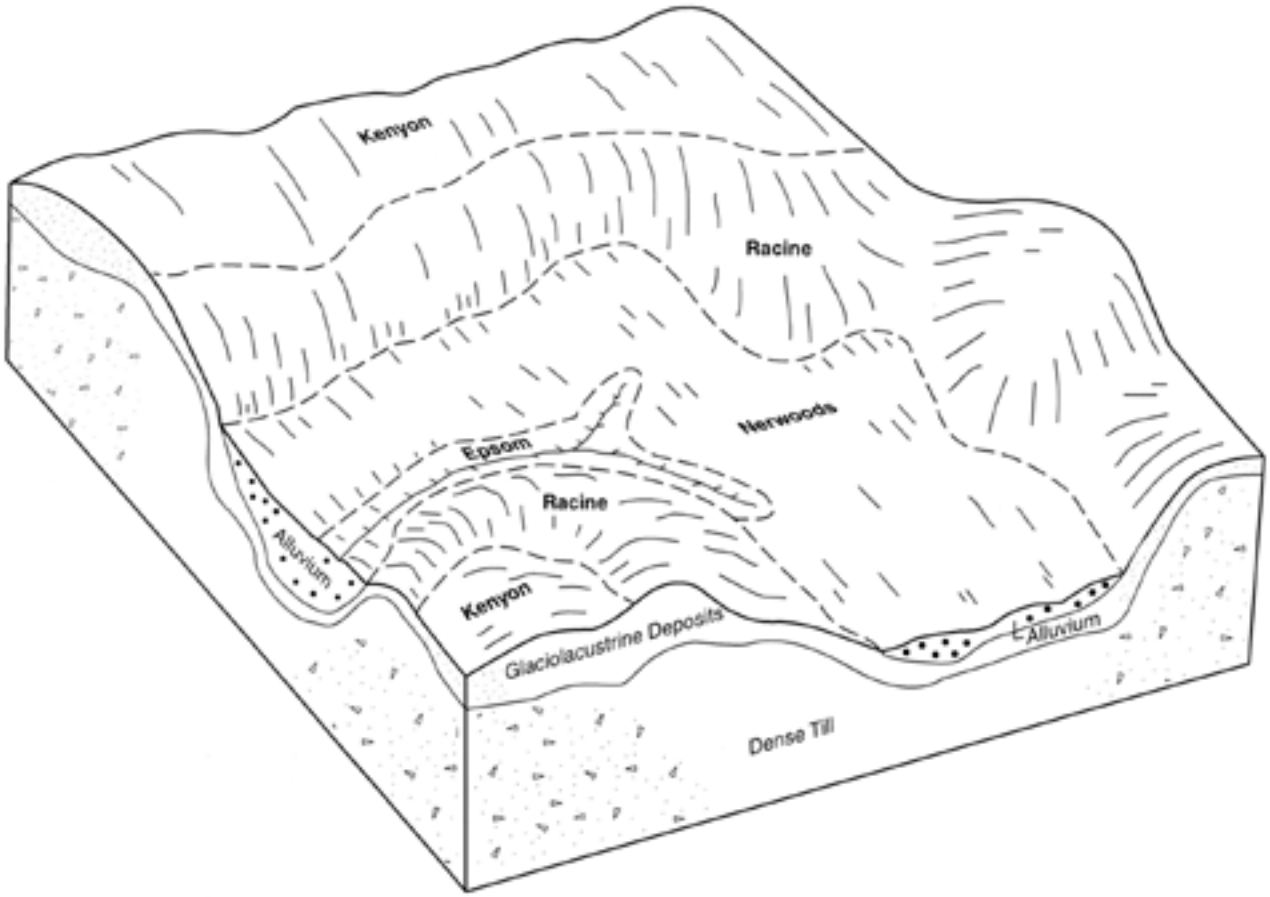

Figure 5.—Typical pattern of soils and underlying material in the Racine-Kenyon-Nerwoods association.

Minor Soils

- Blooming and similar soils
- Epsom and similar soils

9. Kenyon-Klinger-Maxfield Association

Setting

Landform: Moraines
Slope range: 0 to 4 percent

Composition

Percent of the survey area: 4
Extent of the components in the association:
Kenyon and similar soils—50 percent
Klinger and similar soils—25 percent
Maxfield and similar soils—15 percent
Minor soils—10 percent

Soil Properties and Qualities

Kenyon

Drainage class: Moderately well drained
Parent material: Glaciolacustrine deposits and till
Surface texture: Silt loam

Klinger

Drainage class: Somewhat poorly drained
Parent material: Glaciolacustrine deposits and till
Surface texture: Silty clay loam

Maxfield

Drainage class: Poorly drained
Parent material: Glaciolacustrine deposits and till
Surface texture: Silty clay loam

Minor Soils

- Racine and similar soils

- Prinsburg and similar soils
- Maxcreek and similar soils

10. Estherville-Colo-Waukegan Association

Setting

Landform: Outwash plains and terraces; flood plains
Slope range: 0 to 6 percent

Composition

Percent of the survey area: 9
Extent of the components in the association (fig. 6):
Estherville and similar soils—40 percent
Colo and similar soils—30 percent
Waukegan and similar soils—20 percent
Minor soils—10 percent

Soil Properties and Qualities

Estherville

Drainage class: Somewhat excessively drained
Parent material: Glacial outwash
Surface texture: Sandy loam

Colo

Drainage class: Poorly drained
Parent material: Alluvium
Surface texture: Silt loam

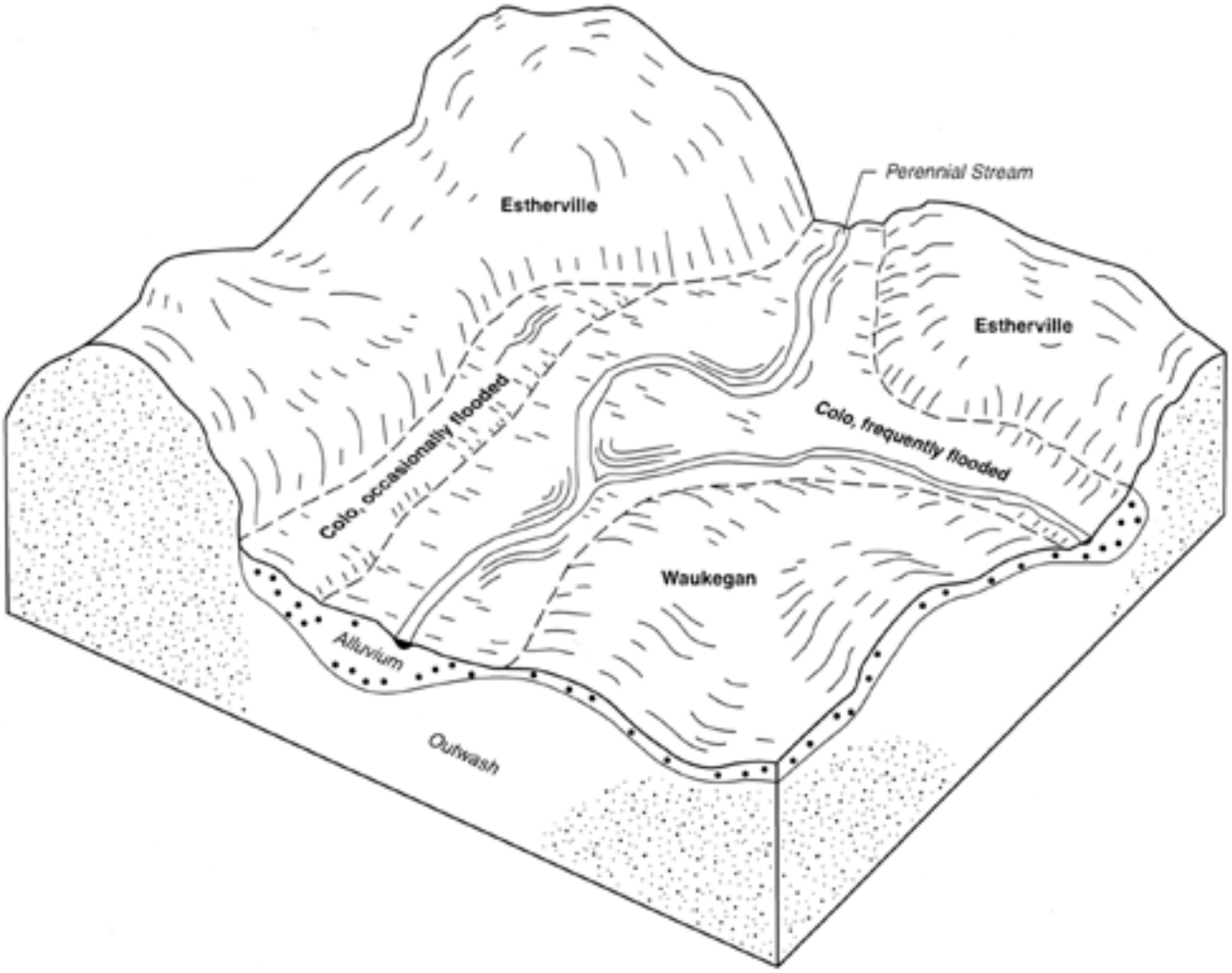

Figure 6.—Typical pattern of soils and underlying material in the Estherville-Colo-Waukegan association.

Waukegan

Drainage class: Well drained
Parent material: Alluvium and outwash
Surface texture: Silt loam

Minor Soils

- Hawick and similar soils
- Kato and similar soils

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material (Jenny, 1941).

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 to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. Some time is always required for the differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent Material

Rice County is covered mainly by glacial drift of the Des Moines lobe of the late Wisconsin glaciation. Most of the Des Moines lobe deposits in the county are 14,000 years old or younger, with the exception of those deposits on the eastern edge of the Des Moines advance, which are 20,000 to 30,000 years old. A separate ice sheet of Illinoian or pre-Illinoian age (older than 130,000 years before present) occurs in the eastern part of the county. This part of the county is overlain by varying thicknesses of loess.

The drift is mostly glacial till and is composed of material derived from the reworking of older glacial deposits and bedrock. Lester and Le Sueur soils formed in this material. Moderately fine textured and fine textured glacial till, which has a high content of shale, covers some parts of the county. This material formed a mantle 3 to 10 feet thick on the medium textured glacial drift. Kilkenny, Lerdal, Shields, and Mazaska soils formed in this material (USDA, 1975).

Glacial outwash deposits developed from the meltwater of the glacier. Soils that formed in this material commonly have a sandy and gravelly substratum with a loamy or silty mantle. Waukegan, Kato, Estherville, and Biscay soils are examples.

The eastern edge of the county is mantled by a thin layer of loess. Moland, Merton, and Maxcreek soils formed in this material.

Climate

Rice County has a cool, subhumid, continental climate characterized by wide variations in temperature from summer to winter. During the winter, the soil-forming processes are largely dormant. Generally, the soils are frozen to a depth of 2 to 3 feet for 4 or 5 months of the year. The depth to which frost penetrates depends mostly on the quantity of snowfall late in fall or early in winter.

The climate is essentially uniform throughout the county; however, differences in vegetation, soil materials, and relief can cause variations in the microclimate. Soils in the prairie regions are exposed to greater variations in temperature than those in the forest region. Fine textured soils, such as Shields and Mazaska soils, warm up more slowly than moderately coarse textured soils, such as Estherville and Hawick soils, because they contain more moisture. Dark soils, such as Clarion and Nicollet soils, absorb more heat from the sunlight than the lighter colored Hayden soils. Soils on south- and west-facing slopes receive more sunlight than soils on north- and east-facing slopes; therefore, they tend to be drier and warmer. The interactions of all these factors affect the formation of soils (USDA, 1975).

Plants and Animals

Two types of vegetation, forest and prairie, have strongly influenced soil formation in Rice County. The survey area is located along the northern margin of an extensive zone of ecological tension between prairie and forest regions. Throughout the centuries this margin advanced and retreated as shifts in the climate pattern affected temperature, relative humidity, wind velocity, and precipitation patterns. In addition, prairie fires may have been a modifying factor in the formation of soils along the edges of the prairie. Except for earthworms and microscopic organisms, the activities of animals probably had little effect on soil formation (USDA, 1975).

Relief

The relief of Rice County is mainly the product of the melting continental glacier that deposited glacial drift of such thickness that the underlying rock strata have had little influence on the configuration of the relief. The relief of the county ranges from nearly level on the summits of ground moraines to rolling in the complex pattern of the morainic landscape dissected by the Cannon River. The main drainage channels developed during the retreat of the glacier and occur as broad valleys within the landscape (USDA, 1975).

Time

Geologically, the soils in the county are young. They were first exposed to soil-forming processes 14,000 years ago or more. It is presumed that most of the material consisted of reworked drift from preceding glaciers, however, and thus the weathering of minerals was somewhat advanced at the time of deposition. This fact is evidenced by the dominance of montmorillonite clays. Soils may have a well developed profile, a weakly developed profile, or one of intermediate development, depending on the intensity of the weathering factors and the resistance of the soil material to weathering. Lester and similar soils have been exposed to greater intensities of influence of the five factors of soil formation than many of the other soils in the area, and they have moderately distinct layers or horizons. Webster soils have horizons that are less pronounced than those of the Clarion soils because they are in areas where a fluctuating water table modifies the normal effect of time. Storden soils have a very shallow profile because of the combination of a high content of carbonates and steep slopes. Rushriver soils show little or no soil development because they are associated with recent alluvial deposits (USDA, 1975).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1999). 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. The table “Classification of the Soils” in Parts I and II of this publication shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve 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 Aquoll (*Aqu*, meaning water, 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 Endoaquolls (*Endo*, meaning within, plus *aquoll*, the suborder of the Mollisols that has an aquic 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 Endoaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, 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, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Endoaquolls.

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.

Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range for the series)

Soil name	Family or higher taxonomic class
Angus	Mollic Hapludalfs, fine-loamy, mixed, mesic
Ankeny	Cumulic Hapludolls, coarse-loamy, mixed, mesic
Biscay	Typic Endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Blooming	Mollic Hapludalfs, fine-loamy, mixed, mesic
Bold	Typic Udorthents, coarse-silty, mixed (calcareous), mesic
Boone	Typic Quartzipsamments, mesic, uncoated
Brodale	Entic Hapludolls, loamy-skeletal, carbonatic, mesic
Clarion	Typic Hapludolls, fine-loamy, mixed, mesic
Collinwood	Aquertic Hapludolls, fine, montmorillonitic, mesic
Colo	Cumulic Endoaquolls, fine-silty, mixed, mesic
Copaston	Lithic Hapludolls, loamy, mixed, mesic
Cordova	Typic Argiaquolls, fine-loamy, mixed, mesic
Derrynane	Cumulic Vertic Endoaquolls, fine, montmorillonitic, mesic
Dickinson	Typic Hapludolls, coarse-loamy, mixed, mesic
Dundas	Mollic Endoaqualfs, fine-loamy, mixed, mesic
Epsom	Cumulic Epiaquolls, fine-loamy, mixed, mesic
Estherville	Typic Hapludolls, sandy, mixed, mesic
Eyota	Cumulic Hapludolls, coarse-loamy, mixed, mesic
Faxon	Typic Endoaquolls, fine-loamy, mixed, mesic
Garwin	Typic Haplaquolls, fine-silty, mixed, mesic
Glencoe	Cumulic Endoaquolls, fine-loamy, mixed, mesic
Hamel	Typic Argiaquolls, fine-loamy, mixed, mesic
Hawick	Entic Hapludolls, sandy, mixed, mesic
Hayden	Typic Hapludalfs, fine-loamy, mixed, mesic
Houghton	Typic Medisaprists, euic, mesic
Kasson	Aquollic Hapludalfs, fine-loamy, mixed, mesic
Kato	Typic Endoaquolls, fine-silty over sandy or sandy-skeletal, mixed, mesic
*Kenyon	Typic Hapludolls, fine-loamy, mixed, mesic
Kilkenny	Oxyaquic Vertic Hapludalfs, fine, montmorillonitic, mesic
Klinger	Aquic Hapludolls, fine-silty, mixed, mesic
Klossner	Terric Medisaprists, loamy, mixed, euic, mesic
Lerdal	Vertic Epiaqualfs, fine, montmorillonitic, mesic
Lester	Mollic Hapludalfs, fine-loamy, mixed, mesic
Le Sueur	Aquic Argiudolls, fine-loamy, mixed, mesic
Lindstrom	Cumulic Hapludolls, fine-silty, mixed, mesic
Littleton	Cumulic Hapludolls, fine-silty, mixed, mesic
Lowlein	Typic Hapludolls, coarse-loamy, mixed, mesic
Maxcreek	Typic Endoaquolls, fine-silty, mixed, mesic
Maxfield	Typic Haplaquolls, fine-silty, mixed, mesic
Mazaska	Vertic Argiaquolls, fine, montmorillonitic, mesic
Medo	Terric Medisaprists, loamy, mixed, euic, mesic
Merton	Aquic Hapludolls, fine-loamy, mixed, mesic
Minneiska	Mollic Udifluvents, coarse-loamy, mixed (calcareous), mesic
Minneopa	Aquic Hapludolls, sandy, mixed, mesic
Moland	Typic Hapludolls, fine-loamy, mixed, mesic
Muskego	Limnic Medisaprists, coprogenous, euic, mesic
Nerwoods	Aquic Hapludolls, fine-silty, mixed, mesic
Nicollet	Aquic Hapludolls, fine-loamy, mixed, mesic
Okoboji	Cumulic Vertic Endoaquolls, fine, montmorillonitic, mesic
Port Byron	Typic Hapludolls, fine-silty, mixed, mesic
Prinsburg	Typic Endoaquolls, fine-silty, mixed (calcareous), mesic
Racine	Mollic Hapludalfs, fine-loamy, mixed, mesic
Renova	Typic Hapludalfs, fine-loamy, mixed, mesic
Ripon	Typic Argiudolls, fine-silty, mixed, mesic
Rolfe	Typic Argialbolls, fine, montmorillonitic, mesic
Rushriver	Mollic Fluvaquents, coarse-loamy, mixed (calcareous), mesic
Sargeant	Aeric Glossaqualfs, fine-loamy, mixed, mesic
Shields	Vertic Epiaqualfs, fine, montmorillonitic, mesic

Classification of the Soils--Continued

Soil name	Family or higher taxonomic class
Storden	Typic Eutrochrepts, fine-loamy, mixed, mesic
Talcot	Typic Endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic
Terril	Cumulic Hapludolls, fine-loamy, mixed, mesic
Timula	Typic Eutrochrepts, coarse-silty, mixed, mesic
Wadena	Typic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Waukegan	Typic Hapludolls, fine-silty over sandy or sandy-skeletal, mixed, mesic
Webster	Typic Endoaquolls, fine-loamy, mixed, mesic

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
4D	Renova loam, 12 to 18 percent slopes	200	*
4E	Renova loam, 18 to 30 percent slopes	2,542	0.8
17	Minneopa sandy loam, 0 to 2 percent slopes, rarely flooded	324	*
24	Kasson silt loam, 1 to 3 percent slopes	1,157	0.4
39A	Wadena loam, 0 to 2 percent slopes	1,083	0.3
41A	Estherville sandy loam, 0 to 2 percent slopes	2,205	0.7
41B	Estherville sandy loam, 2 to 6 percent slopes	2,006	0.6
44	Ankeny sandy loam, 0 to 3 percent slopes	750	0.2
74B	Dickinson fine sandy loam, 1 to 6 percent slopes	1,151	0.3
81B	Boone loamy fine sand, 1 to 6 percent slopes	278	*
81D	Boone loamy fine sand, 6 to 18 percent slopes	486	0.1
81E	Boone loamy fine sand, 18 to 25 percent slopes	417	0.1
98	Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded	2,188	0.7
99D2	Racine loam, 12 to 18 percent slopes, eroded	833	0.3
100A	Copaston sandy clay loam, 0 to 2 percent slopes	63	*
102B	Clarion loam, moderately fine substratum, 2 to 5 percent slopes	1,833	0.6
104B	Hayden loam, 2 to 6 percent slopes	10,084	3.1
104C2	Hayden loam, 6 to 12 percent slopes, eroded	8,021	2.4
104D2	Hayden loam, 12 to 18 percent slopes, eroded	2,041	0.6
104E	Hayden loam, 18 to 25 percent slopes	519	0.2
106C2	Lester loam, 6 to 12 percent slopes, eroded	13,367	4.0
106D2	Lester loam, 12 to 18 percent slopes, eroded	6,486	2.0
106E	Lester loam, 18 to 25 percent slopes	3,631	1.1
109	Cordova clay loam, 0 to 2 percent slopes	6,494	2.0
113	Webster clay loam, 0 to 2 percent slopes	1,352	0.4
114	Glencoe clay loam, depressional, 0 to 1 percent slopes	7,650	2.3
130	Nicollet clay loam, 1 to 3 percent slopes	852	0.3
134	Okoboji silty clay loam, depressional, 0 to 1 percent slopes	4,041	1.2
138B	Lerdal clay loam, 2 to 6 percent slopes	8,165	2.5
138C	Lerdal clay loam, 6 to 12 percent slopes	853	0.3
176	Garwin silt loam, 0 to 2 percent slopes	895	0.3
208	Kato silty clay loam, 0 to 1 percent slopes	1,108	0.3
213B	Klinger silty clay loam, 1 to 4 percent slopes	2,267	0.7
219	Rolfe silt loam, depressional, 0 to 1 percent slopes	398	0.1
238B	Kilkenny loam, 2 to 6 percent slopes	3,726	1.1
238C2	Kilkenny clay loam, 6 to 12 percent slopes, eroded	6,025	1.8
238D2	Kilkenny clay loam, 12 to 18 percent slopes, eroded	3,739	1.1
238E	Kilkenny clay loam, 18 to 25 percent slopes	1,261	0.4
238F	Kilkenny loam, 25 to 35 percent slopes	210	*
239	Le Sueur clay loam, 1 to 3 percent slopes	5,659	1.7
253	Maxcreek silty clay loam, 0 to 1 percent slopes	4,521	1.4
256	Mazaska clay loam, 0 to 2 percent slopes	4,705	1.4
285A	Port Byron silt loam, 0 to 2 percent slopes	141	*
285B	Port Byron silt loam, 2 to 6 percent slopes	931	0.3
301B	Lindstrom silt loam, 2 to 6 percent slopes	2,710	0.8
301C	Lindstrom silt loam, 6 to 12 percent slopes	585	0.2
307	Sargeant silt loam, 0 to 2 percent slopes	762	0.2
323	Shields silty clay loam, 0 to 2 percent slopes	1,303	0.4
376B	Moland silt loam, 1 to 4 percent slopes	9,560	2.9
377	Merton silt loam, 1 to 3 percent slopes	6,359	1.9
378	Maxfield silty clay loam, 0 to 2 percent slopes	9,532	2.9
382B	Blooming silt loam, 2 to 6 percent slopes	7,766	2.4
382C2	Blooming silt loam, 6 to 12 percent slopes, eroded	2,165	0.7
392	Biscay loam, 0 to 2 percent slopes	1,643	0.5
408	Faxon clay loam, 0 to 1 percent slopes	122	*
411A	Waukegan silt loam, 0 to 2 percent slopes	6,096	1.8
411B	Waukegan silt loam, 2 to 6 percent slopes	1,118	0.3
414	Hamel loam, 1 to 3 percent slopes	14,914	4.5
463A	Minneiska fine sandy loam, 0 to 2 percent slopes, occasionally flooded	217	*
484D	Eyota fine sandy loam, 12 to 18 percent slopes	439	0.1
523	Houghton muck, depressional, 0 to 1 percent slopes	2,784	0.8

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
525	Muskego muck, depressional, 0 to 1 percent slopes	515	0.2
528B	Klossner muck, seep land, 1 to 6 percent slopes	349	0.1
529A	Ripon silt loam, 0 to 2 percent slopes	120	*
529B	Ripon silt loam, 2 to 6 percent slopes	291	*
548	Medo muck, depressional, 0 to 1 percent slopes	397	0.1
572	Lowlein sandy loam, 1 to 5 percent slopes	541	0.2
611D	Hawick sandy loam, 12 to 25 percent slopes	1,707	0.5
757	Nerwoods loam, 2 to 6 percent slopes	4,393	1.3
761	Epsom silty clay loam, 0 to 2 percent slopes, frequently flooded	4,805	1.5
764	Klossner muck, 0 to 1 percent slopes, flooded	862	0.3
783C2	Lester-Kilkenny complex, 6 to 12 percent slopes, eroded	3,513	1.1
783D2	Lester-Kilkenny complex, 12 to 18 percent slopes, eroded	2,602	0.8
783E	Lester-Kilkenny complex, 18 to 25 percent slopes	1,379	0.4
783F	Lester-Kilkenny complex, 25 to 35 percent slopes	294	*
849B	Urban land-Estherville complex, 1 to 6 percent slopes	1,741	0.5
860C	Urban land-Hayden complex, 6 to 15 percent slopes	59	*
875B	Hawick-Estherville complex, 2 to 6 percent slopes	2,781	0.8
875C	Hawick-Estherville complex, 6 to 12 percent slopes	3,211	1.0
945C2	Lester-Storden complex, 6 to 12 percent slopes, eroded	2,723	0.8
945D2	Lester-Storden complex, 12 to 18 percent slopes, eroded	814	0.2
963C2	Timula-Bold complex, 6 to 12 percent slopes, eroded	1,191	0.4
963D2	Timula-Bold complex, 12 to 18 percent slopes, eroded	199	*
1013	Pits, quarry	31	*
1016	Udorthents, loamy (cut and fill land)	1,726	0.5
1030	Pits, gravel-Udipsamments complex	1,149	0.3
1058	Houghton and Muskego soils, ponded, 0 to 1 percent slopes	12,862	3.9
1080	Klossner, Okoboji, and Glencoe soils, ponded, 0 to 1 percent slopes	5,359	1.6
1116F	Brodale-Eyota complex, 12 to 35 percent slopes	2,258	0.7
1286	Prinsburg silty clay loam, 0 to 2 percent slopes	1,657	0.5
1356	Water, miscellaneous	27	*
1360	Rushriver fine sandy loam, 0 to 1 percent slopes, frequently flooded	2,524	0.8
1361	Le Sueur loam, moderately coarse substratum, 1 to 3 percent slopes	2,151	0.7
1362B	Angus loam, 2 to 5 percent slopes	18,230	5.5
1363	Dundas silt loam, moderately coarse substratum, 0 to 2 percent slopes	1,551	0.5
1366	Talcot silty clay loam, 0 to 1 percent slopes	491	0.1
1367	Derrynane clay loam, 1 to 3 percent slopes	5,603	1.7
1387A	Collinwood silty clay loam, moderately wet, 0 to 3 percent slopes	222	*
1388B	Terril loam, moderately wet, 2 to 6 percent slopes	2,291	0.7
1408B	Angus-Kilkenny complex, 2 to 6 percent slopes	1,743	0.5
1409A	Kenyon silt loam, moderately wet, 0 to 3 percent slopes	4,868	1.5
1409B	Kenyon silt loam, moderately wet, 3 to 6 percent slopes	3,760	1.1
1410B	Racine silt loam, moderately wet, 2 to 6 percent slopes	3,850	1.2
1410C	Racine silt loam, moderately wet, 6 to 12 percent slopes, eroded	4,044	1.2
1411B	Urban land-Hayden-Estherville complex, 1 to 6 percent slopes	522	0.2
1413B	Littleton silt loam, till substratum, 1 to 4 percent slopes	5,873	1.8
1416C	Renova loam, moderately wet, 6 to 12 percent slopes	194	*
1437B	Renova silt loam, moderately wet, 2 to 6 percent slopes	353	0.1
1501	Klossner mucky silty clay loam, overwash, 0 to 1 percent slopes	2,278	0.7
1831	Colo silt loam, channeled, 0 to 2 percent slopes, frequently flooded	1,631	0.5
1962	Mazaska-Rolfe complex, 0 to 2 percent slopes	1,512	0.5
W	Water	12,120	3.7
	Total	330,100	100.0

* Less than 0.1 percent.

Soil Series and Detailed Soil Map Units

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each series description is followed by descriptions of the associated detailed soil map units.

Characteristics of the soil and the material in which it formed are identified for each soil 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” (USDA, 1993). Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” (USDA, 1999). 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 on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given in Part II of this survey.

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. 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 other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some “included” areas that belong to other taxonomic classes.

Most included soils have properties 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, or similar, inclusions. They may or may not be mentioned in the map unit descriptions. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they 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 the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes 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 if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit. The principal hazards and limitations to be considered in planning for specific uses are described in Part II of this survey.

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

Soils of one series can differ in texture of the surface layer or of the underlying layers. 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, Le Sueur loam, moderately coarse substratum, 1 to 3 percent slopes, is a phase of the Le Sueur series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Mazaska-Rolfe complex, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Houghton and Muskego soils, ponded, 0 to 1 percent slopes, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The map unit Pits, quarry, is an example.

The table “Acreage and Proportionate Extent of the Soils” in Parts I and II of this survey gives the acreage and proportionate extent of each map unit. Other tables (see Contents) 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 or miscellaneous areas.

Angus Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 2 to 5 percent
Taxonomic classification: Fine-loamy, mixed, mesic Mollic Hapludalfs

Typical Pedon

Angus loam, 2 to 5 percent slopes, 1,275 feet north and 2,200 feet west of the southeast corner of sec. 7, T. 109 N., R. 22 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; about 2 percent gravel; neutral; clear smooth boundary.

Bt1—9 to 16 inches; brown (10YR 4/3) clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; about 1 percent gravel; neutral; gradual smooth boundary.

Bt2—16 to 25 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; about 2 percent gravel; neutral; gradual smooth boundary.

Bt3—25 to 34 inches; olive brown (2.5Y 4/4) clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; common faint dark grayish brown (10YR 4/2) clay films on faces of peds and in pores; about 3 percent gravel; neutral; gradual smooth boundary.

Bt4—34 to 42 inches; olive brown (2.5Y 4/4) clay loam; few fine prominent strong brown (7.5YR 5/8) iron concentrations; moderate medium subangular blocky structure; common faint dark grayish brown (10YR 4/2) clay films on faces of peds and in pores; few black (N 2/0) manganese concentrations in pores; about 2 percent gravel; about 2 percent cobbles; neutral; clear wavy boundary.

Bk1—42 to 51 inches; olive brown (2.5Y 4/4) loam; few medium faint grayish brown (2.5Y 5/2) iron depletions; weak coarse subangular blocky structure parting to weak medium subangular blocky; many white (2.5Y 8/2) soft masses of calcium carbonates; slightly effervescent; about 3 percent gravel; about 2 percent cobbles; slightly alkaline; gradual wavy boundary.

Bk2—51 to 64 inches; olive brown (2.5Y 4/4) loam; common fine prominent strong brown ((7.5YR 5/8) and few fine faint grayish brown (2.5Y 5/2) iron depletions; weak coarse subangular blocky structure parting to weak fine subangular blocky; many white (2.5Y 8/2) soft accumulations of calcium carbonate; few black (N 2/0) manganese concentrations in pores; strongly effervescent; about 3 percent gravel; about 2 percent cobbles; moderately alkaline; gradual wavy boundary.

Bk3—64 to 80 inches; olive brown (2.5Y 4/4) loam; many medium distinct olive yellow (2.5Y 6/8) iron concentrations; weak coarse subangular blocky structure parting to weak fine subangular blocky; many white (2.5Y 8/2) soft accumulations of

calcium carbonate; few black (N 2/0) manganese concentrations in pores; violently effervescent; about 4 percent gravel; about 2 percent cobbles; moderately alkaline.

Range in Characteristics

Depth to carbonates: 28 to 45 inches
Thickness of the mollic epipedon: 7 to 15 inches
Content of rock fragments: 1 to 8 percent gravel; 0 to 2 percent cobbles

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—2
Texture—loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—clay loam or loam

Bk horizon:
Hue—2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—loam or clay loam

1362B—Angus loam, 2 to 5 percent slopes

Composition

Angus and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Lester and similar soils
- Le Sueur and similar soils
- Cordova and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

1408B—Angus-Kilkenny complex, 2 to 6 percent slopes

Composition

Angus and similar soils: About 50 percent
Kilkenny and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Angus—summits; Kilkenny—shoulders and summits
Slope range: Angus—2 to 5 percent; Kilkenny—2 to 6 percent

Component Description

Angus

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.1 inches
Organic matter content: Moderate

Kilkenny

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lester and similar soils
- Lerdal and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Ankeny Series

Drainage class: Well drained
Permeability: Moderately rapid
Landform: Outwash plains and terraces
Parent material: Alluvium or colluvium
Slope range: 0 to 3 percent
Taxonomic classification: Coarse-loamy, mixed, mesic Cumulic Hapludolls

Typical Pedon

Ankeny sandy loam, 0 to 3 percent slopes, 1,600 feet north and 550 feet east of the southwest corner of sec. 34, T. 111 N., R. 20 W.

A1—0 to 7 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; slightly acid; gradual smooth boundary.

A2—7 to 17 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; gradual smooth boundary.

A3—17 to 22 inches; black (10YR 2/1) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; clear smooth boundary.

A4—22 to 27 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bw—27 to 44 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; weak medium subangular blocky structure; slightly effervescent; slightly alkaline; gradual smooth boundary.

2C1—44 to 56 inches; brown (10YR 4/3) loamy sand; single grain; loose; slightly effervescent; slightly alkaline; gradual wavy boundary.

2C2—56 to 80 inches; grayish brown (10YR 5/2) loamy fine sand; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 16 to more than 65 inches
Thickness of the mollic epipedon: 27 to 51 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam, fine sandy loam, or loam

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—3
Texture—fine sandy loam or sandy loam

2C horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loamy sand, loamy fine sand, sandy loam, or fine sandy loam

44—Ankeny sandy loam, 0 to 3 percent slopes

Composition

Ankeny and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Footslopes and toeslopes
Slope range: 0 to 3 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium

Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Terril, moderately wet, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Biscay Series

Drainage class: Poorly drained
Permeability: Upper part—moderate; lower part—rapid or very rapid
Landform: Flats and swales on outwash plains and terraces
Parent material: Alluvium and outwash
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Endoaquolls

Typical Pedon

Biscay loam, 0 to 2 percent slopes, 1,250 feet north and 2,200 feet east of the southwest corner of sec. 22, T. 109 N., R. 22 W.

Ap—0 to 8 inches; black (N 2/0) loam, black (10YR 2/1) dry; weak fine granular structure; neutral; abrupt wavy boundary.
A—8 to 15 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; neutral; clear wavy boundary.
AB—15 to 20 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (2.5Y 4/2) loam; few fine distinct light olive brown (2.5Y 5/4) and few fine faint strong brown (7.5YR 5/6) iron concentrations; weak fine subangular blocky structure; neutral; clear wavy boundary.
Bg—20 to 25 inches; dark grayish brown (2.5Y 4/2) loam; many fine distinct yellowish brown (10YR 5/6) and few fine faint strong brown (7.5YR 5/6) iron concentrations; weak fine subangular blocky structure; about 3 percent gravel; neutral; abrupt wavy boundary.
BCg—25 to 33 inches; grayish brown (2.5Y 5/2) sandy loam; many fine distinct light olive brown (2.5Y 5/4) iron concentrations; massive; loose; about 3 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.
2Cg—33 to 80 inches; grayish brown (2.5Y 5/2) gravelly coarse sand; many fine distinct light olive brown (2.5Y 5/4) iron concentrations and light brownish gray (2.5Y 6/2) iron depletions; single grain; loose; about 15 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 36 to 58 inches
Thickness of the mollic epipedon: 15 to 35 inches

Ap or A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—loam
Content of rock fragments—none

AB horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 or 2
Texture—loam or clay loam
Content of rock fragments—0 to 3 percent gravel

Bg horizon:
Hue—2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—loam or clay loam
Content of rock fragments—0 to 5 percent gravel

BCg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 to 3
Texture—clay loam, loam, sandy clay loam, sandy loam, or the gravelly analogs of these textures
Content of rock fragments—0 to 5 percent gravel

2Cg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—gravelly coarse sand, coarse sand, loamy sand, or sand
Content of rock fragments—5 to 30 percent

392—Biscay loam, 0 to 2 percent slopes

Composition

Biscay and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Flats and swales on outwash plains and terraces
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium and outwash
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Talcot and similar soils
- Estherville and similar soils
- Kato and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Blooming Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Eolian deposits over till
Slope range: 2 to 12 percent
Taxonomic classification: Fine-loamy, mixed, mesic Mollic Hapludalfs

Typical Pedon

Blooming silt loam, 2 to 6 percent slopes, 2,400 feet south and 800 feet east of the northwest corner of sec. 33, T. 109 N., R. 19 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; slightly acid; abrupt wavy boundary.

Bt1—9 to 13 inches; dark yellowish brown (10YR 4/4) silt loam; moderate very fine subangular blocky structure; many fine and medium pores; many distinct dark brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—13 to 19 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure; many fine to large pores; few distinct dark brown (10YR 4/3) clay films on faces of peds; slightly acid; abrupt wavy boundary.

2Bt3—19 to 30 inches; yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; common fine and medium pores; few distinct dark brown (10YR 4/3) clay films on faces of peds; about 4 percent gravel; slightly acid; clear wavy boundary.

2Bt4—30 to 38 inches; yellowish brown (10YR 5/4) clay loam; moderate fine prismatic structure parting to weak fine subangular blocky; common fine and medium pores; many distinct dark brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

2Bk1—38 to 44 inches; light olive brown (2.5Y 5/4) loam; weak coarse prismatic structure; common fine pores; 5 percent gravel; neutral; clear wavy boundary.

2Bk2—44 to 80 inches; yellowish brown (10YR 5/6) loam; massive; few pale yellow (2.5Y 8/3) segregated lime masses; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 35 to 65 inches
Thickness of the mollic epipedon: 6 to 9 inches
Content of rock fragments: 0 to 1 percent in the upper part; 2 to 6 percent gravel in the lower part

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 5
Texture—silt loam or silty clay loam

2Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—clay loam, sandy clay loam, or loam

2Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—4 to 6
Texture—loam

382B—Blooming silt loam, 2 to 6 percent slopes

Composition

Blooming and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Eolian deposits over till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Littleton, till substratum, and similar soils
- Garwin and similar soils
- Maxfield and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

382C2—Blooming silt loam, 6 to 12 percent slopes, eroded

Composition

Blooming and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Eolian deposits over till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Littleton, till substratum, and similar soils
- Garwin and similar soils
- Maxfield and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Bold Series

Drainage class: Well drained
Permeability: Moderate
Landform: Upland ridges
Parent material: Loess
Slope range: 6 to 18 percent
Taxonomic classification: Coarse-silty, mixed (calcareous), mesic Typic Udorthents

Typical Pedon

Bold silt loam, in an area of Timula-Bold complex, 12 to 18 percent slopes, eroded, 2,600 feet south and 1,440 feet west of the northeast corner of sec. 22, T. 111 N., R. 19 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; violently effervescent; strongly alkaline; abrupt smooth boundary.

A—8 to 12 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very many fine to large tubular pores; many light yellowish brown (10YR 6/4) masses of calcium carbonate; many mixings of dark grayish brown (10YR 4/2) wormcasts; violently effervescent; strongly alkaline; clear wavy boundary.

C1—12 to 24 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; many fine to large tubular pores; common light yellowish brown (10YR 6/4) masses of calcium carbonate; violently effervescent; strongly alkaline; clear wavy boundary.

C2—24 to 80 inches; yellowish brown (10YR 5/4) silt loam; weak fine granular structure; many fine to large tubular pores; common light yellowish brown (10YR 6/4) masses of calcium carbonate; violently effervescent; strongly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 18 inches
Content of rock fragments: None

Ap or A horizon:
Hue—10YR
Value—4 to 6
Chroma—2 or 3
Texture—silt loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—silt loam or very fine sandy loam

Boone Series

Drainage class: Excessively drained
Permeability: Rapid
Landform: Structural benches
Parent material: Sandstone residuum
Slope range: 1 to 25 percent
Taxonomic classification: Mesic, uncoated Typic Quartzipsamments

Typical Pedon

Boone loamy fine sand, 1 to 6 percent slopes, 2,150 feet north and 100 feet west of the southeast corner of sec. 10, T. 111 N., R. 19 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, light brownish gray (10YR 6/2) dry; very weak medium granular structure parting to very weak fine granular; slightly acid; gradual smooth boundary.

Bw—8 to 15 inches; brown (10YR 4/3) fine sand; very weak fine granular structure; moderately acid; gradual smooth boundary.

C1—15 to 24 inches; pale brown (10YR 6/3) fine sand; single grain; slightly acid; gradual smooth boundary.

C2—24 to 38 inches; light gray (10YR 7/2) fine sand; single grain; many fine distinct brownish yellow (10YR 6/6) iron concentrations; strongly acid; clear smooth boundary.

Cr—38 to 80 inches; white (10YR 8/1), weathered bedrock; moderately acid.

Range in Characteristics

Ap horizon:
Hue—10YR
Value—3
Chroma—2 or 3
Texture—loamy fine sand

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—fine sand

C horizon:
Hue—10YR
Value—6 or 7
Chroma—2 or 3
Texture—fine sand

81B—Boone loamy fine sand, 1 to 6 percent slopes

Composition

Boone and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Structural benches
Position on the landform: Summits and backslopes
Slope range: 1 to 6 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Excessively drained
Dominant parent material: Sandstone residuum
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 2.9 inches
Organic matter content: Low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Copaston and similar soils
- Eyota and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

81D—Boone loamy fine sand, 6 to 18 percent slopes

Composition

Boone and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Structural benches
Position on the landform: Backslopes and shoulders
Slope range: 6 to 18 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Excessively drained
Dominant parent material: Sandstone residuum
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 2.8 inches
Organic matter content: Low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Copaston and similar soils
- Eyota and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

81E—Boone loamy fine sand, 18 to 25 percent slopes

Composition

Boone and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Structural benches
Position on the landform: Backslopes and shoulders
Slope range: 18 to 25 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Excessively drained
Dominant parent material: Sandstone residuum
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 1.9 inches
Organic matter content: Low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Copaston and similar soils
- Eyota and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Brodale Series

Drainage class: Excessively drained
Permeability: Moderate
Landform: Structural benches
Parent material: Limestone residuum
Slope range: 15 to 35 percent
Taxonomic classification: Loamy-skeletal, carbonatic, mesic Entic Hapludolls

Typical Pedon

Brodale flaggy loam, in an area of Brodale-Eyota complex, 12 to 35 percent slopes, 1,200 feet north and 950 feet west of the southeast corner of sec. 36, T. 112 N., R. 19 W.

A1—0 to 3 inches; black (10YR 2/1) flaggy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; many white (N 8/0) calcium carbonate coatings on rock fragments; about 20 percent flagstones; slightly alkaline; clear smooth boundary.

A2—3 to 7 inches; very dark brown (10YR 2/2) extremely flaggy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; common white (N 8/0) calcium carbonate coatings on rock fragments; about 10 percent channers; 70 percent flagstones; moderately alkaline; clear smooth boundary.

A3—7 to 11 inches; very dark grayish brown (10YR 3/2) extremely flaggy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; many white (N 8/0) calcium carbonate coatings on rock fragments; about 2 percent channers; 80 percent flagstones; moderately alkaline; clear wavy boundary.

C1—11 to 15 inches; dark brown (10YR 4/3) very flaggy loam; weak fine subangular blocky structure; very many white (N 8/0) calcium carbonate coatings on rock fragments; about 20 percent channers; about 25 percent flagstones; strongly alkaline; gradual wavy boundary.

C2—15 to 22 inches; yellowish brown (10YR 5/6) cobbly loam; weak medium subangular blocky structure parting to weak fine subangular blocky; very many white (N 8/0) calcium carbonate coatings on rock fragments; about 10 percent gravel; 15 percent cobbles; strongly alkaline; gradual wavy boundary.

C3—22 to 47 inches; olive yellow (2.5Y 6/6) loam; many fine distinct brownish yellow (10YR 6/8) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; very many white (N 8/0) calcium carbonate coatings on rock fragments; about 5 percent gravel and channers; 5 percent flagstones and cobbles; strongly alkaline; clear smooth boundary.

R—47 inches; yellow (2.5Y 7/6), weathered bedrock.

Range in Characteristics

Carbonates: Throughout the profile
Thickness of the mollic epipedon: 7 to 13 inches
Content of rock fragments: 10 to 85 percent flagstones, channers, and gravel

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—flaggy loam or extremely flaggy loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—loam, flaggy loam, very flaggy loam, extremely flaggy loam, cobbly loam, very cobbly loam, or extremely cobbly loam

1116F—Brodale-Eyota complex, 12 to 35 percent slopes

Composition

Brodale and similar soils: About 55 percent
Eyota and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Structural benches
Position on the landform: Brodale—shoulders and summits; Eyota—footslopes
Slope range: Brodale—15 to 35 percent; Eyota—12 to 35 percent

Component Description

Brodale

Surface layer texture: Flaggy loam
Depth class: Deep (40 to 60 inches)
Drainage class: Excessively drained
Dominant parent material: Limestone residuum
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.1 inches
Organic matter content: Moderate

Eyota

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)

Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.0 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Copaston and similar soils
- Boone and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Clarion Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 2 to 5 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Hapludolls

Typical Pedon

Clarion loam, moderately fine substratum, 2 to 5 percent slopes, 2,400 feet north and 600 feet west of the southeast corner of sec. 34, T. 109 N., R. 21 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; about 1 percent gravel; slightly acid; abrupt smooth boundary.

Bw1—10 to 15 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; about 1 percent gravel; slightly acid; clear wavy boundary.

Bw2—15 to 22 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; about 2 percent gravel; slightly acid; clear wavy boundary.

Bw3—22 to 34 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; about 5 percent gravel; slightly acid; clear wavy boundary.

Bw4—34 to 44 inches; brown (10YR 5/3) loam; common fine distinct yellowish brown (10YR 5/6) iron concentrations; weak coarse subangular blocky structure; about 6 percent gravel; neutral; abrupt smooth boundary.

C—44 to 80 inches; light olive brown (2.5Y 5/4) and light yellowish brown (2.5Y 6/4) loam; common medium distinct grayish brown (2.5Y 5/2) iron depletions; massive with oblique partings; few gray (10YR 6/1) calcium carbonate segregations; about 7 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 25 to 40 inches
Thickness of the mollic epipedon: 10 to 20 inches
Content of rock fragments: 1 to 8 percent gravel

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—loam or clay loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 or 4
Texture—loam or clay loam

102B—Clarion loam, moderately fine substratum, 2 to 5 percent slopes

Composition

Clarion and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Dominant parent material: Till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.1 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Nicollet and similar soils
- Webster and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Collinwood Series

Drainage class: Somewhat poorly drained
Permeability: Moderately slow or slow
Landform: Moraines
Parent material: Lacustrine deposits
Slope range: 0 to 3 percent
Taxonomic classification: Fine, montmorillonitic, mesic Aquertic Hapludolls

Typical Pedon

Collinwood silty clay loam, moderately wet, 0 to 3 percent slopes, 1,400 feet north and 2,475 feet west of the southeast corner of sec. 29, T. 109 N., R. 21 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; moderately acid; abrupt smooth boundary.

A—10 to 14 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; common black (10YR 2/1) organic coatings on faces of peds; moderately acid; abrupt wavy boundary.

Bw1—14 to 25 inches dark grayish brown (10YR 4/2) silty clay; moderate fine subangular blocky structure; moderately acid; clear smooth boundary.

Bw2—25 to 29 inches; olive brown (2.5Y 4/3) silty clay; few fine faint dark grayish brown (2.5Y 4/2) iron depletions; moderate fine subangular blocky structure; slightly acid; clear smooth boundary.

Bw3—29 to 41 inches; light olive brown (2.5Y 5/3) silty clay; common fine faint grayish brown (2.5Y 5/2) iron depletions; moderate medium subangular blocky structure; slightly acid; clear wavy boundary.

Bk—41 to 80 inches; light olive brown (2.5Y 5/3) silty clay; many coarse faint grayish brown (2.5Y 5/2) iron depletions; moderate medium subangular blocky structure; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: More than 60 inches
Thickness of the mollic epipedon: 14 to 24 inches
Content of rock fragments: No coarse fragments throughout the profile

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silty clay loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—2 or 3
Texture—silty clay

Bk horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 or 3
Texture—silty clay or silty clay loam

1387A—Collinwood silty clay loam, moderately wet, 0 to 3 percent slopes

Composition

Collinwood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 0 to 3 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Lacustrine deposits
Flooding: None

Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Derrynane and similar soils
- Okoboji and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Colo Series

Drainage class: Poorly drained
Permeability: Moderate
Landform: Flats and swales on flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Taxonomic classification: Fine-silty, mixed, mesic Cumulic Endoaquolls

Typical Pedon

Colo silt loam, channeled, 0 to 2 percent slopes, frequently flooded, 2,200 feet south and 900 feet west of the northeast corner of sec. 14, T. 111 N., R. 19 W.

A1—0 to 5 inches; black (N 2/0) silt loam, very dark gray (10YR 3/1) dry; weak fine granular structure; moderately acid; clear smooth boundary.
A2—5 to 23 inches; black (N 2/0) silt loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; moderately acid; gradual smooth boundary.
A3—23 to 37 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; gradual smooth boundary.
A4—37 to 80 inches; black (5Y 2.5/1) silty clay loam, very dark grayish brown (2.5Y 3/2) dry; weak coarse subangular blocky structure parting to weak medium subangular blocky; slightly acid.

Range in Characteristics

Depth to carbonates: More than 60 inches
Thickness of the mollic epipedon: 36 to more than 80 inches
Content of rock fragments: No coarse fragments throughout the profile

A horizon:
Hue—10YR or neutral in the upper part; 2.5Y or 5Y in the lower part
Value—2 or 3
Chroma—0 or 1
Texture—silt loam or silty clay loam

98—Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded

Composition

Colo and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on flood plains
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Flooding: Occasional
Water table: At the surface to 1 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Epsom and similar soils
- Biscay and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

1831—Colo silt loam, channeled, 0 to 2 percent slopes, frequently flooded

Composition

Colo and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Flats and swales on flood plains
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Flooding: Frequent
Water table: At the surface to 1 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 12.3 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rushriver and similar soils
- Garwin and similar soils
- Minneiska and similar soils

Copaston Series

Drainage class: Well drained
Permeability: Moderate or moderately rapid
Landform: Structural benches
Parent material: Limestone residuum
Slope range: 0 to 2 percent
Taxonomic classification: Loamy, mixed, mesic Lithic Hapludolls

Typical Pedon

Copaston sandy clay loam, 0 to 2 percent slopes, 1,740 feet north and 1,660 feet west of the southeast corner of sec. 2, T. 111 N., R. 20 W.

A—0 to 7 inches; very dark brown (10YR 2/2) sandy clay loam, very dark grayish brown (10YR 3/2) dry; weak very fine subangular blocky structure; friable; about 2 percent gravel; neutral; clear smooth boundary.
AB—7 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; about 2 percent gravel; moderately acid; clear wavy boundary.
Bw—11 to 18 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; friable; dark brown (10YR 3/3) coatings on faces of peds; about 5 percent gravel; slightly acid; abrupt wavy boundary.
2R—18 inches; light gray (10YR 7/1), slightly weathered limestone.

Range in Characteristics

Carbonates: Typically none throughout
Thickness of the mollic epipedon: 3 to 5 inches
Content of rock fragments: Typically no coarse fragments throughout the profile

A horizon:
Hue—10YR
Value—2 or 3
Chroma—2
Texture—sandy clay loam

AB horizon:
Hue—10YR
Value—2 to 4
Chroma—2 or 3
Texture—fine sandy loam, sandy loam, sandy clay loam, or loam

Bw horizon:
Hue—10YR
Value—4
Chroma—2 to 4
Texture—sandy loam

100A—Copaston sandy clay loam, 0 to 2 percent slopes

Composition

Copaston and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Structural benches
Position on the landform: Summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Sandy clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Flooding: None

Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Boone and similar soils
- Eyota and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Cordova Series

Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Moraines
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Argiaquolls

Typical Pedon

Cordova clay loam, 0 to 2 percent slopes, 1,340 feet north and 2,580 feet east of the southwest corner of sec. 24, T. 112 N., R. 21 W.

Ap—0 to 10 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; about 1 percent gravel; moderately acid; abrupt wavy boundary.

A—10 to 13 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; about 1 percent gravel; common thin discontinuous dark gray (10YR 4/1) porous coatings on faces of peds; moderately acid; abrupt wavy boundary.

Btg1—13 to 18 inches; dark olive gray (5Y 3/2) clay loam, olive gray (5Y 5/2) dry; moderate fine angular blocky structure; friable; about 1 percent gravel; many thick black (10YR 2/1) clay films on faces of peds; moderately acid; clear wavy boundary.

Btg2—18 to 26 inches; olive gray (5Y 4/2) clay loam; common fine distinct yellowish brown (10YR 5/8) iron concentrations; moderate medium subangular blocky structure; firm; about 1 percent gravel; many thin very dark gray (10YR 3/1) clay films on faces of peds; moderately acid; clear wavy boundary.

Btg3—26 to 36 inches; olive gray (5Y 5/2) clay loam; common fine distinct yellowish brown (10YR 5/8) iron concentrations; weak medium prismatic structure parting to moderate medium subangular blocky; firm; about 1 percent gravel; common thin very dark gray (10YR 3/1) clay films on faces of peds; moderately acid; clear wavy boundary.

Cg—36 to 60 inches; olive gray (5Y 5/2) loam; common medium distinct yellowish brown (10YR 5/8) iron concentrations; massive; friable; about 2 percent gravel; few black (10YR 2/1) fillings in root channels; slightly alkaline; strongly effervescent.

Range in Characteristics

Depth to carbonates: 24 to 50 inches
Thickness of the mollic epipedon: 10 to 24 inches
Content of rock fragments: 2 to 6 percent gravel

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—clay loam

Btg horizon:
Hue—5Y or 2.5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay loam, clay loam, or loam

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam

109—Cordova clay loam, 0 to 2 percent slopes

Composition

Cordova and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Microlows
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.1 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hamel and similar soils
- Le Sueur and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Derrynane Series

Drainage class: Poorly drained
Permeability: Moderately slow or slow
Landform: Moraines
Parent material: Alluvium or colluvium and till
Slope range: 1 to 3 percent
Taxonomic classification: Fine, montmorillonitic, mesic Cumulic Vertic Endoaquolls

Typical Pedon

Derrynane clay loam, 1 to 3 percent slopes, 1,450 feet south and 900 feet west of the northeast corner of sec. 5, T. 110 N., R. 22 W.

A1—0 to 18 inches; black (10YR 2/1) clay loam, very dark grayish brown (10YR 3/2) dry; moderate medium subangular blocky structure parting to moderate fine granular; about 1 percent gravel; neutral; abrupt smooth boundary.

A2—18 to 36 inches; black (N 2/0) silty clay loam, very dark brown (10YR 2/2) dry; moderate coarse angular blocky structure parting to moderate medium angular blocky; about 1 percent gravel; neutral; gradual smooth boundary.

A3—36 to 43 inches; black (N 2/0) silty clay, black (10YR 2/1) dry; strong coarse angular blocky structure parting to strong medium angular blocky; about 1 percent gravel; neutral; clear smooth boundary.

Bg—43 to 55 inches; dark grayish brown (2.5Y 4/2) silty clay; few fine prominent strong brown (7.5YR 4/6) iron concentrations; moderate coarse angular blocky structure; common black (N 2/0) organic coatings in channels; about 1 percent gravel; neutral; gradual wavy boundary.

2BCg—55 to 80 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many medium prominent strong brown (7.5YR 4/6) iron concentrations; moderate coarse angular blocky structure; common black (N 2/0) organic coatings in channels; about 3 percent gravel; neutral.

Range in Characteristics

Carbonates: Typically none throughout
Thickness of the mollic epipedon: 25 to more than 60 inches
Content of rock fragments: 1 to 3 percent gravel

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—clay loam, silty clay, or silty clay loam

Bg horizon:
Hue—2.5Y or 10YR
Value—4 or 5
Chroma—2
Texture—silty clay, clay loam, or silty clay loam

2BCg horizon:
Hue—2.5Y or 10YR
Value—4 or 5
Chroma—2
Texture—silty clay loam, clay loam, or loam

1367—Derrynane clay loam, 1 to 3 percent slopes

Composition

Derrynane and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Footslopes
Slope range: 1 to 3 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium or colluvium and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Mazaska and similar soils
- Hamel and similar soils
- Lerdal and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Dickinson Series

Drainage class: Well drained
Permeability: Upper part—moderately rapid; lower part—rapid
Landform: Outwash plains and terraces
Parent material: Glacial outwash
Slope range: 1 to 6 percent
Taxonomic classification: Coarse-loamy, mixed, mesic Typic Hapludolls

Typical Pedon

Dickinson fine sandy loam, 1 to 6 percent slopes, 750 feet north and 1,625 feet east of the southwest corner of sec. 36, T. 111 N., R. 21 W.

A—0 to 13 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine granular; neutral; clear smooth boundary.

Bw—13 to 26 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium subangular blocky structure parting to weak fine subangular blocky; moderately acid; gradual smooth boundary.

C1—26 to 52 inches; dark yellowish brown (10YR 4/4) loamy sand; single grain; moderately acid; gradual wavy boundary.

C2—52 to 80 inches; brown (10YR 4/3) loamy coarse sand; single grain; moderately acid.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam
Content of rock fragments—none

Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—2 to 4
Texture—fine sandy loam or sandy loam
Content of rock fragments—none

C horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—loamy coarse sand, coarse sand, sand, fine sand, loamy sand, or loamy fine sand
Content of rock fragments—0 in the upper part; 5 to 15 percent in the lower part

74B—Dickinson fine sandy loam, 1 to 6 percent slopes

Composition

Dickinson and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Summits
Slope range: 1 to 6 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.1 inches

Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wadena and similar soils
- Estherville and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Dundas Series

Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Landform: Moraines
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, mesic Mollic Endoaqualfs

Typical Pedon

Dundas silt loam, moderately coarse substratum, 0 to 2 percent slopes, 200 feet south and 1,700 feet west of the northeast corner of sec. 7, T. 111 N., R. 20 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; neutral; abrupt smooth boundary.

E—9 to 15 inches; dark gray (10YR 4/1) loam, gray (10YR 6/1) dry; moderate medium subangular blocky structure parting to moderate fine subangular blocky; strongly acid; clear wavy boundary.

Btg1—15 to 20 inches; dark grayish brown (2.5Y 4/2) loam; common fine and medium distinct light olive brown (2.5Y 5/4) iron concentrations; moderate medium subangular blocky structure parting to moderate fine angular blocky; about 4 percent gravel; common medium and thick porous gray (10YR 6/1) coatings on faces of peds; few thin clay films on faces of peds; strongly acid; clear wavy boundary.

2Btg2—20 to 26 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct light olive brown (2.5Y 5/4) iron concentrations; moderate medium subangular blocky structure parting to moderate fine subangular blocky; about 4 percent gravel; few thin porous gray (10YR 6/1) coatings on faces of peds; few thin grayish brown (2.5Y 5/2) clay films on faces of peds; strongly acid; clear wavy boundary.

2Btg3—26 to 31 inches; olive (5Y 5/3) clay loam; many medium faint olive gray (5Y 5/2) iron depletions and many fine distinct yellowish brown (10YR 5/8) iron concentrations; strong medium and coarse prismatic structure parting to moderate medium and coarse angular blocky; about 4 percent gravel; thin to thick continuous very dark gray (10YR 3/1) and dark gray (10YR 4/1) clay films on faces of peds; common black (10YR 2/1) clayey fillings in root channels; few thin porous coatings on faces of peds; few dark stains and concretions; moderately acid; clear wavy boundary.

2Bw—31 to 40 inches; olive (5Y 5/4) clay loam; many medium faint olive gray (5Y 5/2) iron depletions and many medium distinct yellowish brown (10YR 5/8) iron concentrations; moderate coarse prismatic structure; about 4 percent gravel; medium and thick continuous very dark gray (10YR 3/1) and dark gray (10YR 4/1) clay films on faces of peds; common black (10YR 2/1) clayey fillings in root channels; few dark stains and concretions; moderately acid; clear wavy boundary.

2Bk—40 to 80 inches; grayish brown (2.5Y 5/2) loam; many medium faint light olive brown (2.5Y 5/4) and common fine distinct olive yellow (2.5Y 6/8) iron concentrations; massive with a few oblique partings; about 4 percent gravel; few black (10YR 2/1) clayey fillings in root channels in the upper part; few soft gray (5Y 6/1) calcium carbonate accumulations; few dark stains; violent effervescence; moderately alkaline.

Range in Characteristics

Depth to carbonates: 30 to 48 inches
Content of rock fragments: 1 to 10 percent gravel

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silt loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—1 or 2

Texture—loam, silt loam, clay loam, sandy clay loam, or fine sandy loam

Btg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 to 3
Texture—loam or clay loam

2Btg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 to 3
Texture—clay loam or loam

2Bw horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2 to 4
Texture—clay loam or loam

2Bk horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam

1363—Dundas silt loam, moderately coarse substratum, 0 to 2 percent slopes

Composition

Dundas and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hayden and similar soils
- Le Sueur, moderately coarse substratum, and similar soils
- Cordova and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Epsom Series

Drainage class: Very poorly drained
Permeability: Upper part—moderate; lower part—moderately slow
Landform: Flats and swales on flood plains
Parent material: Alluvium or colluvium and till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, mesic Cumulic Epiaquolls

Typical Pedon

Epsom silty clay loam (fig. 7), 0 to 2 percent slopes, frequently flooded, 2,460 feet south and 1,960 feet west of the northeast corner of sec. 15, T. 109 N., R. 19 W.

A1—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine granular structure; very friable; neutral; clear smooth boundary.

A2—8 to 16 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; common fine prominent strong brown (7.5YR 4/6) iron concentrations; moderate fine granular structure; friable; neutral; gradual smooth boundary.

A3—16 to 30 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; common fine prominent strong brown (7.5YR 4/6) iron concentrations; moderate medium granular structure; friable; neutral; gradual wavy boundary.

Bg1—30 to 36 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent strong brown (7.5YR 4/6) iron concentrations; weak fine subangular blocky structure; friable; neutral; clear wavy boundary.

2Bg2—36 to 42 inches; light brownish gray (2.5Y 6/2) silt loam; common medium distinct light yellowish brown (2.5Y 6/4) iron concentrations; weak fine subangular blocky structure; friable; slightly alkaline; gradual wavy boundary.

2Bg3—42 to 60 inches; light gray (2.5Y 7/2) silt loam; many medium prominent yellowish brown (10YR 5/6) iron concentrations; weak fine subangular blocky structure; firm; slightly alkaline; gradual wavy boundary.

3Cd—60 to 80 inches; light brownish gray (2.5Y 6/2) loam; common medium prominent strong brown (7.5YR 4/6) iron concentrations; massive; firm; about 2 percent gravel; slightly effervescent; slightly alkaline; about 2 percent gravel.

Range in Characteristics

Depth to carbonates: 40 to 80 inches
Thickness of the mollic epipedon: 24 to 36 inches
Content of rock fragments: 0 to 1 percent in the alluvium and loess; 2 to 15 percent gravel in the till

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 3
Texture—silty clay loam

Bg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—2 to 6
Chroma—0 to 2
Texture—silt loam, silty clay loam, or loam

2Bg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 7
Chroma—2 to 6
Texture—silt loam, loam, or clay loam

3Cd horizon:
Hue—7.5YR, 10YR, 2.5Y, 5Y, or neutral
Value—4 to 6
Chroma—1 to 4
Texture—loam, silt loam, or silty clay loam

761—Epsom silty clay loam, 0 to 2 percent slopes, frequently flooded

Composition

Epsom and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on flood plains
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium or colluvium and till
Flooding: Frequent
Water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Nerwoods and similar soils
- Maxfield and similar soils

Estherville Series

Drainage class: Somewhat excessively drained
Permeability: Upper part—moderately rapid; lower part—rapid or very rapid
Landform: Outwash plains and terraces
Parent material: Glacial outwash
Slope range: 0 to 12 percent
Taxonomic classification: Sandy, mixed, mesic Typic Hapludolls

Typical Pedon

Estherville sandy loam, 0 to 2 percent slopes, 500 feet south and 500 feet west of the northeast corner of sec. 25, T. 110 N., R. 21 W.

A1—0 to 14 inches; black (10YR 2/1) sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; neutral; abrupt smooth boundary.

A2—14 to 19 inches; black (10YR 2/1) sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; neutral; clear wavy boundary.

Bw1—19 to 27 inches; dark yellowish brown (10YR 3/4) loamy coarse sand; weak medium subangular blocky structure; about 4 percent gravel; neutral; gradual wavy boundary.

2Bw2—27 to 39 inches; brown (10YR 4/3) sand; weak medium subangular blocky structure; about 10 percent gravel; neutral; gradual wavy boundary.

2C1—39 to 48 inches; dark grayish brown (10YR 4/2)

coarse sand; single grain; about 13 percent gravel; slightly alkaline; gradual wavy boundary.

2C2—48 to 63 inches; grayish brown (10YR 5/2) very gravelly coarse sand; single grain; about 45 percent gravel; slightly alkaline; gradual wavy boundary.

2C3—63 to 80 inches; grayish brown (10YR 5/2) very gravelly coarse sand; single grain; about 40 percent gravel; slightly alkaline.

Range in Characteristics

Depth to carbonates: 15 to 40 inches
Thickness of the mollic epipedon: 7 to 20 inches
Content of rock fragments: 0 to 10 percent gravel in the upper part; 3 to 45 percent gravel in the lower part

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—3 or 4
Texture—loamy coarse sand, loamy sand, coarse sandy loam, or sandy loam

2Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—coarse sand, gravelly coarse sand, gravelly loamy coarse sand, or sand

2C horizon:
Hue—10YR
Value—4 to 6
Chroma—2 or 3
Texture—coarse sand, sand, loamy coarse sand, gravelly coarse sand, very gravelly coarse sand, gravelly loamy coarse sand, very gravelly loamy coarse sand, gravelly coarse sandy loam, or very gravelly coarse sandy loam

41A—Estherville sandy loam, 0 to 2 percent slopes

Composition

Estherville and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Kato and similar soils
- Biscay and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

41B—Estherville sandy loam, 2 to 6 percent slopes

Composition

Estherville and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Shoulders and summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash
Flooding: None

Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kato and similar soils
- Biscay and similar soils
- Storden and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Eyota Series

Drainage class: Well drained
Permeability: Moderate
Landform: Structural benches
Parent material: Alluvium or colluvium
Slope range: 12 to 35 percent
Taxonomic classification: Coarse-loamy, mixed, mesic Cumulic Hapludolls

Typical Pedon

Eyota fine sandy loam, 12 to 18 percent slopes, 1,150 feet north and 2,450 feet east of the southwest corner of sec. 1, T. 111 N., R. 19 W.

A1—0 to 12 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium granular structure parting to weak fine granular; neutral; gradual smooth boundary.
A2—12 to 23 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine granular; slightly acid; gradual smooth boundary.
A3—23 to 35 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; gradual smooth boundary.
2Bw1—35 to 43 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; gradual smooth boundary.
2Bw2—43 to 48 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; gradual smooth boundary.
3C—48 to 80 inches; dark yellowish brown (10YR 4/4) loamy fine sand; single grain; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 36 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam

2Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—loam or silt loam

3C horizon:
Hue—10YR
Value—4 to 6
Chroma—4 to 6
Texture—loamy fine sand, fine sand, sandy loam, or fine sandy loam

484D—Eyota fine sandy loam, 12 to 18 percent slopes

Composition

Eyota and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Structural benches
Position on the landform: Footslopes
Slope range: 12 to 18 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.1 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lindstrom and similar soils
- Racine and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Faxon Series

Drainage class: Poorly drained
Permeability: Moderate
Landform: Strath terraces
Parent material: Limestone residuum
Slope range: 0 to 1 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Endoaquolls

Typical Pedon

Faxon clay loam, 0 to 1 percent slopes, 1,800 feet north and 460 feet east of the southwest corner of sec. 14, T. 111 N., R. 20 W.

A1—0 to 10 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; about 1 percent gravel; very slightly effervescent; slightly alkaline; clear wavy boundary.

A2—10 to 15 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; about 1 percent gravel; slightly alkaline; clear wavy boundary.

Bg1—15 to 20 inches; dark gray (10YR 4/1) loam; many fine distinct strong brown (7.5YR 5/6) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; about 2 percent gravel; slightly alkaline; clear wavy boundary.

Bg2—20 to 26 inches; gray (5Y 5/1) fine sandy loam; many coarse prominent light olive brown (2.5Y 5/4) iron concentrations; weak medium prismatic structure; friable; about 2 percent gravel; slightly alkaline; abrupt wavy boundary.

Bg3—26 to 34 inches; greenish gray (5GY 5/1) loam; many coarse prominent strong brown (7.5YR 5/8) iron concentrations; slightly alkaline; few lime pebbles; about 5 percent gravel; abrupt smooth boundary.

2R—34 inches; hard limestone bedrock.

Range in Characteristics

Depth to carbonates: 10 to 30 inches
Thickness of the mollic epipedon: 10 to 18 inches

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—clay loam or loam

Bg horizon:
Hue—10YR, 2.5Y, 5Y, or gleyed
Value—3 to 6
Chroma—1 or 2
Texture—clay loam, loam, or fine sandy loam

408—Faxon clay loam, 0 to 1 percent slopes

Composition

Faxon and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Strath terraces
Position on the landform: Summits
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Clay loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Poorly drained
Dominant parent material: Limestone residuum
Flooding: None
Water table: At the surface to 1 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 6.2 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Estherville and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Garwin Series

Drainage class: Poorly drained
Permeability: Moderate
Landform: Moraines
Parent material: Loess
Slope range: 0 to 2 percent
Taxonomic classification: Fine-silty, mixed, mesic Typic Haplaquolls

Typical Pedon

Garwin silt loam, 0 to 2 percent slopes, 400 feet north and 2,300 feet east of the southwest corner of sec. 5, T. 109 N., R. 19 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine granular structure; moderately acid; abrupt wavy boundary.
A—8 to 15 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine angular blocky structure parting to moderate very fine granular; moderately acid; clear wavy boundary.
Bg1—15 to 22 inches; dark gray (10YR 4/1) silty clay loam; moderate fine subangular blocky structure; slightly acid; clear wavy boundary.
Bg2—22 to 40 inches; grayish brown (2.5Y 5/2) silt loam; many medium distinct olive brown (2.5Y 4/4) iron concentrations; weak medium subangular blocky structure; slightly acid; gradual wavy boundary.
Cg—40 to 80 inches; light brownish gray (2.5Y 6/2) silt loam; many coarse prominent yellowish brown (10YR 5/6) iron concentrations; massive; neutral.

Range in Characteristics

Depth to carbonates: 55 to more than 80 inches
Thickness of the mollic epipedon: 10 to 24 inches
Content of rock fragments: Typically none throughout

Ap or A horizon:
Hue—10YR or neutral
Value—2
Chroma—0 or 1
Texture—silt loam or silty clay loam

Bg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay loam or silt loam

Cg horizon:
Hue—2.5Y, 5Y, or 10YR
Value—5 or 6
Chroma—1 or 2
Texture—silt loam or very fine sandy loam

176—Garwin silt loam, 0 to 2 percent slopes

Composition

Garwin and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Footslopes and toeslopes
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 1 to 2 feet
Available water capacity to 60 inches or root-limiting layer: About 12.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Epsom and similar soils
- Nerwoods and similar soils
- Maxcreek and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Glencoe Series

Drainage class: Very poorly drained
Permeability: Moderately slow
Landform: Depressions on moraines
Parent material: Alluvium
Slope range: 0 to 1 percent
Taxonomic classification: Fine-loamy, mixed, mesic Cumulic Endoaquolls

Typical Pedon

Glencoe clay loam, depressional, 0 to 1 percent slopes, 700 feet south and 660 feet east of the northwest corner of sec. 26, T. 109 N., R. 21 W.

Ap—0 to 7 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; weak medium granular structure; neutral; abrupt smooth boundary.
A1—7 to 12 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure; neutral; gradual wavy boundary.
A2—12 to 20 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; neutral; gradual wavy boundary.
ABg—20 to 27 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; neutral; clear wavy boundary.
Bg—27 to 36 inches; gray (5Y 5/1) clay loam; many fine distinct strong brown (7.5YR 5/8) iron concentrations; weak fine subangular blocky structure; slightly alkaline; gradual wavy boundary.
Cg—36 to 80 inches; olive gray (5Y 5/2) clay loam; many fine distinct strong brown (7.5YR 5/8) iron concentrations; massive; about 4 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 35 to 60 inches
Thickness of the mollic epipedon: 24 to 46 inches
Content of rock fragments: 0 to 5 percent gravel in the upper part; 2 to 8 percent gravel in the lower part

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—clay loam

ABg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 5
Chroma—1
Texture—clay loam or loam

Bg horizon:
Hue—5Y or 2.5Y
Value—4 to 5
Chroma—1 or 2
Texture—clay loam or loam

Cg horizon:
Hue—5Y or 2.5Y
Value—4 to 6
Chroma—2
Texture—clay loam or loam

114—Glencoe clay loam, depressional, 0 to 1 percent slopes

Composition

Glencoe and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on moraines
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium
Flooding: None
Water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Hamel and similar soils
- Klossner, overwash, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Hamel Series

Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Moraines
Parent material: Alluvium or colluvium and till
Slope range: 1 to 3 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Argiaquolls

Typical Pedon

Hamel loam, 1 to 3 percent slopes, 200 feet north and 1,650 feet west of the southeast corner of sec. 1, T. 111 N., R. 21 W.

Ap—0 to 6 inches; black (10YR 2/1) loam, very dark brown (10YR 2/2) dry; weak medium subangular blocky structure parting to weak fine granular; slightly acid; abrupt smooth boundary.

A1—6 to 11 inches; very dark gray (10YR 3/1) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; gradual smooth boundary.

A2—11 to 17 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; gradual smooth boundary.

A3—17 to 21 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; abrupt wavy boundary.

Btg1—21 to 26 inches; very dark gray (10YR 3/1) silty clay loam; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; many distinct grayish brown (2.5Y 5/2) clay films on faces of peds and in pores; very many black (N 2/0) organic coatings on faces of peds and in pores; about 1 percent gravel; neutral; gradual wavy boundary.

Btg2—26 to 51 inches; dark gray (10YR 4/1) silty clay loam; moderate coarse prismatic structure parting to moderate medium subangular blocky; very many distinct grayish brown (2.5Y 5/2) clay films on faces of peds and in pores; many black (N 2/0) organic coatings on faces of peds and in pores; about 2 percent gravel; neutral; gradual wavy boundary.

Cg—51 to 80 inches; dark grayish brown (2.5Y 4/2) silty clay loam; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; very many distinct grayish brown (2.5Y 5/2) clay films on faces of peds and in pores; common black (N 2/0) organic coatings in channels; about 2 percent gravel; neutral.

Range in Characteristics

Depth to carbonates: More than 60 inches
Thickness of the mollic epipedon: 14 to 23 inches
Content of rock fragments: 0 to 5 percent gravel

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loam

Btg horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 or 2
Texture—silty clay loam, clay loam, or loam

Cg horizon:
Hue—2.5Y or 5Y
Value—4
Chroma—2
Texture—clay loam, loam, or silty clay loam

414—Hamel loam, 1 to 3 percent slopes

Composition

Hamel and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Footslopes
Slope range: 1 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium or colluvium and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.3 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit,

such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Glencoe and similar soils
- Le Sueur and similar soils
- Lester and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Hawick Series

Drainage class: Excessively drained
Permeability: Rapid
Landform: Outwash plains and terraces
Parent material: Glacial outwash
Slope range: 2 to 25 percent
Taxonomic classification: Sandy, mixed, mesic Entic Hapludolls

Typical Pedon

Hawick sandy loam, 12 to 25 percent slopes, 400 feet north and 2,440 feet east of the southwest corner of sec. 29, T. 109 N., R. 20 W.

A—0 to 9 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; about 7 percent gravel; slightly acid; abrupt wavy boundary.

AC—9 to 16 inches; very dark grayish brown (10YR 3/2) very gravelly loamy coarse sand, grayish brown (10YR 5/2) dry; weak fine granular structure; about 30 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

C—16 to 80 inches; brown (10YR 4/3) gravelly coarse sand; single grain; about 25 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 30 inches
Thickness of the mollic epipedon: 7 to 16 inches
Content of rock fragments: 5 to 35 percent gravel throughout

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam

AC horizon:
Hue—10YR
Value—3 to 5
Chroma—2 to 4
Texture—very gravelly loamy coarse sand, loamy coarse sand, loamy sand, sand, gravelly sand, gravelly loamy coarse sand, or gravelly loamy sand

C horizon:
Hue—10YR
Value—4 to 6
Chroma—3 or 4
Texture—gravelly coarse sand, coarse sand, or sand

611D—Hawick sandy loam, 12 to 25 percent slopes

Composition

Hawick and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Backslopes and shoulders
Slope range: 12 to 25 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lester and similar soils
- Lowlein and similar soils
- Wadena and similar soils

875B—Hawick-Estherville complex, 2 to 6 percent slopes

Composition

Hawick and similar soils: About 55 percent
Estherville and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Summits
Slope range: 2 to 6 percent

Component Description

Hawick

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches
Organic matter content: Moderate

Estherville

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.7 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Angus and similar soils
- Lowlein and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

875C—Hawick-Estherville complex, 6 to 12 percent slopes

Composition

Hawick and similar soils: About 60 percent
Estherville and similar soils: About 25 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Shoulders and summits
Slope range: 6 to 12 percent

Component Description

Hawick

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches
Organic matter content: Moderate

Estherville

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.6 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Lester and similar soils
- Lowlein and similar soils
- Dickinson and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Hayden Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines, outwash plains, and terraces
Parent material: Till or glacial outwash and till
Slope range: 2 to 25 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Hapludalfs

Typical Pedon

Hayden loam, 6 to 12 percent slopes, eroded, 400 feet south and 700 feet east of the northwest corner of sec. 12, T. 110 N., R. 21 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak medium granular structure parting to weak fine granular; about 2 percent gravel; neutral; clear smooth boundary.

Bt1—7 to 13 inches; dark grayish brown (10YR 4/2) loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; common prominent very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; about 2 percent gravel; moderately acid; clear smooth boundary.

Bt2—13 to 20 inches; brown (10YR 4/3) clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; many prominent dark grayish brown (10YR 4/2) clay films on faces of peds and in pores; about 2 percent gravel; strongly acid; gradual wavy boundary.

Bt3—20 to 32 inches; brown (10YR 4/3) clay loam; few fine distinct strong brown (7.5YR 5/8) iron concentrations; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds and in pores; about 3 percent gravel; strongly acid; clear wavy boundary.

Bk1—32 to 60 inches; light olive brown (2.5Y 5/3) loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak coarse subangular blocky structure parting to weak medium subangular blocky; many white (10YR 8/1) soft accumulations of calcium carbonate on faces of peds and in pores; common black (10YR 2/1) manganese concentrations in pores; violently effervescent; about 4 percent gravel; moderately alkaline; gradual wavy boundary.

Bk2—60 to 80 inches; light olive brown (2.5Y 5/3) loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak coarse subangular blocky structure parting to weak fine subangular blocky; disseminated lime; few black (10YR 2/1) manganese concentrations in pores; violently effervescent; about 3 percent gravel; moderately alkaline.

Range in Characteristics

Depth to carbonates: 24 to 54 inches
Thickness of the ochric epipedon: 2 to 8 inches
Content of rock fragments: 2 to 8 percent gravel

Ap horizon:
Hue—10YR
Value—4 or 5
Chroma—1 or 2
Texture—loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 5
Texture—clay loam, loam, or sandy clay loam

Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—loam or sandy clay loam

104B—Hayden loam, 2 to 6 percent slopes

Composition

Hayden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: Low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit,

such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Le Sueur, moderately coarse substratum, and similar soils
- Dundas, moderately coarse substratum, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

104C2—Hayden loam, 6 to 12 percent slopes, eroded

Composition

Hayden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches
Organic matter content: Low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Le Sueur, moderately coarse substratum, and similar soils
- Dundas, moderately coarse substratum, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

104D2—Hayden loam, 12 to 18 percent slopes, eroded

Composition

Hayden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 12 to 18 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: Low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Le Sueur, moderately coarse substratum, and similar soils
- Dundas, moderately coarse substratum, and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

104E—Hayden loam, 18 to 25 percent slopes

Composition

Hayden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes
Slope range: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches
Organic matter content: Low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Le Sueur, moderately coarse substratum, and similar soils
- Dundas, moderately coarse substratum, and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Houghton Series

Drainage class: Very poorly drained
Permeability: Moderately rapid
Landform: Depressions on moraines
Parent material: Organic materials
Slope range: 0 to 1 percent
Taxonomic classification: Euic, mesic Typic Medisaprists

Typical Pedon

Houghton muck, depressional, 0 to 1 percent slopes, 1,900 feet south and 2,600 feet east of the northwest corner of sec. 32, T. 111 N., R. 19 W.

Oa1—0 to 8 inches; black (10YR 2/1) muck; very weak thin platy structure; nonsticky; about 50 percent fiber, 10 percent after rubbing; strongly acid; abrupt smooth boundary.
Oa2—8 to 15 inches; black (N 2/0) muck; very weak coarse subangular blocky structure parting to very weak thin platy; slightly sticky; about 25 percent fiber, 5 percent after rubbing; strongly acid; gradual smooth boundary.
Oa3—15 to 24 inches; black (N 2/0) muck; very weak coarse subangular blocky structure parting to very weak medium subangular blocky; slightly sticky; about 5 percent fiber, a trace after rubbing; strongly acid; gradual wavy boundary.
Oa4—24 to 32 inches; black (N 2/0) muck; massive; slightly sticky; about 2 percent fiber, a trace after rubbing; strongly acid; gradual wavy boundary.
Oa5—32 to 36 inches; black (N 2/0) muck; massive; slightly sticky; a trace fiber; strongly acid; gradual wavy boundary.
Oa6—36 to 66 inches; black (N 2/0) muck; massive; slightly sticky; a trace fiber; strongly acid; gradual wavy boundary.
A—66 to 75 inches; black (N 2/0) mucky loam; weak coarse subangular blocky structure; sticky; slightly acid; clear smooth boundary.
C—75 to 80 inches; grayish brown (2.5Y 5/2) loam; massive; slightly alkaline.

Range in Characteristics

Depth to carbonates: More than 60 inches
Thickness of the histic epipedon: More than 51 inches
Content of rock fragments: None

Oa horizon:
Hue—10YR, 7.5YR, or neutral
Value—2 or 3
Chroma—0 to 3
Texture—muck

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 3
Texture—loam, clay loam, mucky loam, or mucky clay loam

C horizon:
Hue—10YR or 2.5Y

Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam

523—Houghton muck, depressional, 0 to 1 percent slopes

Composition

Houghton and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on moraines
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials
Flooding: None
Water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Muskego and similar soils
- Glencoe and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

1058—Houghton and Muskego soils, ponded, 0 to 1 percent slopes

Composition

Houghton and similar soils: Variable
Muskego and similar soils: Variable
Inclusions: About 10 percent

Setting

Landform: Depressions on moraines
Slope range: 0 to 1 percent

Component Description

Houghton

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials
Flooding: None
Water table: 2.0 feet above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches
Organic matter content: Very high

Muskego

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and coprogenous earth
Flooding: None
Water table: 3 feet above to 1 foot below the surface
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 19.3 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Cordova and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- “Wildlife Habitat” section

Kasson Series

Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Moraines

Parent material: Glaciolacustrine deposits and till
Slope range: 1 to 3 percent
Taxonomic classification: Fine-loamy, mixed, mesic Aquollic Hapludalfs

Typical Pedon

Kasson silt loam, 1 to 3 percent slopes, 2,600 feet north and 50 feet east of the southwest corner of sec. 22, T. 110 N., R. 19 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; moderately acid; abrupt wavy boundary.

Bt1—9 to 13 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure; moderately acid; clear wavy boundary.

Bt2—13 to 20 inches; yellowish brown (10YR 5/4) silt loam; common medium faint grayish brown (10YR 5/2) iron depletions; moderate medium subangular blocky structure; few brown (10YR 4/3) clay films on faces of peds; common light brownish gray (10YR 6/2) silt coatings on faces of peds; moderately acid; clear wavy boundary.

2Bt3—20 to 25 inches; yellowish brown (10YR 5/4) loam; common medium faint yellowish brown (10YR 5/6) iron concentrations; weak very fine subangular blocky structure; few brown (10YR 4/3) clay films on faces of peds and in pores; many light brownish gray (10YR 6/2) silt coatings on faces of peds; about 10 percent gravel; moderately acid; gradual wavy boundary.

2Bt4—25 to 30 inches; yellowish brown (10YR 5/4) loam; many coarse faint grayish brown (10YR 5/2) iron depletions; moderate fine prismatic structure parting to moderate fine subangular blocky; common dark yellowish brown (10YR 4/4) clay films on faces of peds and in pores; common white (10YR 8/2) silt coatings on faces of peds; about 5 percent gravel; moderately acid; gradual wavy boundary.

2Bt5—30 to 42 inches; yellowish brown (10YR 5/6) loam; many coarse distinct grayish brown (10YR 5/2) iron depletions; strong medium prismatic structure parting to moderate fine subangular blocky; many dark yellowish brown (10YR 4/4) and dark brown (7.5YR 3/2) clay films on faces of peds; common white (10YR 8/2) silt coatings on faces of peds; about 3 percent gravel; moderately acid; gradual wavy boundary.

2Bt6—42 to 66 inches; yellowish brown (10YR 5/6) loam; few medium distinct grayish brown (10YR 5/2) iron depletions; moderate medium prismatic structure; many dark yellowish brown (10YR 4/4) and dark brown (7.5YR 3/2) clay films on faces of peds and in pores; about 3 percent gravel; moderately acid; gradual wavy boundary.

2Bt7—66 to 80 inches; yellowish brown (10YR 5/4) loam; few medium distinct grayish brown (10YR 5/2) iron depletions; moderate medium prismatic structure; few dark brown (7.5YR 3/2) clay films on faces of peds; about 3 percent gravel; moderately acid.

Range in Characteristics

Depth to carbonates: 38 to more than 80 inches
Thickness of the mollic epipedon: 6 to 10 inches
Content of rock fragments: Typically none in the upper part; 2 to 12 percent gravel in the lower part

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—loam, silt loam, or silty clay loam

2Bt horizon:
Hue—10YR
Value—5
Chroma—4 to 6
Texture—loam or sandy clay loam

24—Kasson silt loam, 1 to 3 percent slopes

Composition

Kasson and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 1 to 3 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2 to 3 feet
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Maxfield and similar soils
- Sargeant and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Kato Series

Drainage class: Poorly drained
Permeability: Upper part—moderate; lower part—rapid
Landform: Outwash plains and terraces
Parent material: Alluvium and outwash
Slope range: 0 to 1 percent
Taxonomic classification: Fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Endoaquolls

Typical Pedon

Kato silty clay loam, 0 to 1 percent slopes, 1,050 feet south and 1,000 feet east of the northwest corner of sec. 32, T. 111 N., R. 19 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam; weak medium subangular blocky structure parting to weak fine granular; strongly acid; clear smooth boundary.

A—8 to 14 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine granular; strongly acid; gradual smooth boundary.

AB—14 to 19 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; common fine faint dark yellowish brown (10YR 4/6) iron concentrations; weak medium subangular blocky structure parting to weak fine granular; moderately acid; gradual wavy boundary.

Bg—19 to 29 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine distinct dark yellowish brown (10YR 4/6) and light brownish gray (10YR 6/2) iron depletions; weak medium subangular blocky structure parting to weak fine subangular blocky; strongly acid; abrupt wavy boundary.

2Cg1—29 to 35 inches; grayish brown (10YR 5/2) very gravelly coarse sand; single grain; about 35 percent gravel; about 2 percent cobbles; neutral; abrupt wavy boundary.

2Cg2—35 to 44 inches; light gray (10YR 7/2) sand; common medium distinct yellowish brown (10YR 5/4) iron concentrations; single grain; about 4 percent gravel; neutral; abrupt wavy boundary.

2Cg3—44 to 80 inches; pale brown (10YR 6/3) very gravelly coarse sand; single grain; strongly effervescent; about 30 percent gravel; about 10 percent cobbles; neutral.

Range in Characteristics

Depth to carbonates: 42 to 60 inches
Thickness of the mollic epipedon: 13 to 20 inches
Content of rock fragments: 0 to 1 percent in the upper part; 3 to 45 percent gravel in the lower part

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—silty clay loam

AB horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam, silty clay loam, or loam

Bg horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay loam, silt loam, or clay loam

2Cg horizon:
Hue—10YR or 2.5Y
Value—4 to 7
Chroma—1 to 3
Texture—sand, coarse sand, gravelly coarse sand, gravelly sand, or very gravelly coarse sand

208—Kato silty clay loam, 0 to 1 percent slopes

Composition

Kato and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Microlows

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium and outwash
Flooding: None
Depth to the water table: 1.0 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.3 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Waukegan and similar soils
- Littleton, till substratum, and similar soils
- Talcot and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Kenyon Series

Drainage class: Moderately well drained
Permeability: Moderate
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 6 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Hapludolls
Taxadjunct features: The Kenyon soils in this survey area have a water table perched at a depth of 2.5 to 3.5 feet. These soils are classified as fine-loamy, mixed, mesic Oxyaquic Hapludolls.

Typical Pedon

Kenyon silt loam (fig. 8), moderately wet, 0 to 3 percent slopes, 1,750 feet south and 75 feet west of the northeast corner of sec. 15, T. 109 N., R. 19 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine and medium granular structure; slightly acid; abrupt smooth boundary.

BA—10 to 14 inches; dark brown (10YR 3/3) silt loam; moderate very fine subangular blocky structure; many very dark gray (10YR 3/1) organic coatings on faces of peds; common black (10YR 2/1) wormcasts; strongly acid; clear smooth boundary.

2Bt1—14 to 17 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; many distinct brown (10YR 4/3) clay films on faces of peds; few black (10YR 2/1) wormcasts; 2 percent gravel; strongly acid; clear smooth boundary.

2Bt2—17 to 25 inches; yellowish brown (10YR 5/4) clay loam; moderate medium angular blocky structure parting to moderate fine angular blocky; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few black (10YR 2/1) wormcasts; about 4 percent gravel; about 2 percent cobbles; strongly acid; gradual smooth boundary.

2Bt3—25 to 31 inches; yellowish brown (10YR 5/4) clay loam; few medium prominent grayish brown (2.5Y 5/2) iron depletions; strong medium angular blocky structure parting to strong fine angular blocky; many prominent dark grayish brown (10YR 4/2) clay films on faces of peds; very few yellowish red (5YR 5/8) soft concentrations in ped interiors; about 6 percent gravel; about 1 percent cobbles; strongly acid; gradual wavy boundary.

2Bk1—31 to 37 inches; yellowish brown (10YR 5/4) clay loam; few medium prominent grayish brown (2.5Y 5/2) iron depletions; moderate medium prismatic structure parting to moderate medium subangular blocky; many brown (10YR 5/3) clay films on faces of peds; few pale yellow (2.5Y 7/3) calcium carbonate concentrations in ped interiors; very few yellowish red (5YR 5/8) concentrations in ped interiors; slightly effervescent; about 6 percent gravel; 1 percent cobbles; slightly alkaline; gradual wavy boundary.

2Bk2—37 to 55 inches; yellowish brown (10YR 5/4) loam; many medium prominent grayish brown (2.5Y 5/2) iron depletions; moderate coarse prismatic structure parting to weak coarse subangular blocky; many light brownish gray (2.5Y 6/2) calcium carbonate concentrations on faces of peds; many pale yellow (2.5Y 7/3) calcium carbonate concentrations in ped interiors; strongly effervescent; about 6 percent gravel; about 1 percent cobbles; moderately alkaline; gradual wavy boundary.

2Bk3—55 to 69 inches; yellowish brown (10YR 5/4) loam; few coarse prominent grayish brown (2.5Y 5/2) iron depletions; weak coarse prismatic structure parting to weak coarse subangular blocky; many light brownish gray (2.5Y 6/2) calcium carbonate concentrations on faces of peds; few pale yellow (2.5Y 7/3) calcium carbonate concentrations in ped interiors; strongly effervescent; about 6 percent gravel; about 1 percent cobbles; moderately alkaline; gradual wavy boundary.

2BCk—69 to 80 inches; dark grayish brown (10YR 4/2) loam; many coarse prominent strong brown (7.5YR 4/6) iron concentrations; moderate coarse angular blocky structure; very many light brownish gray (2.5Y 6/2) calcium carbonate concentrations on faces of peds; slightly effervescent; about 6 percent gravel; about 1 percent cobbles; moderately alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches
Thickness of the mollic epipedon: 10 to 16 inches
Content of rock fragments: Commonly none in the upper part but may range to 2 percent gravel; 5 to 15 percent gravel and cobbles in the lower part

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

BA horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam or loam

2Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—2 to 6
Texture—clay loam or loam

2Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam

2BCk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam

1409A—Kenyon silt loam, moderately wet, 0 to 3 percent slopes

Composition

Kenyon and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 0 to 3 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Racine, moderately wet, and similar soils
- Maxfield and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

1409B—Kenyon silt loam, moderately wet, 3 to 6 percent slopes

Composition

Kenyon and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits

Slope range: 3 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Racine, moderately wet, and similar soils
- Maxfield and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Kilkenny Series

Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 2 to 35 percent
Taxonomic classification: Fine, montmorillonitic, mesic Oxyaquic Vertic Hapludalfs

Typical Pedon

Kilkenny clay loam, 6 to 12 percent slopes, eroded, 800 feet north and 300 feet east of the southwest corner of sec. 19, T. 111 N., R. 23 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; about 1 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—9 to 19 inches; brown (10YR 4/3) silty clay loam; thin discontinuous very dark brown (10YR 2/2) clay films on faces of peds; moderate medium subangular blocky structure parting to moderate fine subangular blocky; about 2 percent gravel; slightly acid; gradual wavy boundary.

Bt2—19 to 38 inches; brown (10YR 4/3) clay loam; thin continuous very dark brown (10YR 2/2) clay films on faces of peds and few dark yellowish brown (10YR 4/4) clay films in ped interiors; moderate medium prismatic structure parting to moderate medium subangular blocky; about 4 percent gravel; very strongly acid; gradual wavy boundary.

Bt3—38 to 53 inches; brown (10YR 4/3) clay loam; few fine distinct dark brown (7.5YR 4/4) iron concentrations; thin discontinuous very dark brown (10YR 2/2) and olive brown (2.5Y 4/4) clay films on faces of peds; weak medium subangular blocky structure parting to moderate fine subangular blocky; about 5 percent gravel; very strongly acid; gradual smooth boundary.

2C—53 to 60 inches; olive brown (2.5Y 4/4) loam; few fine distinct dark brown (7.5YR 4/4) iron concentrations; very thin discontinuous dark brown (10YR 3/3) clay films in root channels; massive; about 8 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 45 to 75 inches
Content of rock fragments: None in the upper 12 inches; 2 to 10 percent gravel in the rest of the profile

Ap horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—clay loam or loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—clay loam, silty clay loam, clay, or silty clay

2C horizon:
Hue—2.5Y or 10YR
Value—4 to 8
Chroma—2 to 6
Texture—clay loam or loam

238B—Kilkenny loam, 2 to 6 percent slopes

Composition

Kilkenny and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

238C2—Kilkenny clay loam, 6 to 12 percent slopes, eroded

Composition

Kilkenny and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

238D2—Kilkenny clay loam, 12 to 18 percent slopes, eroded

Composition

Kilkenny and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 12 to 18 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit,

such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

238E—Kilkenny clay loam, 18 to 25 percent slopes

Composition

Kilkenny and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes
Slope range: 18 to 25 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

238F—Kilkenny loam, 25 to 35 percent slopes

Composition

Kilkenny and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes
Slope range: 25 to 35 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Klinger Series

Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 1 to 4 percent
Taxonomic classification: Fine-silty, mixed, mesic Aquic Hapludolls

Typical Pedon

Klinger silty clay loam, 1 to 4 percent slopes, 950 feet south and 2,150 feet east of the northwest corner of sec. 22, T. 110 N., R. 19 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate fine granular; about 1 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—10 to 15 inches; brown (10YR 5/3) silty clay loam; weak medium prismatic structure parting to moderate fine subangular blocky; common distinct brown (10YR 4/3) clay films on faces of peds; few light brownish gray (10YR 6/2) silt coatings on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.

Bt2—15 to 21 inches; brown (10YR 5/3) silty clay loam; few fine distinct yellowish brown (10YR 5/6) and few fine faint grayish brown (10YR 5/2) iron depletions; weak medium prismatic structure parting to moderate medium subangular blocky; common distinct brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.

2Bt3—21 to 28 inches; yellowish brown (10YR 5/4) clay loam; common fine prominent yellowish brown (10YR 5/8) and few fine distinct grayish brown (2.5Y 5/2) iron depletions; moderate medium prismatic structure parting to moderate medium subangular blocky; common distinct brown (10YR 4/3) clay films on faces of peds; about 10 percent gravel; slightly acid; clear wavy boundary.

2Bt4—28 to 36 inches; yellowish brown (10YR 5/4) clay loam; few fine prominent yellowish brown (10YR 5/8) iron concentrations; moderate medium prismatic structure parting to moderate medium angular blocky; common distinct brown (10YR 4/3) and grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

2Bt5—36 to 43 inches; yellowish brown (10YR 5/4) clay loam; common fine prominent yellowish brown (10YR 5/8) and few fine distinct grayish brown (2.5Y 5/2) iron depletions; moderate coarse prismatic structure parting to weak medium subangular blocky; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common very dark brown (10YR 2/2) organic stains on faces of peds and in pores; about 5 percent gravel; slightly acid; gradual wavy boundary.

2Btk—43 to 66 inches; yellowish brown (10YR 5/4) clay loam; few medium prominent yellowish brown (10YR 5/8) iron concentrations; moderate coarse prismatic structure parting to weak coarse angular blocky; few faint grayish brown (2.5Y 5/2) clay films on faces of peds and in pores; common very pale brown (10YR 7/3) calcium carbonate accumulations; slightly effervescent; about 9 percent gravel; slightly alkaline; gradual wavy boundary.

2BCk—66 to 80 inches; yellowish brown (10YR 5/4) clay loam; many medium prominent yellowish brown (10YR 5/8) and few fine distinct grayish brown (2.5Y 5/2) iron depletions; weak coarse prismatic structure parting to moderate coarse angular blocky; few very pale brown (10YR 7/3) calcium carbonate threads; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 42 to 65 inches
Thickness of the mollic epipedon: 7 to 16 inches
Content of rock fragments: 0 to 2 percent in the upper part; 1 to 15 percent in the lower part

Ap horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—silty clay loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—silty clay loam or silt loam

2Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—clay loam or silty clay loam

2Btk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—clay loam, silty clay loam, or loam

2BCk horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—clay loam or loam

213B—Klinger silty clay loam, 1 to 4 percent slopes

Composition

Klinger and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 1 to 4 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2 to 4 feet
Available water capacity to 60 inches or root-limiting layer: About 11.1 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kenyon, moderately wet, and similar soils
- Maxfield and similar soils
- Racine, moderately wet, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Klossner Series

Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—moderate or moderately slow
Landform: Depressions on moraines; flats and swales on flood plains; fens
Parent material: Organic materials and till or organic materials and alluvium
Slope range: 0 to 6 percent
Taxonomic classification: Loamy, mixed, euic, mesic Terric Medisaprists

Typical Pedon

Klossner mucky silty clay loam, overwash, 0 to 1 percent slopes, 1,700 feet north and 500 feet east of the southwest corner of sec. 3, T. 110 N., R. 22 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) mucky silty clay loam, gray (10YR 5/1) dry; many fine prominent yellowish brown (10YR 5/8) iron concentrations; weak medium granular structure parting to weak fine granular; neutral; clear wavy boundary.

Oa—7 to 44 inches; black (N 2/0) muck, black (10YR 2/1) dry; many fine prominent yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; about 10 percent fiber, less than 5 percent after rubbing; slightly acid; clear smooth boundary.

A—44 to 58 inches; black (N 2/0) mucky silt loam, very dark gray (10YR 3/1) dry; common medium prominent yellowish brown (10YR 5/6) iron concentrations; very weak coarse subangular blocky structure; about 1 percent gravel; slightly acid; clear smooth boundary.

Cg—58 to 80 inches; grayish brown (2.5Y 5/2) silt loam; many fine and medium prominent strong brown (7.5YR 5/6) iron concentrations in the form of oxidized rhizospheres; massive; about 2 percent gravel; neutral.

Range in Characteristics

Ap horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—mucky silty clay loam

Oa horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—muck or mucky peat

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—mucky silt loam, mucky loam, or mucky clay loam, silt loam, loam, or clay loam
Content of rock fragments—1 to 5 percent

Cg horizon:
Hue—10YR, 2.5Y, or 5Y

Value—4 to 7
Chroma—1 or 2
Texture—loam, silt loam, silty clay loam, or clay loam
Content of rock fragments—2 to 10 percent

528B—Klossner muck, seep land, 1 to 6 percent slopes

Composition

Klossner and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Fens
Slope range: 1 to 6 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Water table: At the surface to 1 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 15.6 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Houghton and similar soils
- Glencoe and similar soils
- Hamel and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- "Wildlife Habitat" section

764—Klossner muck, 0 to 1 percent slopes, flooded

Composition

Klossner and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on flood plains
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and alluvium
Flooding: Frequent
Water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 21.6 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rushriver and similar soils
- Medo and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- "Wildlife Habitat" section

1080—Klossner, Okoboji, and Glencoe soils, ponded, 0 to 1 percent slopes

Composition

Klossner and similar soils: Variable
Okoboji and similar soils: Variable
Glencoe and similar soils: Variable
Inclusions: About 10 percent

Setting

Landform: Depressions on moraines
Slope range: 0 to 1 percent

Component Description

Klossner

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained

Dominant parent material: Organic materials and till
Flooding: None
Water table: At the surface to 3 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 19.6 inches
Organic matter content: Very high

Okoboji

Surface layer texture: Mucky silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium
Flooding: None
Water table: 3 feet above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 12.1 inches
Organic matter content: Very high

Glencoe

Surface layer texture: Mucky loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium
Flooding: None
Water table: At the surface to 3 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Cordova and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- “Wildlife Habitat” section

1501—Klossner mucky silty clay loam, overwash, 0 to 1 percent slopes

Composition

Klossner and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Depressions on moraines
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Mucky silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 20.7 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Glencoe and similar soils
- Houghton and similar soils
- Muskego and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Lerdal Series

Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 2 to 12 percent
Taxonomic classification: Fine, montmorillonitic, mesic Vertic Epiaqualfs

Typical Pedon

Lerdal clay loam, 2 to 6 percent slopes, 1,825 feet south and 525 feet west of the northeast corner of sec. 5, T. 110 N., R. 22 W.

Ap—0 to 8 inches; black (10YR 2/1) clay loam, gray (10YR 5/1) dry; weak medium subangular blocky structure parting to weak fine granular; about 1

percent gravel, mostly shale; slightly acid; abrupt smooth boundary.

E—8 to 12 inches; dark grayish brown (10YR 4/2) clay loam, gray (10YR 6/1) dry; few medium faint dark yellowish brown (10YR 4/4) iron concentrations; moderate medium subangular blocky structure parting to moderate fine subangular blocky; about 1 percent gravel, mostly shale; moderately acid; gradual smooth boundary.

Bt—12 to 24 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and common fine faint very dark grayish brown (10YR 3/2) iron depletions; moderate coarse subangular blocky structure parting to strong medium angular blocky; common prominent black (10YR 2/1) clay films on faces of peds; about 1 percent gravel, mostly shale; slightly acid; gradual smooth boundary.

Btg—24 to 41 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common medium distinct olive brown (2.5Y 5/4) and common fine distinct very dark grayish brown (10YR 3/2) iron depletions; strong coarse angular blocky structure parting to strong medium angular blocky; common prominent black (10YR 2/1) clay films on faces of peds; about 2 percent gravel, mostly shale; slightly acid; clear wavy boundary.

Bk—41 to 80 inches; light olive brown (2.5Y 5/3) clay loam; many medium distinct olive brown (2.5Y 5/6) iron concentrations; moderate medium subangular blocky structure parting to moderate fine subangular blocky; many white (2.5Y 8/0) nodules of calcium carbonate; violently effervescent; about 3 percent gravel, mostly shale; strongly alkaline.

Range in Characteristics

Depth to carbonates: 32 to 65 inches
Thickness of the mollic epipedon: 6 to 9 inches
Content of rock fragments: 1 to 8 percent gravel

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—clay loam

E horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—2
Texture—clay loam, loam, silty clay loam, or silt loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay loam, clay loam, silty clay, or clay

Btg horizon:
Hue—2.5Y or 10YR
Value—4 or 5
Chroma—1 to 3
Texture—silty clay loam, clay loam, silty clay, or clay

Bk horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—clay loam, loam, silty clay loam, or silty clay

138B—Lerdal clay loam, 2 to 6 percent slopes

Composition

Lerdal and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Mazaska and similar soils
- Kilkenny and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

138C—Lerdal clay loam, 6 to 12 percent slopes

Composition

Lerdal and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Mazaska and similar soils
- Kilkenny and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Lester Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 6 to 35 percent
Taxonomic classification: Fine-loamy, mixed, mesic Mollic Hapludalfs

Typical Pedon

Lester loam, 6 to 12 percent slopes, eroded, 1,000 feet north and 2,350 feet west of the southeast corner of sec. 32, T. 112 N., R. 22 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; about 1 percent gravel; neutral; abrupt smooth boundary.

Bt1—6 to 11 inches; brown (10YR 4/3) clay loam; moderate coarse subangular blocky structure parting to moderate fine subangular blocky; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; about 3 percent gravel; moderately acid; gradual smooth boundary.

Bt2—11 to 24 inches; brown (10YR 4/3) clay loam; moderate coarse subangular blocky structure; many prominent very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; about 5 percent gravel; moderately acid; gradual smooth boundary.

Bt3—24 to 41 inches; brown (10YR 4/3) loam; moderate coarse angular blocky structure parting to moderate fine subangular blocky; many dark grayish brown (10YR 4/2) clay films on faces of peds and in pores; about 7 percent gravel; slightly acid; clear smooth boundary.

Bk1—41 to 49 inches; grayish brown (2.5Y 5/2) loam; many fine and medium distinct olive brown (2.5Y 5/6) and few fine distinct gray (10YR 6/1) iron depletions; weak medium subangular blocky structure parting to weak fine subangular blocky; strongly effervescent; few white (10YR 8/1) calcium carbonate concentrations in pores; about 5 percent gravel; slightly alkaline; gradual smooth boundary.

Bk2—49 to 80 inches; light brownish gray (2.5Y 6/2) loam; many fine and medium distinct olive brown (2.5Y 5/6) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; many soft accumulations of calcium carbonate on faces of peds and in pores; violently effervescent; 3 percent gravel; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 37 inches
Thickness of the mollic epipedon: 4 to 9 inches
Content of rock fragments: 1 to 8 percent gravel

Ap horizon:
Hue—10YR
Value—3

Chroma—1 or 2
Texture—loam

Bt horizon:
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—clay loam or loam

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam

106C2—Lester loam, 6 to 12 percent slopes, eroded

Composition

Lester and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Le Sueur and similar soils
- Hamel and similar soils
- Angus and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

106D2—Lester loam, 12 to 18 percent slopes, eroded

Composition

Lester and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 12 to 18 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Le Sueur and similar soils
- Hamel and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

106E—Lester loam, 18 to 25 percent slopes

Composition

Lester and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes

Slope range: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Le Sueur and similar soils
- Hamel and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

783C2—Lester-Kilkenny complex, 6 to 12 percent slopes, eroded

Composition

Lester and similar soils: About 50 percent
Kilkenny and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 6 to 12 percent

Component Description

Lester

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.1 inches
Organic matter content: Moderate

Kilkenny

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Le Sueur and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

783D2—Lester-Kilkenny complex, 12 to 18 percent slopes, eroded

Composition

Lester and similar soils: About 50 percent
Kilkenny and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 12 to 18 percent

Component Description

Lester

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 10.2 inches
Organic matter content: Moderate

Kilkenny

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Le Sueur and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

783E—Lester-Kilkenny complex, 18 to 25 percent slopes

Composition

Lester and similar soils: About 45 percent
Kilkenny and similar soils: About 40 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Backslopes
Slope range: 18 to 25 percent

Component Description

Lester

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: Moderate

Kilkenny

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Le Sueur and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

783F—Lester-Kilkenny complex, 25 to 35 percent slopes

Composition

Lester and similar soils: About 45 percent
Kilkenny and similar soils: About 40 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Backslopes
Slope range: 25 to 35 percent

Component Description

Lester

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Figure 7.—Profile of Epsom silty clay loam. The mollic epipedon extends to a depth of about 65 centimeters (26 inches). The alluvial sediment is in contact with the till at a depth of about 85 centimeters (33 inches). Depth is marked in centimeters.

Figure 8.—Profile of Kenyon silt loam. The mollic epipedon extends to a depth of about 25 centimeters (10 inches). The glaciolacustrine sediment is in contact with the till at a depth of about 32 centimeters (13 inches). A stone line is visible in the upper part of the till contact. Depth is marked in centimeters.

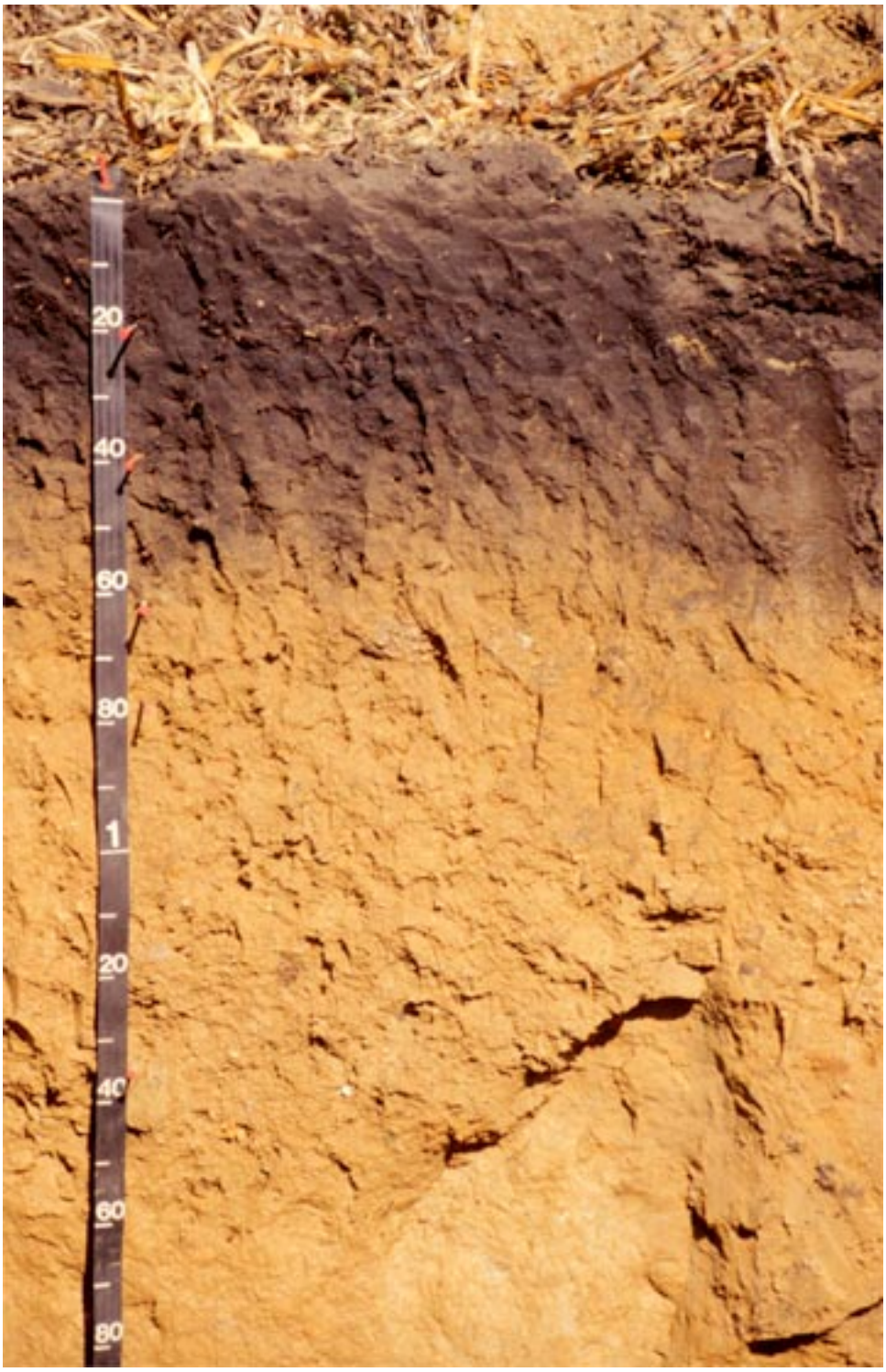

Figure 9.—Profile of Merton silt loam. The mollic epipedon extends to a depth of about 38 centimeters (15 inches). The eolian deposits are in contact with the till at a depth of about 58 centimeters (23 inches). Depth is marked in centimeters.

Figure 10.—Profile of Moland silt loam. The plow layer ends abruptly at a depth of 21 centimeters (8 inches). Stubble from the previous year's crop is visible in this layer. The eolian deposits are in contact with the till at a depth of about 65 centimeters (26 inches). The composition of the till is variable, particularly between depths of 100 and 140 centimeters. Depth is marked in centimeters.

Figure 11.—Profile of Nerwoods loam. The mollic epipedon extends to a depth of about 50 centimeters (20 inches). The upper sediment is in contact with the till at a depth of about 115 centimeters (45 inches). Depth is marked in centimeters.

Figure 12.—Profile of Racine silt loam. The mollic epipedon extends to a depth of about 18 centimeters (7 inches). The glaciolacustrine sediment is in contact with the till at a depth of about 60 centimeters (24 inches). White calcium carbonate coatings are visible in the till (below a depth of 60 centimeters). Depth is marked in centimeters.

Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: Moderate

Kilkenny

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lerdal and similar soils
- Le Sueur and similar soils
- Mazaska and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

945C2—Lester-Storden complex, 6 to 12 percent slopes, eroded

Composition

Lester and similar soils: About 65 percent
Storden and similar soils: About 20 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Lester—shoulders and summits; Storden—shoulders
Slope range: 6 to 12 percent

Component Description

Lester

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: Moderate

Storden

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hamel and similar soils
- Le Sueur and similar soils
- Angus and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

945D2—Lester-Storden complex, 12 to 18 percent slopes, eroded

Composition

Lester and similar soils: About 65 percent
Storden and similar soils: About 20 percent
Inclusions: About 15 percent

Setting

Landform: Moraines

Position on the landform: Backslopes and shoulders
Slope range: 12 to 18 percent

Component Description

Lester

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: Moderate

Storden

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hamel and similar soils
- Le Sueur and similar soils
- Angus and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Le Sueur Series

Drainage class: Moderately well drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 1 to 3 percent
Taxonomic classification: Fine-loamy, mixed, mesic Aquic Argiudolls

Typical Pedon

Le Sueur clay loam, 1 to 3 percent slopes, 1,700 feet south and 300 feet east of the northwest corner of sec. 36, T. 111 N., R. 21 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; about 1 percent gravel; neutral; abrupt wavy boundary.
Bt1—11 to 24 inches; brown (10YR 5/3) clay loam; moderate fine and medium subangular blocky structure; common distinct dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; neutral; gradual wavy boundary.
Bt2—24 to 42 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) iron depletions; moderate fine prismatic structure parting to moderate fine angular blocky; many distinct dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; neutral; gradual wavy boundary.
C—42 to 80 inches; yellowish brown (10YR 5/4) loam; common medium faint grayish brown (10YR 5/2) iron depletions; massive with moderate coarse prismatic fragments; about 3 percent gravel; moderately alkaline.

Range in Characteristics

Depth to carbonates: 36 to 46 inches
Thickness of the mollic epipedon: 7 to 12 inches
Content of rock fragments: 1 to 8 percent gravel throughout

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—2
Texture—clay loam

Bt horizon:
Hue—2.5Y or 10YR
Value—4 or 5
Chroma—3 or 4
Texture—clay loam or loam

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—3 or 4
Texture—loam

239—Le Sueur clay loam, 1 to 3 percent slopes

Composition

Le Sueur and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 1 to 3 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 4.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Angus and similar soils
- Hamel and similar soils
- Cordova and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

1361—Le Sueur loam, moderately coarse substratum, 1 to 3 percent slopes

Composition

Le Sueur and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 1 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 4.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hayden and similar soils
- Dundas, moderately coarse substratum, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Lindstrom Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Alluvium or colluvium
Slope range: 2 to 12 percent
Taxonomic classification: Fine-silty, mixed, mesic Cumulic Hapludolls

Typical Pedon

Lindstrom silt loam, 2 to 6 percent slopes, 2,310 feet south and 2,475 feet west of the northeast corner of sec. 22, T. 111 N., R. 19 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A1—10 to 16 inches; black (10YR 2/1) silt loam, very dark brown (10YR 2/2) dry; weak very fine granular structure; very friable; slightly acid; clear wavy boundary.

A2—16 to 30 inches; black (10YR 2/1) silt loam, very

dark brown (10YR 2/2) dry; weak medium subangular blocky structure; very friable; few sand coatings on faces of peds; slightly acid; clear wavy boundary.

Bw1—30 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; very friable; few sand coatings on faces of peds; moderately acid; clear wavy boundary.

Bw2—40 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure parting to weak medium subangular blocky; very friable; few sand coatings on faces of peds; few fine faint strong brown (7.5YR 5/8) iron concentrations; moderately acid; clear wavy boundary.

C—60 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; very friable; few fine distinct strong brown (7.5YR 5/8) iron concentrations and few fine distinct grayish brown (2.5Y 5/2) iron depletions; neutral.

Range in Characteristics

Depth to carbonates: More than 60 inches
Thickness of the mollic epipedon: 21 to 33 inches

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—silt loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam or loam

C horizon:
Hue—10YR
Value—4 or 5
Chroma—2 to 4
Texture—silt loam or loam

301B—Lindstrom silt loam, 2 to 6 percent slopes

Composition

Lindstrom and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Footslopes
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 13.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Terril, moderately wet, and similar soils
- Littleton, till substratum, and similar soils
- Garwin and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

301C—Lindstrom silt loam, 6 to 12 percent slopes

Composition

Lindstrom and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Footslopes
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium or colluvium
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Terril, moderately wet, and similar soils
- Littleton, till substratum, and similar soils
- Garwin and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Littleton Series

Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Moraines
Parent material: Alluvium or colluvium and till
Slope range: 1 to 4 percent
Taxonomic classification: Fine-silty, mixed, mesic Cumulic Hapludolls

Typical Pedon

Littleton silt loam, till substratum, 1 to 4 percent slopes, 910 feet south and 100 feet east of the northwest corner of sec. 10, T. 110 N., R. 19 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam; weak fine granular structure; slightly alkaline; abrupt smooth boundary.

A1—9 to 17 inches; black (10YR 2/1) silt loam; moderate very fine granular structure; many fine to large tubular pores; slightly alkaline; clear wavy boundary.

A2—17 to 26 inches; very dark brown (10YR 2/2) silt loam; moderate fine subangular blocky structure; many fine to large tubular pores; slightly alkaline; clear wavy boundary.

Bw1—26 to 36 inches; olive brown (2.5Y 4/3) silt loam; common medium faint grayish brown (10YR 5/2) iron depletions; moderate fine subangular blocky structure; common dark grayish brown (10YR 3/2) organic coatings on faces of peds; common fine to large pores; slightly alkaline; gradual wavy boundary.

Bw2—36 to 66 inches; light brownish gray (2.5Y 6/2) silt loam; common large prominent yellowish brown (10YR 5/6) iron concentrations; weak coarse subangular blocky structure parting to weak coarse subangular blocky; slightly alkaline; clear wavy boundary.

2C—66 to 80 inches; yellowish brown (10YR 5/4) loam; common medium faint gray (10YR 5/1) iron depletions; massive; about 6 percent gravel; slightly alkaline.

Range in Characteristics

Depth to carbonates: More than 60 inches
Thickness of the mollic epipedon: 24 to 36 inches
Content of rock fragments: Typically none throughout

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—silt loam or silty clay loam

2C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 6
Texture—loam or sandy loam

1413B—Littleton silt loam, till substratum, 1 to 4 percent slopes

Composition

Littleton and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Footslopes and toeslopes
Slope range: 1 to 4 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium or colluvium and till
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 13.0 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lindstrom and similar soils
- Garwin and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Lowlein Series

Drainage class: Moderately well drained
Permeability: Moderate
Landform: Moraines
Parent material: Glacial outwash and till
Slope range: 1 to 5 percent
Taxonomic classification: Coarse-loamy, mixed, mesic Typic Hapludolls

Typical Pedon

Lowlein sandy loam, 1 to 5 percent slopes, 1,700 feet north and 1,340 feet west of the southeast corner of sec. 21, T. 111 N., R. 20 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; very friable; about 3 percent gravel; slightly acid; abrupt smooth boundary.

AB—8 to 13 inches; dark grayish brown (10YR 4/2) sandy loam; moderate fine subangular blocky structure; very friable; many very dark grayish brown (10YR 3/2) organic coatings on faces of peds; about 3 percent gravel; slightly acid; clear smooth boundary.

Bw1—13 to 24 inches; yellowish brown (10YR 5/4) sandy loam; moderate fine subangular blocky structure; very friable; many brown (10YR 4/3) organic coatings on faces of peds; about 3 percent gravel; neutral; gradual wavy boundary.

Bw2—24 to 36 inches; yellowish brown (10YR 5/4) loamy sand; weak medium subangular blocky structure; very friable; about 2 percent gravel; neutral; gradual wavy boundary.

Bw3—36 to 46 inches; yellowish brown (10YR 5/4), stratified silt loam and sandy loam; weak medium subangular blocky structure; very friable; about 2 percent gravel; neutral; clear smooth boundary.

2Bw4—46 to 60 inches; light olive brown (2.5Y 5/4) loam; weak coarse subangular blocky structure; friable; about 4 percent gravel; neutral; clear wavy boundary.

2C—60 to 80 inches; light olive brown (2.5Y 5/4) loam; massive; friable; about 4 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam

AB horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—sandy loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—sandy loam, fine sandy loam, loamy sand, or silt loam

2Bw horizon:
Hue—2.5Y or 10YR
Value—4 or 5
Chroma—2 to 4
Texture—sandy loam, fine sandy loam, loam, or silt loam

2C horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam, clay loam, silt loam, or silty clay loam

572—Lowlein sandy loam, 1 to 5 percent slopes

Composition

Lowlein and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Summits

Slope range: 1 to 5 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glacial outwash and till
Flooding: None
Depth to the water table: 2.5 to 4.0 feet
Available water capacity to 60 inches or root-limiting layer: About 7.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Dickinson and similar soils
- Angus and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Maxcreek Series

Drainage class: Poorly drained
Permeability: Moderate
Landform: Flats on moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 1 percent
Taxonomic classification: Fine-silty, mixed, mesic Typic Endoaquolls

Typical Pedon

Maxcreek silty clay loam, 0 to 1 percent slopes, 1,140 feet north and 2,540 feet east of the southwest corner of sec. 34, T. 109 N., R. 19 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure; neutral; abrupt smooth boundary.
A—8 to 14 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; neutral; clear wavy boundary.
AB—14 to 18 inches; very dark gray (2.5Y 3/1) silty clay loam, gray (2.5Y 5/1) dry; weak fine subangular blocky structure; neutral; clear wavy boundary.
Bg1—18 to 26 inches; dark grayish brown (2.5Y 4/2) and olive gray (5Y 4/2) silt loam; common fine distinct olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6) iron concentrations; neutral; clear wavy boundary.
2Bg2—26 to 36 inches; olive (5Y 4/3) silt loam; few fine prominent yellowish brown (10YR 5/8) iron concentrations; weak fine subangular blocky structure; neutral; about 3 percent gravel; clear wavy boundary.
2Cg—36 to 80 inches; grayish brown (2.5Y 5/2) loam; many medium prominent yellowish brown (10YR 5/6) iron concentrations and common fine distinct olive gray (5Y 4/2) iron depletions; massive; about 5 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 26 to 48 inches
Thickness of the mollic epipedon: 7 to 18 inches
Content of rock fragments: 0 to 1 percent gravel in the upper part; 2 to 8 percent gravel in the lower part

Ap or A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam

AB horizon:
Hue—10YR or 2.5Y
Value—2 to 4
Chroma—1 or 2
Texture—silty clay loam or silt loam

Bg horizon:
Hue—5Y, 2.5Y, or 10YR
Value—4 or 5
Chroma—1 or 2
Texture—silty clay loam or silt loam

2Bg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 or 5
Chroma—1 to 3
Texture—silt loam or loam

2Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam or sandy clay loam

253—Maxcreek silty clay loam, 0 to 1 percent slopes

Composition

Maxcreek and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats on moraines
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 1 to 3 feet
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Epsom and similar soils
- Nerwoods and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Maxfield Series

Drainage class: Poorly drained
Permeability: Moderate
Landform: Flats on moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-silty, mixed, mesic Typic Haplaquolls

Typical Pedon

Maxfield silty clay loam, 0 to 2 percent slopes, 60 feet north and 20 feet east of the southwest corner of sec. 31, T. 110 N., R. 19 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine granular structure; neutral; abrupt smooth boundary.

A1—8 to 15 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine granular structure; neutral; clear wavy boundary.

A2—15 to 20 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; neutral; clear wavy boundary.

Bg1—20 to 23 inches; dark grayish brown (2.5Y 4/2) silt loam; few fine distinct olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; neutral; clear wavy boundary.

Bg2—23 to 27 inches; dark grayish brown (2.5Y 4/2) silt loam; few medium distinct olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; neutral; clear wavy boundary.

2Bw—27 to 45 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (2.5Y 5/2) iron depletions; weak fine subangular blocky structure; about 5 percent gravel; neutral; clear wavy boundary.

2C—45 to 80 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (2.5Y 5/2) iron depletions and few medium distinct strong brown (7.5YR 5/8) iron concentrations; massive; about 5 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 38 to 60 inches
Thickness of the mollic epipedon: 10 to 24 inches
Content of rock fragments: 0 to 1 percent gravel in the upper part; 2 to 8 percent gravel in the lower part

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam

Bg horizon:
Hue—5Y or 2.5Y
Value—4 or 5
Chroma—2
Texture—silty clay loam or silt loam

2Bw horizon:
Hue—10YR
Value—5
Chroma—4 to 8
Texture—loam

2C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam

378—Maxfield silty clay loam, 0 to 2 percent slopes

Composition

Maxfield and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Flats on moraines
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 1 to 2 feet
Available water capacity to 60 inches or root-limiting layer: About 11.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kenyon, moderately wet, and similar soils
- Racine, moderately wet, and similar soils
- Nerwoods and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Mazaska Series

Drainage class: Poorly drained
Permeability: Slow
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Fine, montmorillonitic, mesic Vertic Argiaquolls

Typical Pedon

Mazaska clay loam, 0 to 2 percent slopes, 960 feet south and 1,280 feet east of the northwest corner of sec. 12, T. 111 N., R. 22 W.

Ap—0 to 9 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; slightly acid; abrupt smooth boundary.

A—9 to 15 inches; black (10YR 2/1) clay loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure parting to moderate fine subangular blocky; few thin porous coatings on faces of peds; moderately acid; abrupt smooth boundary.

Btg1—15 to 22 inches; olive gray (5Y 5/2) clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; few thin very dark grayish brown (2.5Y 3/2) clay films on faces of peds; about 3 percent gravel, mostly shale; very strongly acid; abrupt smooth boundary.

Btg2—22 to 34 inches; olive gray (5Y 5/2) clay; common fine prominent dark brown (7.5YR 4/4) iron concentrations; moderate medium subangular blocky structure parting to moderate fine subangular blocky; common thick very dark gray (5Y 3/1) and dark gray (5Y 4/1) clay films on faces of peds; about 8 percent gravel, mostly shale; very strongly acid; abrupt smooth boundary.

Btg3—34 to 42 inches; olive gray (5Y 5/2) clay; common medium distinct olive brown (2.5Y 5/6) iron concentrations; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; common olive gray (5Y 4/2 and 5/2) clay films on faces of peds and in old root channels; about 3 percent gravel, mostly shale; strongly acid; abrupt smooth boundary.

Bk—42 to 80 inches; olive gray (5Y 5/2) clay loam; many coarse prominent olive brown (2.5Y 5/6) iron concentrations; massive; few black (10YR 2/1) manganese concentrations; few lime pebbles; about 5 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches
Thickness of the mollic epipedon: 10 to 22 inches
Content of rock fragments: 2 to 8 percent gravel; 1 to 3 percent cobbles

Ap or A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam or clay loam

Btg horizon:
Hue—10YR, 5Y, or 2.5Y

Value—4 or 5
Chroma—1 or 2
Texture—clay loam, silty clay loam, clay, or loam

Bk horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2 to 4
Texture—loam, clay loam, or silty clay loam

256—Mazaska clay loam, 0 to 2 percent slopes

Composition

Mazaska and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Water table: At the surface to 1 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 9.1 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Rolfe and similar soils
- Lerdal and similar soils
- Kilkenny and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

1962—Mazaska-Rolfe complex, 0 to 2 percent slopes

Composition

Mazaska and similar soils: About 50 percent
Rolfe and similar soils: About 35 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Mazaska—summits; Rolfe—microlows
Slope range: Mazaska—0 to 2 percent; Rolfe—0 to 1 percent

Component Description

Mazaska

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Water table: At the surface to 1 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 8.7 inches
Organic matter content: High

Rolfe

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Cordova and similar soils
- Lerdal and similar soils
- Okoboji and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Medo Series

Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—moderately rapid or rapid
Landform: Depressions on moraines
Parent material: Organic materials and outwash
Slope range: 0 to 1 percent
Taxonomic classification: Loamy, mixed, euic, mesic Terric Medisaprists

Typical Pedon

Medo muck, depressional, 0 to 1 percent slopes, 1,075 feet north and 1,225 feet west of the southeast corner of sec. 24, T. 109 N., R. 21 W.

Oa1—0 to 9 inches; black (N 2/0) muck, black (10YR 2/1) dry; very weak medium subangular blocky structure parting to very weak fine granular; about 10 percent fiber, less than 5 percent after rubbing; neutral; clear smooth boundary.
Oa2—9 to 20 inches; black (N 2/0) muck, black (10YR 2/1) dry; common fine distinct dark brown (7.5YR 3/3) iron concentrations; weak thick platy structure; about 10 percent fiber, less than 5 percent after rubbing; neutral; clear smooth boundary.
Oa3—20 to 25 inches; black (N 2/0) muck, black (10YR 2/1) dry; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak thick platy structure parting to weak medium subangular blocky; about 5 percent fiber, less than 2 percent after rubbing; neutral; abrupt smooth boundary.
2A—25 to 31 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak thin platy structure parting to weak fine subangular blocky; slightly acid; abrupt smooth boundary.
2Cg1—31 to 39 inches; dark gray (2.5Y 4/1) silt loam; common fine and medium distinct yellowish brown (10YR 5/6) iron concentrations; massive; about 1 percent gravel; slightly alkaline; clear wavy boundary.
3Cg2—39 to 45 inches; dark grayish brown (2.5Y 4/2) sandy loam; common medium distinct yellowish brown (10YR 5/6) iron concentrations; single grain; about 5 percent gravel; slightly alkaline; gradual wavy boundary.
3Cg3—45 to 80 inches; olive (5Y 5/3) gravelly coarse sand; single grain; about 17 percent gravel; slightly alkaline.

Range in Characteristics

Oa horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—muck

2A horizon:
Hue—10YR or 2.5Y
Value—2 or 3
Chroma—0 or 1
Texture—silt loam, loam, silty clay loam, clay loam, sandy clay loam, or the mucky analogs of these textures

2Cg horizon:
Hue—2.5Y or 5Y
Value—3 or 4
Chroma—1 or 2
Texture—silt loam or loam

3Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 to 3
Texture—coarse sandy loam, sandy loam, gravelly coarse sand, coarse sand, sand, fine sand, loamy sand, or loamy fine sand

548—Medo muck, depressional, 0 to 1 percent slopes

Composition

Medo and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Depressions on moraines
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and outwash

Flooding: None
Water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 14.3 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Klossner and similar soils
- Rushriver and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Merton Series

Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Moraines
Parent material: Eolian deposits over till
Slope range: 1 to 3 percent
Taxonomic classification: Fine-loamy, mixed, mesic Aquic Hapludolls

Typical Pedon

Merton silt loam (fig. 9), 1 to 3 percent slopes, 850 feet south and 2,175 feet east of the northwest corner of sec. 25, T. 110 N., R. 20 W.

Ap—0 to 8 inches; black (N 2/0) silt loam, black (10YR 2/1) dry; weak medium subangular blocky structure parting to weak fine granular; about 1 percent gravel; slightly acid; abrupt smooth boundary.

A—8 to 15 inches; black (N 2/0) silt loam, black (10YR 2/1) dry; weak coarse subangular blocky structure parting to weak medium subangular blocky; about 1 percent gravel; slightly acid; gradual wavy boundary.

Bw1—15 to 23 inches; dark grayish brown (2.5Y 4/2) silt loam; common fine faint olive brown (2.5Y 4/3) iron concentrations; weak coarse subangular blocky structure parting to weak medium subangular blocky; about 4 percent gravel; slightly acid; gradual wavy boundary.

2Bw2—23 to 31 inches; yellowish brown (10YR 5/4) loam; common fine faint brown (10YR 5/3) iron concentrations; weak coarse subangular blocky structure parting to weak medium subangular blocky; about 10 percent gravel; slightly acid; clear smooth boundary.

2C1—31 to 55 inches; yellowish brown (10YR 5/4) loam; few fine faint yellowish brown (10YR 5/4) iron concentrations; weak very coarse prismatic structure parting to weak medium subangular blocky; few light yellowish brown (10YR 6/4) lime masses on faces of peds and in pores; slightly effervescent; about 7 percent gravel; slightly alkaline; clear smooth boundary.

2C2—55 to 80 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (2.5Y 5/2) iron depletions; weak very coarse prismatic structure parting to moderate medium subangular blocky; few light yellowish brown (10YR 6/4) lime masses on faces of peds and in pores; slightly effervescent; about 5 percent gravel; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 66 inches
Thickness of the mollic epipedon: 10 to 18 inches
Content of rock fragments: 0 to 1 percent gravel in the upper part; 2 to 12 percent gravel in the lower part

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—silt loam

Bw horizon:
Hue—10YR or 2.5YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam or silty clay loam

2Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—loam or clay loam

2C horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—2 to 4
Texture—loam

377—Merton silt loam, 1 to 3 percent slopes

Composition

Merton and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 1 to 3 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Eolian deposits over till
Flooding: None
Depth to the water table: 2 to 5 feet
Available water capacity to 60 inches or root-limiting layer: About 12.8 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Moland and similar soils
- Maxcreek and similar soils
- Nerwoods and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Minneiska Series

Drainage class: Moderately well drained
Permeability: Moderately rapid
Landform: Flood plains and terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Taxonomic classification: Coarse-loamy, mixed (calcareous), mesic Mollic Udifluvents

Typical Pedon

Minneiska fine sandy loam, 0 to 2 percent slopes, occasionally flooded, 1,350 feet north and 2,100 feet west of the southeast corner of sec. 1, T. 112 N., R. 26 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; slightly effervescent; slightly alkaline; abrupt smooth boundary.

C1—9 to 20 inches; dark brown (10YR 3/3) loamy fine sand and fine sandy loam; weak fine subangular blocky structure; very friable; slightly effervescent; slightly alkaline; clear wavy boundary.

C2—20 to 60 inches; brown (10YR 4/3), stratified loamy fine sand and fine sandy loam; massive; few fine distinct yellowish brown (10YR 5/6) iron concentrations; very friable; few fine snail-shell fragments in the lower part; slightly effervescent; slightly alkaline.

Range in Characteristics

Carbonates: Throughout the profile
Thickness of the mollic epipedon: 8 to 18 inches

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam

C horizon:
Hue—10YR
Value—3 to 5
Chroma—2 to 4
Texture—loam, sandy loam, loamy fine sand, loamy sand, fine sandy loam, or very fine sandy loam

463A—Minneiska fine sandy loam, 0 to 2 percent slopes, occasionally flooded

Composition

Minneiska and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Flood plains and terraces
Position on the landform: Shoulders and summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium

Flooding: Occasional
Depth to the water table: 2.5 to 4.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Minneopa and similar soils
- Rushriver and similar soils
- Ankeny and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Minneopa Series

Drainage class: Moderately well drained
Permeability: Upper part—moderately rapid; lower part—rapid or very rapid
Landform: Flood plains and terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Taxonomic classification: Sandy, mixed, mesic Aquic Hapludolls

Typical Pedon

Minneopa sandy loam, 0 to 2 percent slopes, rarely flooded, 2,100 feet north and 1,050 feet east of the southwest corner of sec. 4, T. 109 N., R. 20 W.

A1—0 to 12 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; very weak fine granular structure; neutral; gradual smooth boundary.
A2—12 to 20 inches; very dark brown (10YR 2/2) loamy sand, very dark grayish brown (10YR 3/2) dry; very weak medium subangular blocky structure parting to very weak fine granular; slightly effervescent; slightly alkaline; gradual smooth boundary.
C1—20 to 31 inches; very dark grayish brown (10YR 3/2) loamy sand; single grain; strongly effervescent; slightly alkaline; gradual smooth boundary.
C2—31 to 38 inches; very dark grayish brown (10YR 3/2) loamy sand; single grain; violently effervescent; about 2 percent gravel; moderately alkaline; gradual smooth boundary.
C3—38 to 47 inches; very dark grayish brown (10YR 3/2) loamy sand; single grain; violently effervescent; about 3 percent gravel; moderately alkaline; abrupt smooth boundary.
C4—47 to 80 inches; dark grayish brown (10YR 4/2) very gravelly loamy sand; single grain; violently effervescent; about 30 percent gravel; about 10 percent cobbles; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Thickness of the mollic epipedon: 15 to 24 inches
Content of rock fragments: 0 to 5 percent gravel in the upper part; 3 to 45 percent gravel and cobbles in the lower part

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam or loamy sand

C horizon:
Hue—10YR
Value—3 or 4
Chroma—2
Texture—loamy sand or sand or the gravelly analogs of these textures

17—Minneopa sandy loam, 0 to 2 percent slopes, rarely flooded

Composition

Minneopa and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains and terraces
Position on the landform: Shoulders and summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium

Flooding: Rare
Depth to the water table: 3 to 5 feet
Available water capacity to 60 inches or root-limiting layer: About 5.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rushriver and similar soils
- Ankeny and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Moland Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Eolian deposits over till
Slope range: 1 to 4 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Hapludolls

Typical Pedon

Moland silt loam (fig. 10), 1 to 4 percent slopes, 1,240 feet north and 1,280 feet west of the southeast corner of sec. 26, T. 110 N., R. 20 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A—10 to 14 inches; dark brown (10YR 3/3) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common very dark grayish brown (10YR 3/2) organic coatings on faces of peds; slightly acid; clear wavy boundary.

Bw1—14 to 20 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; common dark yellowish brown (10YR 3/4) coatings on faces of peds; slightly acid; clear wavy boundary.

2Bw2—20 to 24 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; common dark yellowish brown (10YR 3/4) coatings on faces of peds; slightly acid; clear wavy boundary.

2Bw3—24 to 31 inches; light olive brown (2.5Y 5/4) loam; weak medium prismatic structure; friable; few thin dark grayish brown (2.5Y 4/2) clay films on faces of peds; about 4 percent gravel; slightly acid; clear wavy boundary.

2Bw4—31 to 45 inches; light olive brown (2.5Y 5/4) loam; weak medium prismatic structure; friable; few olive brown (2.5Y 4/3) coatings on faces of peds; about 4 percent gravel; slightly acid; clear wavy boundary.

2Bw5—45 to 49 inches; light olive brown (2.5Y 5/4) loam; weak medium prismatic structure; friable; few grayish brown (2.5Y 5/2) coatings on faces of peds; about 4 percent gravel; neutral; clear wavy boundary.

2C—49 to 80 inches; light olive brown (2.5Y 5/4) loam; massive; friable; few white segregations of lime; few fine distinct brown (10YR 5/3) iron concentrations; about 4 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 36 to 66 inches
Thickness of the mollic epipedon: 10 to 16 inches
Content of rock fragments: 0 to 1 percent gravel in the upper part; 2 to 8 percent gravel in the lower part

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam or silty clay loam

2Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—clay loam or loam

2C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 5
Texture—loam or sandy clay loam

376B—Moland silt loam, 1 to 4 percent slopes

Composition

Moland and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 1 to 4 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Eolian deposits over till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Merton and similar soils
- Maxcreek and similar soils
- Garwin and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Muskego Series

Drainage class: Very poorly drained
Permeability: Upper part—moderate; lower part—slow
Landform: Depressions on moraines
Parent material: Organic materials and coprogenous earth
Slope range: 0 to 1 percent
Taxonomic classification: Coprogenous, euic, mesic Limnic Medisaprists

Typical Pedon

Muskego muck, depressional, 0 to 1 percent slopes, 2,000 feet south and 600 feet west of the northeast corner of sec. 5, T. 110 N., R. 24 W.

Oap—0 to 7 inches; black (10YR 2/1) muck, rubbed and unrubbed; about 15 percent fiber, 5 percent rubbed; weak fine angular blocky structure; very friable; slightly acid; clear smooth boundary.

Oa1—7 to 14 inches; black (10YR 2/1) muck, rubbed and unrubbed; about 15 percent fiber, 5 percent rubbed; weak thin and medium platy structure; very friable; moderately acid; clear smooth boundary.

Oa2—14 to 23 inches; muck, dark brown (7.5YR 3/2) unrubbed, very dark brown (10YR 2/2) rubbed; about 25 percent fiber, 5 to 10 percent rubbed; moderate medium platy structure; friable; moderately acid; clear smooth boundary.

Oa3—23 to 27 inches; muck, very dark brown (10YR 2/2) unrubbed, black (10YR 2/1) rubbed; about 10 percent fiber, 5 percent rubbed; massive; friable; moderately acid; clear smooth boundary.

C—27 to 80 inches; black (5Y 2.5/2) mucky silt loam (coprogenous earth); massive; very friable; violent effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 24 inches
Thickness of the histic epipedon: 16 to 51 inches
Content of rock fragments: None

Oa horizon:
Hue—10YR, 7.5YR, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—muck

C horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—2 to 5
Chroma—0 to 3
Texture—coprogenous earth (mucky silt loam)

525—Muskego muck, depressional, 0 to 1 percent slopes

Composition

Muskego and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on moraines

Slope range: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and coprogenous earth
Flooding: None
Water table: 1 foot above to 1 foot below the surface
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 17.7 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Houghton and similar soils
- Glencoe and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Nerwoods Series

Drainage class: Somewhat poorly drained
Permeability: Upper part—moderate; lower part—moderately slow
Landform: Moraines
Parent material: Alluvium or colluvium and till
Slope range: 2 to 6 percent
Taxonomic classification: Fine-silty, mixed, mesic Aquic Hapludolls

Typical Pedon

Nerwoods loam (fig. 11), 2 to 6 percent slopes, 2,150 feet south and 875 feet west of the northeast corner of sec. 15, T. 109 N., R. 19 W.

Ap—0 to 12 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; very weak medium subangular blocky structure parting to very weak fine granular; very friable; neutral; clear smooth boundary.

2A—12 to 18 inches; very dark grayish brown (2.5Y 3/2) silt loam, dark grayish brown (10YR 4/2) dry; common fine faint dark grayish brown (2.5Y 4/2) iron depletions; weak medium subangular blocky structure parting to weak fine granular; very friable; neutral; clear smooth boundary.

2Bw1—18 to 24 inches; dark grayish brown (2.5Y 4/2) silt loam; common fine faint olive brown (2.5Y 4/3) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; neutral; clear wavy boundary.

2Bw2—24 to 33 inches; light olive brown (2.5Y 5/4) silt loam; few fine faint light olive brown (2.5Y 5/6) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; neutral; gradual wavy boundary.

2Bw3—33 to 44 inches; light olive brown (2.5Y 5/4) silt loam; common fine faint light olive brown (2.5Y 5/6) iron concentrations and few fine faint light brownish gray (2.5Y 6/2) iron depletions; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; neutral; gradual wavy boundary.

3Bw4—44 to 50 inches; light olive brown (2.5Y 5/4) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) iron concentrations and few fine distinct grayish green (5G 4/2) iron depletions; weak medium subangular blocky structure parting to weak fine subangular blocky; firm; about 3 percent gravel; slightly alkaline; gradual wavy boundary.

3Bw5—50 to 65 inches; light olive brown (2.5Y 5/4) clay loam; common fine prominent olive yellow (2.5Y 6/8) and few fine prominent strong brown (7.5YR 5/8) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; common medium light brownish gray (2.5Y 6/2) concentrations of calcium carbonate; few medium black (N 2/0) concretions of manganese; firm; about 3 percent gravel; strong effervescence; strongly alkaline; gradual wavy boundary.

3C—65 to 80 inches; light olive brown (2.5Y 5/4) clay loam; common fine prominent olive yellow (2.5Y 6/8) and few fine prominent strong brown (7.5YR 5/8) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; common medium light brownish gray (2.5Y 6/2) concentrations of calcium carbonate; few medium black (N 2/0) concretions of manganese; firm; about 5 percent gravel; strong effervescence; strongly alkaline.

Range in Characteristics

Depth to carbonates: 70 to 85 inches
Thickness of the mollic epipedon: 12 to 24 inches

Content of rock fragments: 0 to 1 percent in the colluvium and loess; 2 to 12 percent gravel in the till

Ap horizon:
Hue—2.5Y, 10YR, or neutral
Value—2 or 3
Chroma—0 to 3
Texture—loam, silt loam, or silty clay loam

2A horizon:
Hue—2.5Y or 10YR
Value—3 to 5
Chroma—2 to 4
Texture—silt loam

2Bw horizon:
Hue—2.5Y or 10YR
Value—4 or 5
Chroma—2 to 4
Texture—silty clay loam, silt loam, loam, or sandy loam

3Bw horizon:
Hue—2.5Y or 10YR
Value—4 or 5
Chroma—2 to 4
Texture—clay loam, silty clay loam, silt loam, or loam

3C horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—2 to 4
Texture—clay loam or loam

757—Nerwoods loam, 2 to 6 percent slopes

Composition

Nerwoods and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Footslopes and toeslopes
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Alluvium or colluvium and till
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Epsom and similar soils
- Kenyon, moderately wet, and similar soils
- Racine, moderately wet, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Nicollet Series

Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 1 to 3 percent
Taxonomic classification: Fine-loamy, mixed, mesic Aquic Hapludolls

Typical Pedon

Nicollet clay loam, 1 to 3 percent slopes, 200 feet north and 1,600 feet east of the southwest corner of sec. 22, T. 109 N., R. 21 W.

Ap—0 to 9 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; weak medium subangular blocky structure parting to weak fine granular; slightly acid; clear smooth boundary.

A1—9 to 14 inches; very dark gray (10YR 3/1) clay loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine granular; slightly acid; gradual smooth boundary.

A2—14 to 20 inches; very dark gray (10YR 3/1) clay loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly acid; clear smooth boundary.

Bw—20 to 30 inches; olive brown (2.5Y 4/3) clay loam; common fine faint grayish brown (2.5Y 5/2) iron depletions and few fine distinct dark yellowish

brown (10YR 4/6) iron concentrations; moderate medium subangular blocky structure parting to moderate fine subangular blocky; 1 percent rock fragments; slightly acid; gradual smooth boundary.

Bg1—30 to 36 inches; dark grayish brown (2.5Y 4/2) clay loam; few fine distinct dark grayish brown (10YR 4/2) iron depletions; moderate medium subangular blocky structure parting to moderate fine subangular blocky; 2 percent rock fragments; slightly acid; clear wavy boundary.

Bg2—36 to 40 inches; grayish brown (2.5Y 5/2) loam; common medium distinct dark yellowish brown (10YR 4/6) iron concentrations; weak medium subangular blocky structure; slightly effervescent; 2 percent rock fragments; slightly alkaline; clear wavy boundary.

C—40 to 80 inches; grayish brown (2.5Y 5/2) loam; common medium prominent dark brown (7.5YR 4/2) iron depletions and common medium distinct yellowish brown (10YR 5/6) iron concentrations; weak coarse subangular blocky structure parting to weak medium subangular blocky; common white (10YR 8/1) soft accumulations of calcium carbonate; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 45 inches
Thickness of the mollic epipedon: 10 to 24 inches

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—clay loam
Content of rock fragments—none

Bw horizon:
Hue—2.5Y or 10YR
Value—3 or 4
Chroma—2 to 4
Texture—clay loam or loam
Content of rock fragments—1 to 5 percent

Bg horizon:
Hue—2.5Y or 10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam, clay loam, or silty clay loam
Content of rock fragments—1 to 10 percent

C horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam or clay loam
Content of rock fragments—2 to 10 percent

130—Nicollet clay loam, 1 to 3 percent slopes

Composition

Nicollet and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 1 to 3 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.0 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Webster and similar soils
- Clarion and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Okoboji Series

Drainage class: Very poorly drained
Permeability: Moderately slow
Landform: Depressions on moraines
Parent material: Alluvium
Slope range: 0 to 1 percent
Taxonomic classification: Fine, montmorillonitic, mesic Cumulic Vertic Endoaquolls

Typical Pedon

Okoboji silty clay loam, depressional, 0 to 1 percent

slopes, 2,100 feet north and 1,300 feet west of the southeast corner of sec. 29, T. 109 N., R. 21 W.

A1—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine granular structure; slightly alkaline; abrupt wavy boundary.

A2—7 to 14 inches; black (N 2/0) silty clay, black (10YR 2/1) dry; moderate very fine subangular blocky structure; slightly alkaline; clear wavy boundary.

A3—14 to 24 inches; black (N 2/0) silty clay, black (10YR 2/1) dry; moderate fine prismatic structure parting to moderate fine angular blocky; slightly alkaline; clear wavy boundary.

A4—24 to 40 inches; black (N 2/0) silty clay, black (10YR 2/1) dry; moderate very fine granular structure; slightly alkaline; clear wavy boundary.

Cg1—40 to 60 inches; olive gray (5Y 5/2) silty clay; many coarse prominent olive brown (2.5Y 5/4) iron concentrations and common medium prominent greenish gray (5BG 5/1) iron depletions; massive; slightly alkaline; clear wavy boundary.

Cg2—60 to 70 inches; olive gray (5Y 5/2) silty clay; many medium prominent olive brown (2.5Y 5/6) iron concentrations; massive; slightly alkaline; clear wavy boundary.

Cg3—70 to 80 inches; olive gray (5Y 4/2) silty clay loam; massive; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 48 inches

A horizon:
Hue—10YR or neutral
Value—2
Chroma—0 or 1
Texture—silty clay loam or silty clay

Cg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 to 5
Chroma—0 to 2
Texture—silty clay loam or silty clay

134—Okoboji silty clay loam, depressional, 0 to 1 percent slopes

Composition

Okoboji and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Depressions on moraines
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium
Flooding: None
Water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Mazaska and similar soils
- Klossner, overwash, and similar soils
- Lerdal and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

1013—Pits, quarry

Composition

Pits: 100 percent

Setting

Landform: Structural benches

Component Description

Dominant parent material: Limestone residuum

1030—Pits, gravel-Udipsamments complex

Composition

Pits: 45 percent
Udipsamments: 45 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and terraces

Slope range: Udipsamments—0 to 30 percent

Component Description

Pits

Dominant parent material: Glacial outwash

Udipsamments

Surface layer texture: Sand
Depth class: Very deep (more than 60 inches)
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.0 inches
Organic matter content: Very low

Inclusions

- Estherville and similar soils

Port Byron Series

Drainage class: Well drained
Permeability: Moderate
Landform: Upland ridges
Parent material: Loess
Slope range: 0 to 6 percent
Taxonomic classification: Fine-silty, mixed, mesic Typic Hapludolls

Typical Pedon

Port Byron silt loam, 2 to 6 percent slopes, 900 feet north and 120 feet west of the southeast corner of sec. 1, T. 110 N., R. 19 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; neutral; abrupt smooth boundary.

A—10 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; many fine and medium pores; very dark gray (10YR 3/1) coatings on faces of peds; slightly acid; clear wavy boundary.

Bw1—14 to 23 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine and medium subangular blocky structure; many fine and medium pores; few dark brown (10YR 4/3) clay films on faces of peds; moderately acid; clear wavy boundary.

Bw2—23 to 42 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; many fine and medium pores; slightly acid; abrupt wavy boundary.

C1—42 to 46 inches; yellowish brown (10YR 5/4) silt loam; massive; common fine and medium pores; slightly effervescent; slightly alkaline; clear wavy boundary.

C2—46 to 80 inches; yellowish brown (10YR 5/4) silt loam; common fine faint grayish brown (10YR 5/2) iron depletions; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 42 to 60 inches
Thickness of the mollic epipedon: 10 to 24 inches
Content of rock fragments: None

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam

C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—4 to 6
Texture—silt loam or very fine sandy loam

285A—Port Byron silt loam, 0 to 2 percent slopes

Composition

Port Byron and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Upland ridges
Position on the landform: Summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: More than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 12.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Garwin and similar soils
- Littleton, till substratum, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

285B—Port Byron silt loam, 2 to 6 percent slopes

Composition

Port Byron and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Upland ridges
Position on the landform: Shoulders and summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Garwin and similar soils
- Littleton, till substratum, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Prinsburg Series

Drainage class: Poorly drained
Permeability: Moderate
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-silty, mixed (calcareous), mesic Typic Endoaquolls

Typical Pedon

Prinsburg silty clay loam, 0 to 2 percent slopes, 700 feet north and 2,450 feet west of the southeast corner of sec. 14, T. 110 N., R. 19 W.

Ap—0 to 11 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; violent effervescence; moderately alkaline; clear smooth boundary.

A—11 to 20 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak medium subangular blocky structure; friable; common snail shells throughout; violent effervescence; moderately alkaline; clear wavy boundary.

Bg1—20 to 25 inches; grayish brown (2.5Y 5/2) silt loam; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; many medium prominent yellowish brown (10YR 5/8) iron concentrations; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bg2—25 to 42 inches; grayish brown (2.5Y 5/2) silt loam; weak medium subangular blocky structure; friable; many medium prominent yellowish brown (10YR 5/8) iron concentrations; slightly effervescent; slightly alkaline; gradual wavy boundary.

2Cg—42 to 80 inches; grayish brown (2.5Y 5/2) loam; massive; friable; many medium prominent yellowish brown (10YR 5/8) iron concentrations; strongly effervescent; slightly alkaline.

Range in Characteristics

Carbonates: Throughout the profile

Thickness of the mollic epipedon: 7 to 20 inches

Ap or A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam

Bg horizon:
Hue—2.5Y, 5Y, or 10YR
Value—4 to 6
Chroma—1 or 2
Texture—clay loam, loam, silty clay loam, or silt loam

2Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 or 6
Chroma—1 to 4
Texture—clay loam, loam, or fine sandy loam

1286—Prinsburg silty clay loam, 0 to 2 percent slopes

Composition

Prinsburg and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Microlows
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Nerwoods and similar soils
- Maxfield and similar soils
- Kenyon, moderately wet, and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Racine Series

Drainage class: Well drained
Permeability: Moderately slow
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 2 to 18 percent
Taxonomic classification: Fine-loamy, mixed, mesic Mollic Hapludalfs

Typical Pedon

Racine silt loam (fig. 12), moderately wet, 6 to 12 percent slopes, eroded, 200 feet north and 40 feet west of the southeast corner of sec. 5, T. 109 N., R. 19 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; about 5 percent gravel; slightly acid; abrupt wavy boundary.

Bt1—7 to 12 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine subangular blocky structure; friable; common brown (10YR 4/3) clay films on faces of peds; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

Bt2—12 to 20 inches; yellowish brown (10YR 5/4) clay loam; moderate fine prismatic structure parting to moderate fine angular blocky; friable; many brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

2Bt3—20 to 30 inches; yellowish brown (10YR 5/4) clay loam; strong fine prismatic structure parting to strong medium angular blocky; firm; many brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

2Bt4—30 to 48 inches; yellowish brown (10YR 5/4) loam; moderate fine prismatic structure; firm; many brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2Bk1—48 to 60 inches; brown (10YR 5/3) loam; weak medium prismatic structure; very firm; common very pale brown (10YR 7/3) calcium carbonate

coatings on faces of peds; common medium faint grayish brown (10YR 5/2) iron depletions; about 5 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

2Bk2—60 to 70 inches; yellowish brown (10YR 5/4) loam; weak medium prismatic structure; very firm; few very pale brown (10YR 7/3) calcium carbonate coatings on faces of peds; about 5 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

2C—70 to 80 inches; yellowish brown (10YR 5/4) loam; massive with a few oblique partings; extremely firm; about 5 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to more than 60 inches
Content of rock fragments: 0 to 3 percent gravel in the upper part; 3 to 10 percent gravel in the lower part

Ap horizon:
Hue—10YR
Value—2 to 5
Chroma—1 or 2
Texture—silt loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—clay loam, silty clay loam, or loam

2Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—clay loam or loam

2Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—loam, clay loam, or sandy clay loam

2C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—4 to 8
Texture—loam or clay loam

99D2—Racine loam, 12 to 18 percent slopes, eroded

Composition

Racine and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 12 to 18 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.9 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Kenyon, moderately wet, and similar soils
- Nerwoods and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

1410B—Racine silt loam, moderately wet, 2 to 6 percent slopes

Composition

Racine and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None

Depth to the water table: 3.5 to 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kilkenny and similar soils
- Maxfield and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

1410C—Racine silt loam, moderately wet, 6 to 12 percent slopes, eroded

Composition

Racine and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kilkenny and similar soils
- Maxfield and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Renova Series

Drainage class: Well drained
Permeability: Moderately slow
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 2 to 30 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Hapludalfs

Typical Pedon

Renova loam, moderately wet, 6 to 12 percent slopes, 275 feet north and 2,090 feet west of the southeast corner of sec. 9, T. 110 N., R. 19 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; moderately acid; gradual wavy boundary.

E—5 to 10 inches; brown (10YR 5/3) loam, very pale brown (10YR 7/3) dry; very weak medium subangular blocky structure; very friable; strongly acid; gradual wavy boundary.

Bt1—10 to 17 inches; dark yellowish brown (10YR 4/4) loam; strong coarse angular blocky structure parting to strong medium angular blocky; friable; many brown (10YR 4/3) clay films on faces of peds and in pores; few bleached sand grains on faces of peds; common medium distinct dark yellowish brown (10YR 4/6) iron concentrations; about 1 percent gravel; very strongly acid; gradual wavy boundary.

2Bt2—17 to 25 inches; dark yellowish brown (10YR 4/4) clay loam; strong coarse angular blocky structure parting to strong medium angular blocky; firm; many brown (10YR 4/3) clay films on faces of peds and in pores; few bleached sand grains on faces of peds; many medium distinct dark yellowish brown (10YR 4/6) iron concentrations;

about 3 percent gravel; 2 percent stones; very strongly acid; gradual wavy boundary.

2Bt3—25 to 34 inches; yellowish brown (10YR 5/4) loam; strong coarse subangular blocky structure parting to strong medium subangular blocky; firm; many brown (10YR 4/3) clay films on faces of peds; many medium distinct dark yellowish brown (10YR 4/6) iron concentrations; about 3 percent gravel; 2 percent stones; very strongly acid; gradual wavy boundary.

2Bt4—34 to 43 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; firm; common brown (10YR 4/3) clay films on faces of peds and in pores; many medium prominent gray (10YR 6/1) iron depletions and many medium distinct dark yellowish brown (10YR 4/6) iron concentrations; about 4 percent gravel; 1 percent stones; very strongly acid; gradual wavy boundary.

2Bt5—43 to 54 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; firm; few brown (10YR 4/3) clay films on faces of peds and in pores; common medium prominent gray (10YR 5/1) iron depletions and dark yellowish brown (10YR 4/6) iron concentrations; about 3 percent gravel; about 2 percent stones; strongly acid; gradual wavy boundary.

2BC—54 to 60 inches; yellowish brown (10YR 5/4) loam; weak coarse subangular blocky structure parting to weak medium subangular blocky; firm; many coarse prominent brownish yellow (10YR 6/8) iron concentrations and common medium distinct gray (10YR 6/1) and light brownish gray (10YR 6/2) iron depletions; about 3 percent gravel; strongly acid; gradual wavy boundary.

2C—60 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; many coarse prominent brownish yellow (10YR 6/8) iron concentrations; about 2 percent gravel; strongly acid.

Range in Characteristics

Depth to carbonates: 20 to more than 60 inches
Content of rock fragments: 0 to 3 percent gravel in the upper part; 3 to 10 percent gravel in the lower part

A horizon:
Hue—10YR
Value—2 to 5
Chroma—1 or 2
Texture—loam

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2 to 4
Texture—loam

Bt horizon:
Hue—10YR
Value—3 or 4
Chroma—3 or 4
Texture—silt loam, clay loam, silty clay loam, or loam

2Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—loam, clay loam, or sandy clay loam

2BC horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam

2C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—4 to 8
Texture—loam or clay loam

4D—Renova loam, 12 to 18 percent slopes

Composition

Renova and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: 12 to 18 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit,

such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kasson and similar soils
- Sargeant and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

4E—Renova loam, 18 to 30 percent slopes

Composition

Renova and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Backslopes
Slope range: 18 to 30 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kasson and similar soils
- Sargeant and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

1416C—Renova loam, moderately wet, 6 to 12 percent slopes

Composition

Renova and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 6 to 12 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kasson and similar soils
- Sargeant and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

1437B—Renova silt loam, moderately wet, 2 to 6 percent slopes

Composition

Renova and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Shoulders and summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kenyon, moderately wet, and similar soils
- Maxfield and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Ripon Series

Drainage class: Well drained
Permeability: Moderate
Landform: Structural benches
Parent material: Limestone residuum
Slope range: 0 to 6 percent
Taxonomic classification: Fine-silty, mixed, mesic Typic Argiudolls

Typical Pedon

Ripon silt loam, 0 to 2 percent slopes, 700 feet north and 800 feet west of the southeast corner of sec. 36, T. 112 N., R. 19 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky structure parting to weak medium subangular blocky and weak fine granular; neutral; abrupt smooth boundary.

BA—10 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry (A); dark brown (10YR 4/3) silt loam, dark yellowish brown (10YR 4/4) dry (B); weak coarse subangular blocky structure parting to weak medium subangular blocky and weak fine granular; neutral; gradual smooth boundary.

Bt1—15 to 21 inches; dark brown (10YR 4/3) silt loam; weak coarse subangular blocky structure parting to weak medium subangular blocky; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—21 to 28 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure parting to weak fine subangular blocky; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; clear smooth boundary.

2Bt3—28 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; about 3 percent gravel; neutral; abrupt smooth boundary.

3R—32 inches; very pale brown (10YR 7/3), slightly weathered limestone bedrock.

Range in Characteristics

Depth to carbonates: 21 to 41 inches
Thickness of the mollic epipedon: 9 to 14 inches
Content of rock fragments: None in the upper part; 1 to 10 percent gravel in the lower part

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

BA horizon:
Hue—10YR
Value—3 or 4
Chroma—2 to 4
Texture—silt loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam

2Bt horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—3 or 4
Texture—clay loam or loam

529A—Ripon silt loam, 0 to 2 percent slopes

Composition

Ripon and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Structural benches
Position on the landform: Summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.7 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Copaston and similar soils
- Brodale and similar soils
- Boone and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

529B—Ripon silt loam, 2 to 6 percent slopes

Composition

Ripon and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Structural benches
Position on the landform: Shoulders and summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Limestone residuum
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Copaston and similar soils
- Brodale and similar soils
- Boone and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Rolfe Series

Drainage class: Very poorly drained
Permeability: Slow
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 1 percent
Taxonomic classification: Fine, montmorillonitic, mesic Typic Argialbolls

Typical Pedon

Rolfe silt loam, depressional, 0 to 1 percent slopes, 200 feet north and 1,140 feet west of the southeast corner of sec. 27, T. 111 N., R. 22 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; slightly acid; abrupt smooth boundary.

E—7 to 12 inches; very dark gray (10YR 3/1) and dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; weak medium platy structure; strongly acid; abrupt smooth boundary.

Btg1—12 to 16 inches; very dark grayish brown (10YR 3/2) clay; moderate medium subangular blocky

structure parting to moderate fine subangular blocky; about 2 percent gravel; many thick very dark gray (10YR 3/1) clay films on faces of peds; strongly acid; clear wavy boundary.

Btg2—16 to 21 inches; grayish brown (2.5Y 5/2) clay; many fine distinct olive brown (2.5Y 5/4) iron concentrations; moderate medium prismatic structure; about 12 percent gravel; many medium and thick very dark grayish brown (2.5Y 3/2) clay films on faces of peds; many very dark gray (10YR 3/1) clay films lining root channels; very strongly acid; clear wavy boundary.

Btg3—21 to 26 inches; grayish brown (2.5Y 5/2) clay; many fine distinct olive brown (2.5Y 5/4) iron concentrations; moderate medium prismatic structure; about 2 percent gravel; many medium very dark grayish brown (2.5Y 3/2) clay films on faces of peds; very strongly acid; clear wavy boundary.

Btg4—26 to 33 inches; olive gray (5Y 5/2) clay; moderate coarse prismatic structure parting to moderate medium prismatic; about 2 percent gravel; common very dark grayish brown (2.5Y 3/2) clay films lining root channels; strongly acid; clear wavy boundary.

2Btg5—33 to 40 inches; olive gray (5Y 5/2) clay loam; many fine distinct yellowish brown (10YR 5/8) iron concentrations; weak coarse prismatic structure; few black (10YR 2/1) clay films lining root channels; moderately acid; clear wavy boundary.

2Btg6—40 to 54 inches; olive gray (5Y 5/2) clay loam; many medium distinct olive brown (2.5Y 5/4) iron concentrations; weak coarse prismatic structure; about 4 percent gravel; few black (10YR 2/1) clay films lining root channels; neutral; clear wavy boundary.

2Cg—54 to 80 inches; olive gray (5Y 5/2) clay loam; many medium distinct olive brown (2.5Y 5/4) iron concentrations; massive; about 4 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 45 to more than 60 inches
Thickness of the mollic epipedon: 10 to 24 inches

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silt loam

E horizon:
Hue—10YR
Value—3 or 4
Chroma—1
Texture—silt loam or loam

Btg horizon:
Hue—5Y, 2.5Y, or 10YR
Value—3 to 6
Chroma—1 or 2
Texture—silty clay or clay

2Btg horizon:
Hue—5Y or 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—clay loam or loam

2Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2
Texture—loam or clay loam

219—Rolfe silt loam, depressional, 0 to 1 percent slopes

Composition

Rolfe and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Moraines
Position on the landform: Microlows
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 9.3 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Mazaska and similar soils
- Lerdal and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- ”Agronomy” section

Rushriver Series

Drainage class: Poorly drained
Permeability: Upper part—moderately rapid; lower part—rapid
Landform: Flats and swales on flood plains
Parent material: Alluvium
Slope range: 0 to 1 percent
Taxonomic classification: Coarse-loamy, mixed (calcareous), mesic Mollic Fluvaquents

Typical Pedon

Rushriver fine sandy loam, 0 to 1 percent slopes, frequently flooded, 1,100 feet north and 1,050 feet west of the southeast corner of sec. 5, T. 109 N., R. 20 W.

A1—0 to 8 inches; very dark brown (10YR 2/2) fine sandy loam, very dark gray (10YR 3/1) dry; weak medium granular structure parting to weak fine granular; slightly effervescent; strongly alkaline; gradual smooth boundary.
A2—8 to 15 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; common fine distinct and common medium distinct dark yellowish brown (10YR 4/6) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly effervescent; strongly alkaline; gradual smooth boundary.
A3—15 to 23 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly effervescent; strongly alkaline; gradual smooth boundary.
A4—23 to 41 inches; very dark grayish brown (10YR 3/2) sandy loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; strongly effervescent; about 2 percent gravel; strongly alkaline; clear smooth boundary.
2C1—41 to 56 inches; dark grayish brown (10YR 4/2) loamy sand; common fine distinct dark yellowish brown (10YR 3/6) iron depletions; single grain; strongly effervescent; about 2 percent gravel; strongly alkaline; gradual smooth boundary.
2C2—56 to 69 inches; grayish brown (10YR 5/2) coarse sand; common fine distinct dark yellowish brown (10YR 3/6) iron concentrations; single grain; strongly effervescent; about 5 percent gravel; about 2 percent cobbles; moderately alkaline; abrupt smooth boundary.
3C3—69 to 80 inches; dark brown (7.5YR 3/2) extremely gravelly loamy coarse sand; single grain; strongly effervescent; moderately alkaline.

Range in Characteristics

Carbonates: Throughout the profile
Content of rock fragments: 0 to 5 percent in the upper part; 2 to 10 percent in the lower part; 15 to 80 percent in the underlying sediment

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam or sandy loam

2C horizon:
Hue—10YR
Value—4 or 5
Chroma—2
Texture—loamy sand, coarse sand, or loamy coarse sand

3C horizon:
Hue—7.5YR or 10YR
Value—3 to 6
Chroma—2
Texture—extremely gravelly loamy coarse sand, gravelly loamy coarse sand, gravelly coarse sand, or extremely gravelly coarse sand

1360—Rushriver fine sandy loam, 0 to 1 percent slopes, frequently flooded

Composition

Rushriver and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Flats and swales on flood plains
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained

Dominant parent material: Alluvium
Flooding: Frequent
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Klossner and similar soils
- Medo and similar soils
- Houghton and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- "Wildlife Habitat" section

Sargeant Series

Drainage class: Poorly drained
Permeability: Upper part—moderate; lower part—slow
Landform: Moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, mesic Aeric Glossaqualfs

Typical Pedon

Sargeant silt loam, 0 to 2 percent slopes, 320 feet north and 1,610 feet west of the southeast corner, sec. 15, T. 110 N., R. 19 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; moderate very fine granular structure; slightly alkaline; abrupt smooth boundary.

E—7 to 13 inches; grayish brown (10YR 5/2) silt loam; common large faint yellowish brown (10YR 5/4) iron concentrations; moderate thin and medium platy structure; common fine pores; slightly acid; clear irregular boundary.

E/B—13 to 19 inches; grayish brown (10YR 5/2) silt loam; many large distinct yellowish brown (10YR 5/6) iron concentrations; moderate fine subangular blocky structure; many fine pores; common light brownish gray (10YR 6/2) silt coatings on faces of peds; moderately acid; clear wavy boundary.

B/E—19 to 25 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/6) iron concentrations; moderate medium subangular blocky structure; few dark brown (10YR 4/3) clay films in ped interiors; many clean light brownish gray (10YR 6/2) silt coatings on faces of peds; common fine pores; moderately acid; clear wavy boundary.

2Bt1—25 to 28 inches; brown (10YR 5/3) loam; few medium distinct yellowish brown (10YR 5/6) iron concentrations; weak coarse subangular blocky structure parting to moderate fine subangular blocky; many fine pores; many clean light gray (10YR 7/2) silt and sand coatings on faces of peds; about 10 percent gravel; common distinct dark brown (7.5YR 3/2) clay films on pores in ped interiors; about 10 percent gravel; very strongly acid; clear irregular boundary.

2Bt2—28 to 40 inches; yellowish brown (10YR 5/4) loam; common medium faint grayish brown (10YR 5/2) iron depletions; strong medium prismatic structure parting to moderate fine subangular blocky; few fine pores; very many clean light gray (10YR 7/2) sand and silt coatings on faces of prisms; common distinct dark brown (7.5YR 4/3) clay films on faces of peds; about 4 percent gravel; strongly acid; clear wavy boundary.

2Bt3—40 to 55 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium distinct grayish brown (10YR 5/2) iron depletions; strong medium prismatic structure parting to moderate medium angular blocky; common distinct dark brown (7.5YR 4/3) clay films on faces of peds; common clean light gray silt and sand coatings on faces of peds; about 4 percent gravel; moderately acid; gradual wavy boundary.

2Bt4—55 to 75 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate medium subangular blocky structure; few distinct dark brown (7.5YR 4/3) clay films on faces of peds; about 4 percent gravel; moderately acid; gradual wavy boundary.

2C—75 to 80 inches; yellowish brown (10YR 5/4) sandy clay loam; weak coarse prismatic structure; about 4 percent gravel; slightly acid.

Range in Characteristics

Depth to carbonates: 42 to 80 inches
Thickness of the ochric epipedon: 7 to 10 inches
Content of rock fragments: 0 to 1 percent gravel in the upper part; 2 to 15 percent gravel in the lower part

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—1 or 2
Texture—silt loam or silty clay loam

E/B and B/E horizons:
Hue—10YR
Value—4 to 6
Chroma—2
Texture—silt loam

2Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—2 to 6
Texture—loam or sandy clay loam

2C horizon:
Hue—10YR
Value—4 or 5
Chroma—4 or 5
Texture—loam to sandy clay loam

307—Sargeant silt loam, 0 to 2 percent slopes

Composition

Sargeant and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.9 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Kasson and similar soils
- Kenyon, moderately wet, and similar soils
- Maxfield and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Shields Series

Drainage class: Poorly drained
Permeability: Slow
Landform: Flats on moraines
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Fine, montmorillonitic, mesic Vertic Epiaqualfs

Typical Pedon

Shields silty clay loam, 0 to 2 percent slopes, 1,350 feet south and 1,525 feet west of the northeast corner of sec. 14, T. 110 N., R. 22 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; weak medium subangular blocky structure parting to weak fine granular; moderately acid; clear smooth boundary.

B/E—8 to 11 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry (B); dark grayish brown (10YR 4/2) loam, light gray (10YR 7/2) dry (E); moderate coarse subangular blocky structure parting to moderate medium subangular blocky; moderately acid; clear smooth boundary.

Btg1—11 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine distinct dark yellowish brown (10YR 4/6) iron concentrations; strong coarse angular blocky structure parting to strong medium angular blocky; many distinct black (10YR 2/1) clay films on faces of peds and in pores; strongly acid; gradual smooth boundary.

Btg2—22 to 27 inches; dark grayish brown (2.5Y 4/2) silty clay; common medium distinct dark yellowish brown (10YR 4/6) iron concentrations; strong coarse angular blocky structure parting to strong medium angular blocky; many distinct very dark brown (10YR 2/2) clay films on faces of peds and in pores; strongly acid; gradual smooth boundary.

Btg3—27 to 53 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many medium distinct dark yellowish brown (10YR 4/6) iron concentrations; strong coarse angular blocky structure parting to strong medium angular blocky; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; moderately acid; clear smooth boundary.

Bk1—53 to 61 inches; grayish brown (2.5Y 5/2) clay loam; many medium distinct dark yellowish brown (10YR 4/6) iron concentrations; weak coarse subangular blocky structure parting to weak medium subangular blocky; common white (10YR 8/1) calcium carbonate threads; about 2 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—61 to 80 inches; grayish brown (2.5Y 5/2) clay loam; many medium distinct dark yellowish brown (10YR 4/6) and few medium prominent strong brown (7.5YR 4/6) iron concentrations; weak coarse subangular blocky structure parting to weak medium subangular blocky; many white (10YR 8/1) soft accumulations of calcium carbonate; about 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam

B/E horizon:
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—loam or clay loam

Btg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay, silty clay loam, or clay loam

Bk horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2 or 3
Texture—clay loam or silty clay loam

323—Shields silty clay loam, 0 to 2 percent slopes

Composition

Shields and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Flats on moraines
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.5 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Mazaska and similar soils
- Lerdal and similar soils
- Rolfe and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Storden Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Till
Slope range: 6 to 18 percent slopes
Taxonomic classification: Fine-loamy, mixed, mesic Typic Eutrochrepts

Typical Pedon

Storden loam, in an area of Lester-Storden complex, 6 to 12 percent slopes, eroded, 1,375 feet south and 1,450 feet west of the northeast corner of sec. 25, T. 109 N., R. 21 W.

Ap—0 to 7 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure parting to weak fine granular; strongly effervescent; 2 percent gravel; slightly alkaline; abrupt smooth boundary.

C1—7 to 16 inches; light olive brown (2.5Y 5/3) loam; weak medium subangular blocky structure parting to weak fine subangular blocky; strongly effervescent; disseminated lime throughout; 3 percent gravel; slightly alkaline; clear smooth boundary.

C2—16 to 25 inches; light olive brown (2.5Y 5/3) loam; weak medium subangular blocky structure; strongly effervescent; disseminated lime throughout; 4 percent gravel; slightly alkaline; gradual smooth boundary.

C3—25 to 39 inches; olive brown (2.5Y 5/4) loam; few fine distinct yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure; violently effervescent; disseminated lime throughout; 2 percent gravel; moderately alkaline; gradual wavy boundary.

C4—39 to 47 inches; olive brown (2.5Y 5/4) loam; few fine prominent strong brown (7.5YR 5/8) iron concentrations; weak medium subangular blocky structure parting to weak fine subangular blocky; violently effervescent; disseminated lime throughout; 4 percent gravel; moderately alkaline; gradual wavy boundary.

C5—47 to 80 inches; olive brown (2.5Y 5/4) loam; few fine prominent strong brown (7.5YR 5/8) iron concentrations; weak medium subangular blocky structure parting to weak fine granular; violently effervescent; disseminated lime throughout; 5 percent gravel; moderately alkaline.

Range in Characteristics

Carbonates: Throughout the profile
Content of rock fragments: 2 to 10 percent throughout

Ap horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 6
Texture—loam or clay loam

Talcot Series

Drainage class: Poorly drained
Permeability: Upper part—moderate; lower part—rapid
Landform: Outwash plains and terraces
Parent material: Alluvium and outwash
Slope range: 0 to 1 percent
Taxonomic classification: Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic Typic Endoaquolls

Typical Pedon

Talcot silty clay loam, 0 to 1 percent slopes, 1,800 feet north and 1,550 feet east of the southwest corner of sec. 12, T. 109 N., R. 20 W.

Ap—0 to 10 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate coarse subangular blocky structure parting to moderate medium and fine subangular blocky; strongly alkaline; clear smooth boundary.

A—10 to 17 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) dry; moderate medium subangular blocky structure parting to moderate fine subangular blocky; common very fine and fine distinct dark brown (7.5YR 3/4) iron concentrations; strongly alkaline; gradual smooth boundary.

Bg—17 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; few very fine and fine distinct strong brown (7.5YR 4/6) iron concentrations and few fine faint dark grayish brown (2.5Y 4/2) iron depletions; slightly alkaline; gradual smooth boundary.

2C1—25 to 30 inches; grayish brown (2.5Y 5/2) loamy sand; single grain; about 1 percent gravel; few fine distinct yellowish brown (10YR 5/6) iron concentrations; slightly alkaline; gradual smooth boundary.

2C2—30 to 37 inches; dark grayish brown (2.5Y 4/2) loamy sand; single grain; about 2 percent gravel; few medium distinct dark brown (7.5YR 3/4) iron concentrations; slightly alkaline; gradual wavy boundary.

2C3—37 to 48 inches; grayish brown (2.5Y 5/2) loamy sand; single grain; about 2 percent gravel; neutral; gradual wavy boundary.

2C4—48 to 80 inches; light brownish gray (2.5Y 6/2)

sand; single grain; about 2 percent gravel; slightly alkaline.

Range in Characteristics

Carbonates: At the surface
Thickness of the mollic epipedon: 8 to 20 inches
Content of rock fragments: None in the upper part; 1 to 8 percent gravel in the lower part

Ap horizon:
Hue—neutral
Value—2
Chroma—0
Texture—silty clay loam

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silty clay loam or silt loam

Bg horizon:
Hue—2.5Y
Value—4 to 6
Chroma—2
Texture—silty clay loam or silt loam

2C horizon:
Hue—2.5Y or 10YR
Value—4 to 7
Chroma—2 or 3
Texture—loamy sand, sand, fine sand, or loamy fine sand

1366—Talcot silty clay loam, 0 to 1 percent slopes

Composition

Talcot and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and terraces
Slope range: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium and outwash
Flooding: None
Depth to the water table: 1.0 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Kato and similar soils
- Dickinson and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Terril Series

Drainage class: Well drained
Permeability: Moderate
Landform: Moraines
Parent material: Alluvium or colluvium and till
Slope range: 2 to 6 percent
Taxonomic classification: Fine-loamy, mixed, mesic Cumulic Hapludolls

Typical Pedon

Terril loam, moderately wet, 2 to 6 percent slopes, 400 feet north and 800 feet east of the southwest corner of sec. 2, T. 110 N., R. 26 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
A—9 to 28 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure; friable; slightly acid; clear smooth boundary.
AB—28 to 44 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure parting to moderate fine subangular blocky; friable; few very dark brown (10YR 2/2) organic coatings on faces of peds; neutral; clear smooth boundary.
Bw—44 to 80 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 36 inches
Content of rock fragments: 1 to 5 percent

A horizon:
Hue—10YR

Value—2 or 3
Chroma—1 or 2
Texture—sandy loam or loam

AB horizon:
Hue—10YR
Value—2 to 4
Chroma—2 or 3
Texture—loam or clay loam

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—2 to 4
Texture—loam or clay loam

1388B—Terril loam, moderately wet, 2 to 6 percent slopes

Composition

Terril and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Position on the landform: Footslopes
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium or colluvium and till
Flooding: None
Depth to the water table: 3.5 to 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lester and similar soils
- Le Sueur and similar soils
- Hamel and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Agronomy" section

Timula Series

Drainage class: Well drained
Permeability: Moderate
Landform: Upland ridges
Parent material: Loess
Slope range: 6 to 18 percent
Taxonomic classification: Coarse-silty, mixed, mesic Typic Eutrochrepts

Typical Pedon

Timula silt loam, in an area of Timula-Bold complex, 6 to 12 percent slopes, eroded, 1,000 feet south and 1,360 feet east of the northwest corner of sec. 28, T. 111 N., R. 19 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak very fine granular structure; neutral; abrupt wavy boundary.
Bw—8 to 25 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; many fine to large tubular pores; slightly alkaline; abrupt wavy boundary.
C—25 to 80 inches; light yellowish brown (10YR 6/4) silt loam; massive; slightly alkaline; strongly effervescent.

Range in Characteristics

Depth to carbonates: 18 to 36 inches
Thickness of the ochric epipedon: 3 to 10 inches
Content of rock fragments: None

Ap horizon:
Hue—10YR
Value—3 or 4
Chroma—3 to 6
Texture—silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—silt loam or very fine sandy loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—silt loam or very fine sandy loam

963C2—Timula-Bold complex, 6 to 12 percent slopes, eroded

Composition

Timula and similar soils: About 55 percent
Bold and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Upland ridges
Position on the landform: Timula—shoulders and summits; Bold—shoulders
Slope range: 6 to 12 percent

Component Description

Timula

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.2 inches
Organic matter content: Moderately low

Bold

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 13.2 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Racine, moderately wet, and similar soils
- Garwin and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

963D2—Timula-Bold complex, 12 to 18 percent slopes, eroded

Composition

Timula and similar soils: About 55 percent
Bold and similar soils: About 35 percent
Inclusions: About 10 percent

Setting

Landform: Upland ridges
Position on the landform: Backslopes and shoulders
Slope range: 12 to 18 percent

Component Description

Timula

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.3 inches
Organic matter content: Moderately low

Bold

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 13.2 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Racine and similar soils
- Garwin and similar soils

Major Uses of the Unit

- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

1016—Udorthents, loamy (cut and fill land)

Composition

Udorthents: 85 percent
Inclusions: About 15 percent

Setting

Landform: Moraines
Slope range: 0 to 20 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.6 inches
Organic matter content: Low

Inclusions

- Lester and similar soils
- Hawick and similar soils
- Hayden and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- “Wildlife Habitat” section

849B—Urban land-Estherville complex, 1 to 6 percent slopes

Composition

Urban land: 60 percent
Estherville: 40 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Summits
Slope range: Estherville—1 to 6 percent

Component Description

Urban land

Definition: Areas in which the surface layer is impervious because of pavement or buildings
Dominant parent material: Glacial outwash

Estherville

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Major Uses of the Unit

- Urban development
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Engineering” section
- “Agronomy” section

860C—Urban land-Hayden complex, 6 to 15 percent slopes

Composition

Urban land: 60 percent
Hayden: 40 percent

Setting

Landform: Moraines
Position on the landform: Backslopes and shoulders
Slope range: Hayden—6 to 15 percent

Component Description

Urban land

Definition: Areas in which the surface layer is impervious because of pavement or buildings
Dominant parent material: Till

Hayden

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: More than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 10.3 inches
Organic matter content: Low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Engineering" section
- "Agronomy" section

1411B—Urban land-Hayden-Estherville complex, 1 to 6 percent slopes

Composition

Urban land: 50 percent
Hayden: 30 percent
Estherville: 20 percent

Setting

Landform: Hayden—moraines; Estherville—outwash plains and terraces
Position on the landform: Shoulders and summits
Slope range: Hayden and Estherville—2 to 6 percent

Component Description

Urban land

Definition: Areas in which the surface layer is impervious because of pavement or buildings
Dominant parent material: Glacial outwash and till

Hayden

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glacial outwash and till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: Low

Estherville

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Dominant parent material: Glacial outwash and till
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- "Engineering" section
- "Agronomy" section

Wadena Series

Drainage class: Well drained
Permeability: Upper part—moderate; lower part—very rapid
Landform: Outwash plains and terraces
Parent material: Glacial outwash
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls

Typical Pedon

Wadena loam, 0 to 2 percent slopes, 200 feet south and 700 feet east of the northwest corner of sec. 10, T. 109 N., R. 20 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; neutral; abrupt smooth boundary.

A—10 to 14 inches; dark brown (10YR 3/3) loam; moderate very fine subangular blocky structure; many very dark brown (10YR 2/2) organic coatings in ped exteriors; slightly acid; clear wavy boundary.

Bw1—14 to 24 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; slightly acid; clear wavy boundary.

2Bw2—24 to 30 inches; brown (10YR 4/3) gravelly sandy clay loam; moderate medium subangular blocky structure; neutral; clear wavy boundary.

2BC—30 to 36 inches; dark yellowish brown (10YR

4/4) gravelly loamy coarse sand; weak coarse subangular blocky structure; neutral; clear wavy boundary.

2C—36 to 80 inches; brown (10YR 5/3) gravelly coarse sand; single grain; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches
Thickness of the mollic epipedon: 10 to 24 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—loam

Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—loam or clay loam

2Bw horizon:
Hue—10YR
Value—3 to 6
Chroma—3 or 4
Texture—gravelly sandy clay loam, sandy clay loam, sandy loam, or gravelly sandy loam

2BC horizon:
Hue—10YR or 7.5YR
Value—4 to 6
Chroma—3 or 4
Texture—gravelly loamy coarse sand or gravelly loamy sand

2C horizon:
Hue—10YR or 7.5YR
Value—4 to 6
Chroma—2 to 4
Texture—gravelly coarse sand, coarse sand, very gravelly coarse sand, or very gravelly sand

39A—Wadena loam, 0 to 2 percent slopes

Composition

Wadena and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Glacial outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Terril, moderately wet, and similar soils
- Minneopa and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

W—Water

Composition

Water: 100 percent

Component Description

- Naturally occurring basins of surface water

1356—Water, miscellaneous

Composition

Water: 95 percent
Inclusions: About 5 percent

Component Description

- Small manmade areas that are used for industrial, sanitary, or mining applications and that contain water most of the year

Inclusions

- Lester and similar soils

Waukegan Series

Drainage class: Well drained
Permeability: Upper part—moderate; lower part—rapid or very rapid
Landform: Outwash plains and terraces
Parent material: Alluvium and outwash
Slope range: 0 to 6 percent
Taxonomic classification: Fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls

Typical Pedon

Waukegan silt loam, 0 to 2 percent slopes, 190 feet north and 200 feet west of the southeast corner of sec. 34, T. 112 N., R. 19 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; neutral; abrupt smooth boundary.
A—8 to 12 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine granular structure; neutral; clear wavy boundary.
Bw1—12 to 22 inches; brown (10YR 4/3) silt loam; dark grayish brown (10YR 4/2) coatings on faces of peds; weak fine subangular blocky structure; moderately acid; gradual wavy boundary.
Bw2—22 to 30 inches; brown (10YR 4/3) silt loam; dark brown (10YR 3/3) coatings on faces of peds; weak medium subangular blocky structure; moderately acid; clear wavy boundary.
Bw3—30 to 33 inches; dark yellowish brown (10YR 4/4) silt loam; few brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; moderately acid; abrupt smooth boundary.
2Bw4—33 to 52 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) gravelly coarse sand; single grain; about 15 percent gravel; neutral; clear wavy boundary.
2C—52 to 80 inches; brown (10YR 5/3), yellowish brown (10YR 5/4), and grayish brown (2.5Y 5/2) gravelly coarse sand; single grain; about 20 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 40 to more than 80 inches
Thickness of the mollic epipedon: 10 to 20 inches
Content of rock fragments: 0 to 1 percent gravel in the upper part; 10 to 35 percent gravel in the lower part

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—3 to 5
Texture—silt loam or loam

2Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—coarse sand, sand, loamy coarse sand, loamy sand, or the gravelly analogs of these textures

2C horizon:
Hue—10YR, 7.5YR, or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—coarse sand, sand, or the gravelly analogs of these textures

411A—Waukegan silt loam, 0 to 2 percent slopes

Composition

Waukegan and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Shoulders and summits
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium and outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 8.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Kato and similar soils

- Littleton, till substratum, and similar soils
- Boone and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

411B—Waukegan silt loam, 2 to 6 percent slopes

Composition

Waukegan and similar soils: About 85 percent
Inclusions: About 15 percent

Setting

Landform: Outwash plains and terraces
Position on the landform: Shoulders and summits
Slope range: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium and outwash
Flooding: None
Depth to the water table: More than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Kato and similar soils
- Littleton, till substratum, and similar soils
- Boone and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Webster Series

Drainage class: Poorly drained
Permeability: Moderate
Landform: Flats on moraines
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, mesic Typic Endoaquolls

Typical Pedon

Webster clay loam, 0 to 2 percent slopes, 2,070 feet south and 1,140 feet east of the northwest corner of sec. 24, T. 107 N., R. 23 W.

A—0 to 13 inches; black (N 2/0) clay loam, black (2.5Y 2/0) dry; moderate medium angular blocky structure; friable; about 1 percent gravel; neutral; gradual wavy boundary.

AB—13 to 21 inches; 60 percent black (10YR 2/1) clay loam (A); 40 percent very dark grayish brown (10YR 3/2) clay loam (B); weak fine subangular blocky structure; friable; about 3 percent gravel; slightly acid; gradual wavy boundary.

Bw1—21 to 29 inches; dark grayish brown (2.5Y 4/2) clay loam; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; common fine faint olive brown (2.5Y 4/4) iron concentrations; about 5 percent gravel; slightly acid; gradual wavy boundary.

Bw2—29 to 48 inches; grayish brown (2.5Y 5/2) clay loam; weak medium subangular blocky structure; friable; few fine black (10YR 2/1) manganese concentrations on ped interiors; common medium distinct olive brown (2.5Y 5/6) iron concentrations; about 4 percent gravel; slightly acid; clear wavy boundary.

BC—48 to 57 inches; grayish brown (2.5Y 5/2) loam; weak medium subangular blocky structure; friable; common fine black (10YR 2/1) manganese concentrations in ped interiors; common fine distinct olive brown (2.5Y 5/6) iron concentrations; about 3 percent gravel; neutral; gradual smooth boundary.

C—57 to 80 inches; light olive brown (2.5Y 5/4) loam; massive; friable; common fine prominent gray (5Y 5/1) iron depletions and few fine distinct yellowish brown (10YR 5/8) iron concentrations; about 3 percent gravel; slightly alkaline.

Range in Characteristics

Depth to carbonates: 45 to 60 inches
Content of rock fragments: 2 to 5 percent gravel

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—clay loam

AB horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loam or clay loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 or 3
Texture—clay loam, silty clay loam, or loam

BC horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam

C horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—3 to 5
Texture—clay loam or loam

113—Webster clay loam, 0 to 2 percent slopes

Composition

Webster and similar soils: About 85 percent

Inclusions: About 15 percent

Setting

Landform: Flats on moraines
Slope range: 0 to 2 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Nicollet and similar soils
- Clarion and similar soils

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- “Agronomy” section

Soil Survey of
Rice County, Minnesota—Part II

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 to prevent 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 behavioral 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 sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational 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.

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

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.

The classification and extent of the soils in this survey area are shown in the tables “Classification of the Soils” and “Acreage and Proportionate Extent of the Soils,” which are at the end of this section.

Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range for the series)

Soil name	Family or higher taxonomic class
Angus	Mollic Hapludalfs, fine-loamy, mixed, mesic
Ankeny	Cumulic Hapludolls, coarse-loamy, mixed, mesic
Biscay	Typic Endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Blooming	Mollic Hapludalfs, fine-loamy, mixed, mesic
Bold	Typic Udorthents, coarse-silty, mixed (calcareous), mesic
Boone	Typic Quartzipsamments, mesic, uncoated
Brodale	Entic Hapludolls, loamy-skeletal, carbonatic, mesic
Clarion	Typic Hapludolls, fine-loamy, mixed, mesic
Collinwood	Aquertic Hapludolls, fine, montmorillonitic, mesic
Colo	Cumulic Endoaquolls, fine-silty, mixed, mesic
Copaston	Lithic Hapludolls, loamy, mixed, mesic
Cordova	Typic Argiaquolls, fine-loamy, mixed, mesic
Derrynane	Cumulic Vertic Endoaquolls, fine, montmorillonitic, mesic
Dickinson	Typic Hapludolls, coarse-loamy, mixed, mesic
Dundas	Mollic Endoaqualfs, fine-loamy, mixed, mesic
Epsom	Cumulic Epiaquolls, fine-loamy, mixed, mesic
Estherville	Typic Hapludolls, sandy, mixed, mesic
Eyota	Cumulic Hapludolls, coarse-loamy, mixed, mesic
Faxon	Typic Endoaquolls, fine-loamy, mixed, mesic
Garwin	Typic Haplaquolls, fine-silty, mixed, mesic
Glencoe	Cumulic Endoaquolls, fine-loamy, mixed, mesic
Hamel	Typic Argiaquolls, fine-loamy, mixed, mesic
Hawick	Entic Hapludolls, sandy, mixed, mesic
Hayden	Typic Hapludalfs, fine-loamy, mixed, mesic
Houghton	Typic Medisaprists, euic, mesic
Kasson	Aquollic Hapludalfs, fine-loamy, mixed, mesic
Kato	Typic Endoaquolls, fine-silty over sandy or sandy-skeletal, mixed, mesic
*Kenyon	Typic Hapludolls, fine-loamy, mixed, mesic
Kilkenny	Oxyaquic Vertic Hapludalfs, fine, montmorillonitic, mesic
Klinger	Aquic Hapludolls, fine-silty, mixed, mesic
Klossner	Terric Medisaprists, loamy, mixed, euic, mesic
Lerdal	Vertic Epiaqualfs, fine, montmorillonitic, mesic
Lester	Mollic Hapludalfs, fine-loamy, mixed, mesic
Le Sueur	Aquic Argiudolls, fine-loamy, mixed, mesic
Lindstrom	Cumulic Hapludolls, fine-silty, mixed, mesic
Littleton	Cumulic Hapludolls, fine-silty, mixed, mesic
Lowlein	Typic Hapludolls, coarse-loamy, mixed, mesic
Maxcreek	Typic Endoaquolls, fine-silty, mixed, mesic
Maxfield	Typic Haplaquolls, fine-silty, mixed, mesic
Mazaska	Vertic Argiaquolls, fine, montmorillonitic, mesic
Medo	Terric Medisaprists, loamy, mixed, euic, mesic
Merton	Aquic Hapludolls, fine-loamy, mixed, mesic
Minneiska	Mollic Udifluvents, coarse-loamy, mixed (calcareous), mesic
Minneopa	Aquic Hapludolls, sandy, mixed, mesic
Moland	Typic Hapludolls, fine-loamy, mixed, mesic
Muskego	Limnic Medisaprists, coprogenous, euic, mesic
Nerwoods	Aquic Hapludolls, fine-silty, mixed, mesic
Nicollet	Aquic Hapludolls, fine-loamy, mixed, mesic
Okoboji	Cumulic Vertic Endoaquolls, fine, montmorillonitic, mesic
Port Byron	Typic Hapludolls, fine-silty, mixed, mesic
Prinsburg	Typic Endoaquolls, fine-silty, mixed (calcareous), mesic
Racine	Mollic Hapludalfs, fine-loamy, mixed, mesic
Renova	Typic Hapludalfs, fine-loamy, mixed, mesic
Ripon	Typic Argiudolls, fine-silty, mixed, mesic
Rolfe	Typic Argialbolls, fine, montmorillonitic, mesic
Rushriver	Mollic Fluvaquents, coarse-loamy, mixed (calcareous), mesic
Sargeant	Aeric Glossaqualfs, fine-loamy, mixed, mesic
Shields	Vertic Epiaqualfs, fine, montmorillonitic, mesic

Classification of the Soils--Continued

Soil name	Family or higher taxonomic class
Storden	Typic Eutrochrepts, fine-loamy, mixed, mesic
Talcot	Typic Endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic
Terril	Cumulic Hapludolls, fine-loamy, mixed, mesic
Timula	Typic Eutrochrepts, coarse-silty, mixed, mesic
Wadena	Typic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Waukegan	Typic Hapludolls, fine-silty over sandy or sandy-skeletal, mixed, mesic
Webster	Typic Endoaquolls, fine-loamy, mixed, mesic

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
4D	Renova loam, 12 to 18 percent slopes	200	*
4E	Renova loam, 18 to 30 percent slopes	2,542	0.8
17	Minneopa sandy loam, 0 to 2 percent slopes, rarely flooded	324	*
24	Kasson silt loam, 1 to 3 percent slopes	1,157	0.4
39A	Wadena loam, 0 to 2 percent slopes	1,083	0.3
41A	Estherville sandy loam, 0 to 2 percent slopes	2,205	0.7
41B	Estherville sandy loam, 2 to 6 percent slopes	2,006	0.6
44	Ankeny sandy loam, 0 to 3 percent slopes	750	0.2
74B	Dickinson fine sandy loam, 1 to 6 percent slopes	1,151	0.3
81B	Boone loamy fine sand, 1 to 6 percent slopes	278	*
81D	Boone loamy fine sand, 6 to 18 percent slopes	486	0.1
81E	Boone loamy fine sand, 18 to 25 percent slopes	417	0.1
98	Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded	2,188	0.7
99D2	Racine loam, 12 to 18 percent slopes, eroded	833	0.3
100A	Copaston sandy clay loam, 0 to 2 percent slopes	63	*
102B	Clarion loam, moderately fine substratum, 2 to 5 percent slopes	1,833	0.6
104B	Hayden loam, 2 to 6 percent slopes	10,084	3.1
104C2	Hayden loam, 6 to 12 percent slopes, eroded	8,021	2.4
104D2	Hayden loam, 12 to 18 percent slopes, eroded	2,041	0.6
104E	Hayden loam, 18 to 25 percent slopes	519	0.2
106C2	Lester loam, 6 to 12 percent slopes, eroded	13,367	4.0
106D2	Lester loam, 12 to 18 percent slopes, eroded	6,486	2.0
106E	Lester loam, 18 to 25 percent slopes	3,631	1.1
109	Cordova clay loam, 0 to 2 percent slopes	6,494	2.0
113	Webster clay loam, 0 to 2 percent slopes	1,352	0.4
114	Glencoe clay loam, depressional, 0 to 1 percent slopes	7,650	2.3
130	Nicollet clay loam, 1 to 3 percent slopes	852	0.3
134	Okoboji silty clay loam, depressional, 0 to 1 percent slopes	4,041	1.2
138B	Lerdal clay loam, 2 to 6 percent slopes	8,165	2.5
138C	Lerdal clay loam, 6 to 12 percent slopes	853	0.3
176	Garwin silt loam, 0 to 2 percent slopes	895	0.3
208	Kato silty clay loam, 0 to 1 percent slopes	1,108	0.3
213B	Klinger silty clay loam, 1 to 4 percent slopes	2,267	0.7
219	Rolfe silt loam, depressional, 0 to 1 percent slopes	398	0.1
238B	Kilkenny loam, 2 to 6 percent slopes	3,726	1.1
238C2	Kilkenny clay loam, 6 to 12 percent slopes, eroded	6,025	1.8
238D2	Kilkenny clay loam, 12 to 18 percent slopes, eroded	3,739	1.1
238E	Kilkenny clay loam, 18 to 25 percent slopes	1,261	0.4
238F	Kilkenny loam, 25 to 35 percent slopes	210	*
239	Le Sueur clay loam, 1 to 3 percent slopes	5,659	1.7
253	Maxcreek silty clay loam, 0 to 1 percent slopes	4,521	1.4
256	Mazaska clay loam, 0 to 2 percent slopes	4,705	1.4
285A	Port Byron silt loam, 0 to 2 percent slopes	141	*
285B	Port Byron silt loam, 2 to 6 percent slopes	931	0.3
301B	Lindstrom silt loam, 2 to 6 percent slopes	2,710	0.8
301C	Lindstrom silt loam, 6 to 12 percent slopes	585	0.2
307	Sargeant silt loam, 0 to 2 percent slopes	762	0.2
323	Shields silty clay loam, 0 to 2 percent slopes	1,303	0.4
376B	Moland silt loam, 1 to 4 percent slopes	9,560	2.9
377	Merton silt loam, 1 to 3 percent slopes	6,359	1.9
378	Maxfield silty clay loam, 0 to 2 percent slopes	9,532	2.9
382B	Blooming silt loam, 2 to 6 percent slopes	7,766	2.4
382C2	Blooming silt loam, 6 to 12 percent slopes, eroded	2,165	0.7
392	Biscay loam, 0 to 2 percent slopes	1,643	0.5
408	Faxon clay loam, 0 to 1 percent slopes	122	*
411A	Waukegan silt loam, 0 to 2 percent slopes	6,096	1.8
411B	Waukegan silt loam, 2 to 6 percent slopes	1,118	0.3
414	Hamel loam, 1 to 3 percent slopes	14,914	4.5
463A	Minneiska fine sandy loam, 0 to 2 percent slopes, occasionally flooded	217	*
484D	Eyota fine sandy loam, 12 to 18 percent slopes	439	0.1
523	Houghton muck, depressional, 0 to 1 percent slopes	2,784	0.8

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
525	Muskego muck, depressional, 0 to 1 percent slopes	515	0.2
528B	Klossner muck, seep land, 1 to 6 percent slopes	349	0.1
529A	Ripon silt loam, 0 to 2 percent slopes	120	*
529B	Ripon silt loam, 2 to 6 percent slopes	291	*
548	Medo muck, depressional, 0 to 1 percent slopes	397	0.1
572	Lowlein sandy loam, 1 to 5 percent slopes	541	0.2
611D	Hawick sandy loam, 12 to 25 percent slopes	1,707	0.5
757	Nerwoods loam, 2 to 6 percent slopes	4,393	1.3
761	Epsom silty clay loam, 0 to 2 percent slopes, frequently flooded	4,805	1.5
764	Klossner muck, 0 to 1 percent slopes, flooded	862	0.3
783C2	Lester-Kilkenny complex, 6 to 12 percent slopes, eroded	3,513	1.1
783D2	Lester-Kilkenny complex, 12 to 18 percent slopes, eroded	2,602	0.8
783E	Lester-Kilkenny complex, 18 to 25 percent slopes	1,379	0.4
783F	Lester-Kilkenny complex, 25 to 35 percent slopes	294	*
849B	Urban land-Estherville complex, 1 to 6 percent slopes	1,741	0.5
860C	Urban land-Hayden complex, 6 to 15 percent slopes	59	*
875B	Hawick-Estherville complex, 2 to 6 percent slopes	2,781	0.8
875C	Hawick-Estherville complex, 6 to 12 percent slopes	3,211	1.0
945C2	Lester-Storden complex, 6 to 12 percent slopes, eroded	2,723	0.8
945D2	Lester-Storden complex, 12 to 18 percent slopes, eroded	814	0.2
963C2	Timula-Bold complex, 6 to 12 percent slopes, eroded	1,191	0.4
963D2	Timula-Bold complex, 12 to 18 percent slopes, eroded	199	*
1013	Pits, quarry	31	*
1016	Udorthents, loamy (cut and fill land)	1,726	0.5
1030	Pits, gravel-Udipsamments complex	1,149	0.3
1058	Houghton and Muskego soils, ponded, 0 to 1 percent slopes	12,862	3.9
1080	Klossner, Okoboji, and Glencoe soils, ponded, 0 to 1 percent slopes	5,359	1.6
1116F	Brodale-Eyota complex, 12 to 35 percent slopes	2,258	0.7
1286	Prinsburg silty clay loam, 0 to 2 percent slopes	1,657	0.5
1356	Water, miscellaneous	27	*
1360	Rushriver fine sandy loam, 0 to 1 percent slopes, frequently flooded	2,524	0.8
1361	Le Sueur loam, moderately coarse substratum, 1 to 3 percent slopes	2,151	0.7
1362B	Angus loam, 2 to 5 percent slopes	18,230	5.5
1363	Dundas silt loam, moderately coarse substratum, 0 to 2 percent slopes	1,551	0.5
1366	Talcot silty clay loam, 0 to 1 percent slopes	491	0.1
1367	Derrynane clay loam, 1 to 3 percent slopes	5,603	1.7
1387A	Collinwood silty clay loam, moderately wet, 0 to 3 percent slopes	222	*
1388B	Terril loam, moderately wet, 2 to 6 percent slopes	2,291	0.7
1408B	Angus-Kilkenny complex, 2 to 6 percent slopes	1,743	0.5
1409A	Kenyon silt loam, moderately wet, 0 to 3 percent slopes	4,868	1.5
1409B	Kenyon silt loam, moderately wet, 3 to 6 percent slopes	3,760	1.1
1410B	Racine silt loam, moderately wet, 2 to 6 percent slopes	3,850	1.2
1410C	Racine silt loam, moderately wet, 6 to 12 percent slopes, eroded	4,044	1.2
1411B	Urban land-Hayden-Estherville complex, 1 to 6 percent slopes	522	0.2
1413B	Littleton silt loam, till substratum, 1 to 4 percent slopes	5,873	1.8
1416C	Renova loam, moderately wet, 6 to 12 percent slopes	194	*
1437B	Renova silt loam, moderately wet, 2 to 6 percent slopes	353	0.1
1501	Klossner mucky silty clay loam, overwash, 0 to 1 percent slopes	2,278	0.7
1831	Colo silt loam, channeled, 0 to 2 percent slopes, frequently flooded	1,631	0.5
1962	Mazaska-Rolfe complex, 0 to 2 percent slopes	1,512	0.5
W	Water	12,120	3.7
	Total	330,100	100.0

* Less than 0.1 percent.

Agronomy

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, prime farmland is defined, 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 obtaining specific information from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Crops and Pasture

Tom Coffman, district conservationist, Natural Resources Conservation Service, helped prepare this section.

The main concerns affecting the management of the soils for crops and pasture in Rice County are erosion and soil wetness.

Erosion is widespread throughout the county. The hazard of water erosion is greater than the hazard of wind erosion.

Prior to settlement, approximately two-thirds of the county was woodland. When the land was cleared for farming, excessive erosion occurred for various reasons. Woodland soils have low levels of organic matter. Soil tilth was poor, and thus the soils were susceptible to erosion. Little was known about crop rotations and conservation practices prior to 1940. Small grain was a major crop in the early days of settlement. Continuous planting of small grain crops and excessive tillage resulted in excessive erosion. Preparing a smooth, clean seedbed and cultivating row crops several times also led to excessive erosion. Many retired farmers today remember the huge gullies that existed on their farms one or two generations ago. It is quite common to hear the comment that tractors could be buried in many of the gullies that covered the cropped landscape.

Excessive erosion early in the development of agriculture in the county contributed a considerable amount of sediment in lakes and streams. When sediment is deposited into a lake, the nutrients attached to the sediment are available for plant growth annually. When the plants die, the nutrients are released back into the water for the next cycle.

Because of current farming practices, the huge gullies no longer exist on the landscape. Water- and sediment-control basins have reduced the hazard of gully erosion. In areas with large drainageways, grassed waterways are used.

Sheet and rill erosion occurs in many areas throughout the county. This type of erosion is less noticeable than gully erosion. Crop residue management is the best practice for controlling sheet and rill erosion. This practice is being used on approximately 25 percent of the tillable acres in the county. The most common form of crop residue management is a mulch tillage system, which involves the use of a chisel plow or v-ripper. Ridge-till is used consistently on a small acreage, and no-till is also used.

In some areas, subsurface drainage tile may be needed to optimize the effects of crop residue management systems and sediment basins. Approximately 40 percent of the soils used as cropland in Rice County have a seasonal high water table. On many farms, tile systems have been established on these wet soils with a spacing of 70 to 80 feet. Although many farms are completely tiled, there are still many that are incompletely drained. Federal and State programs prohibit the drainage of wetlands, but drainage is still common in areas of wet soils that have a cropping history.

Pastures in Rice County have not been managed significantly in the past. A few farmers now are seeding areas of cropland and managing these fields as pastureland using an intensive system of rotation grazing.

The potential of the soils in Rice County for increased production of crops and pasture is good. Most areas that are suitable are presently used for these purposes, but production could generally be increased by applying the latest crop production technology. This soil survey can greatly facilitate the application of such technology.

Cropland Management Considerations

The management concerns affecting the use of the detailed soil map units in the survey area for crops are shown in the table "Cropland Management Considerations." The main concerns in managing nonirrigated cropland are conserving moisture, controlling wind erosion and water erosion, and maintaining soil fertility.

Conserving moisture consists primarily of reducing the evaporation and runoff rates and increasing the rate of water infiltration. Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, and leaving crop residue on the surface conserve moisture.

Generally, a combination of several practices is needed to control *wind erosion* and *water erosion*. Conservation tillage, stripcropping, field windbreaks, contour farming, conservation cropping systems, crop residue management, terraces, diversions, and grassed waterways help to prevent excessive soil loss.

Measures that are effective in maintaining *soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients and thus helps to maintain productivity, although the level of fertility can be reduced even in areas where erosion is controlled. All soils used for nonirrigated crops respond well to applications of fertilizer.

Some of the considerations shown in the table cannot be easily overcome. These are *channels, flooding, gullies,* and *ponding*.

Additional considerations are as follows:

Lime content, limited available water capacity, potential poor tilth and compaction, and restricted permeability.—These limitations can be minimized by incorporating green manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. Also, crops may respond well to additions of phosphate fertilizer to soils that have a high content of lime.

Potential for ground-water contamination.—The proper use of nutrients and pesticides can reduce the risk of ground-water contamination.

Potential for surface-water contamination.—The risk of surface-water contamination can be reduced by the proper use of nutrients and pesticides and by conservation farming practices that reduce the runoff rate.

Surface crusting.—This limitation retards seedling development after periods of heavy rainfall.

Surface rock fragments.—This limitation causes rapid wear of tillage equipment. It cannot be easily overcome.

Surface stones.—Stones or boulders on or near the surface can hinder normal tillage unless they are removed.

Salt content.—In areas where this is a limitation, only salt-tolerant crops should be grown.

Explanation of Criteria

Acid soil.—The pH is less than 6.1.

Channeled.—The word "channeled" is included in the map unit name.

Dense layer.—The bulk density is 1.80 g/cc or greater within the soil profile.

Depth to rock.—The depth to bedrock is less than 40 inches.

Eroded.—The word "eroded" is included in the map unit name.

Excessive permeability.—Permeability is 6 inches per hour or more within the soil profile.

Flooding.—Flooding is occasional or frequent.

Gullied.—The word "gullied" is included in the map unit name.

High organic matter content.—The surface layer has more than 20 percent organic matter.

Lime content.—The pH is 7.4 or more in the surface layer, or the wind erodibility group is 4L.

Limited available water capacity.—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 6 inches or less.

Limited organic matter content.—The content of organic matter is 2 percent or less in the surface layer.

Ponding.—Ponding duration is assigned to the map unit component. The water table is above the surface.

Potential poor tilth and compaction.—The content of clay is 27 percent or more in the surface layer.

Potential for ground-water contamination (by nutrients or pesticides).—Depth to the water table is 4 feet or less, the permeability of any layer is more than 6.0 inches per hour, or the depth to bedrock is less than 60 inches.

Potential for surface-water contamination (by nutrients or pesticides).—The map unit component is occasionally flooded or frequently flooded, is subject to ponding, is assigned to hydrologic group C or D and has a slope of more than 2 percent, is assigned to hydrologic group A and has a slope of more than 6 percent, or is assigned to hydrologic group B, has a slope of 3 percent or more, and has a K factor of more than 0.17.

Restricted permeability.—Permeability is less than 0.06 inch per hour within the soil profile.

Salt content.—The electrical conductivity is 4 or more in the surface layer or 8 or more within a depth of 30 inches.

Slope (equipment limitation).—The slope is more than 15 percent.

Surface crusting.—The content of clay is 27 percent or more and the content of organic matter is 2 percent or less in the surface layer.

Surface rock fragments (equipment limitation).—The terms describing the texture of the surface layer include any rock fragment modifier, except for gravelly, channery, stony, very stony, extremely stony, bouldery, very bouldery, and extremely bouldery.

Surface stones (equipment limitation).—The word "stony" or "bouldery" is included in the map unit name or in the description of the surface layer.

Water erosion.—Either the slope is 6 percent or more, or the slope is more than 3 percent and less than 6 percent and the surface layer is not sandy.

Water table.—A water table is within 2.5 feet of the surface.

Wind erosion.—The wind erodibility group is 1, 2, 3, or 4L.

Crop Yield Estimates

The average yields per acre that can be expected of the principal crops under a high level of management are shown in the table "Land Capability and Yields per Acre of Crops." 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 the map units in the survey area 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 also are 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 the table 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 Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Pasture and Hayland Interpretations

Under good management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season. Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

Yield estimates are often provided in animal unit months (AUM), or 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.

The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about forage yields other than those shown in the table "Land Capability and Yields per Acre of 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 take into account 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 woodland or for engineering purposes.

In the capability system, soils generally are grouped at three levels—capability class, subclass, and unit (USDA, 1961). These categories indicate the degree and kinds of limitations affecting mechanized farming

systems that produce the more commonly grown field crops, such as corn, small grain, cotton, hay, and field-grown vegetables. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and woodland. The degree of the soil limitations affecting the production of cultivated crops increases progressively from class 1 to class 4. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7.

Areas in class 8 are generally not suitable for crops, pasture, or woodland without a level of management that is impractical. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

Capability subclasses identify the dominant kind of limitation in the class. They are designated by adding a small letter, *e, w, s,* or *c*, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless a 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.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the table “Land Capability and Yields per Acre of Crops” at the end of this section.

Prime Farmland

Prime farmland is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, State, and Federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in National forests, National parks, military reservations, and State parks.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity and the content of salts and sodium are acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and they are not frequently flooded during the growing season or are protected from flooding. Slopes range mainly from 0 to 6 percent.

Soils that have a high water table or are subject to flooding may qualify as prime farmland where these limitations are overcome by drainage measures or flood control. Onsite evaluation is necessary to determine the effectiveness of corrective measures.

More information about the criteria for prime farmland can be obtained at the local office of the Natural Resources Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 186,726 acres, or nearly 57 percent of the survey area, meets the requirements for prime farmland.

The map units in the survey area that meet the requirements for prime farmland are listed in the table "Prime Farmland." On some soils included in the table, measures that overcome limitations are needed. The need for these measures is indicated in parentheses after the map unit name. The location of each map unit is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section "Soil Series and Detailed Soil Map Units" in Part I of this publication. This list does not constitute a recommendation for a particular land use.

Erosion Factors

Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices. The erosion factors are shown in the table "Physical Properties of the Soils."

Soil Erodibility (K) Factor

The soil erodibility (K) factor indicates the susceptibility of a soil to sheet and rill erosion by water. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand, the content of sand coarser than very fine sand, the content of organic matter, soil structure, and permeability.

Fragment-Free Soil Erodibility (Kf) Factor

This is one of the factors used in the Revised Universal Soil Loss Equation. It shows the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Soil-Loss Tolerance (T) Factor

The soil-loss tolerance (T) factor is an estimate of the maximum annual rate of soil erosion that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used, depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

Wind Erodibility Groups

Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index (I) factor is determined. This factor is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEG) having similar percentages of dry soil aggregates larger than 0.84 millimeter. The wind erodibility groups and wind erodibility index factors are listed in the table "Physical Properties of the Soils."

Additional information about wind erodibility groups and K, Kf, T, and I factors can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

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, 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.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of trees that have been planted and have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or grow poorly, depending on the characteristics of the soil. Each tree or shrub has definable potential heights in a given physiographic area and under a given climate. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The table “Windbreaks and Environmental Plantings” shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in this table 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 Natural Resources Conservation Service or the Cooperative Extension Service or from a nursery.

Windbreak Suitability Groups

Windbreak suitability groups consist of soils in which the kinds and degrees of the hazards and limitations that affect the survival and growth of trees and shrubs in windbreaks are about the same. The windbreak suitability groups assigned to the soils in the survey area are listed in the table “Windbreak Suitability Groups” at the end of this section. The groups are described in the following paragraphs.

Group 1 consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and do not have free carbonates in the upper 20 inches.

Group 1K consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and have free carbonates within 20 inches of the surface. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2 consists of poorly drained soils that have been artificially drained and do not have free carbonates in the upper 20 inches. Permeability varies.

Group 2K consists of poorly drained or very poorly drained soils that have been artificially drained and have free carbonates within 20 inches of the surface. Permeability varies. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2H consists of very poorly drained soils that have been artificially drained and have more than 16 inches of organic material. Permeability varies.

Group 2W consists of very poorly drained soils that are subject to ponding and have been artificially drained. It includes soils that have an organic surface layer up to 16 inches thick. Permeability varies.

Group 3 consists of soils that are well drained or moderately well drained and are loamy or silty throughout. Permeability is moderate or moderately slow. These soils do not have free carbonates in the upper 20 inches.

Group 4 consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a silty or loamy surface layer and a clayey subsoil. Permeability is slow or very slow.

Group 4C consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a clayey surface layer and subsoil. Permeability is slow or very slow.

Group 4F consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a substratum of dense till. Permeability is slow or very slow.

Group 5 consists of soils that are excessively drained to moderately well drained and have a moderate available water capacity. These soils are dominantly fine sandy loam or sandy loam, but some are sandy in the upper part and loamy in the lower part.

Group 6G consists of excessively drained to moderately well drained soils that are loamy in the upper part and have sand or sand and gravel at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 6D consists of excessively drained to moderately well drained, loamy soils that have bedrock at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 7 consists of excessively drained to well drained soils that are dominantly loamy fine sand or coarser textured and are shallow to sand or to sand and gravel. These soils have a low available water capacity.

Group 8 consists of excessively drained to well drained, loamy soils that have free carbonates within 20 inches of the surface.

Group 9W consists of soils that are somewhat poorly drained, poorly drained, or very poorly drained and are moderately saline (the electrical conductivity is 8 to 16).

Group 10 consists of soils or miscellaneous areas that generally are not suitable for windbreaks. One or more characteristics, such as soil depth, texture, wetness, available water capacity, or slope, limit the planting, survival, or growth of trees and shrubs.

Cropland Management Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Cropland management considerations
4D:	
Renova	Acid soil Limited organic matter content Potential for surface-water contamination Slope Water erosion
4E:	
Renova	Acid soil Limited organic matter content Potential for surface-water contamination Slope Water erosion
17:	
Minneopa	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
24:	
Kasson	Acid soil Potential for ground-water contamination Potential for surface-water contamination Water table
39A:	
Wadena	Excessive permeability Potential for ground-water contamination
41A:	
Estherville	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
41B:	
Estherville	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
44:	
Ankeny	Excessive permeability Potential for ground-water contamination Wind erosion
74B:	
Dickinson	Excessive permeability Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
81B:	
Boone	Depth to rock Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
81D:	
Boone	Depth to rock Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
81E:	
Boone	Depth to rock Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
98:	
Colo	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
99D2:	
Racine	Acid soil Potential for surface-water contamination Previously eroded Slope Water erosion
100A:	
Copaston	Depth to rock Limited available water capacity Potential for ground-water contamination
102B:	
Clarion	Potential for ground-water contamination Potential for surface-water contamination Water erosion
104B:	
Hayden	Limited organic matter content Potential for surface-water contamination Water erosion
104C2:	
Hayden	Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
104D2:	
Hayden	Limited organic matter content Potential for surface-water contamination Previously eroded Slope Water erosion
104E:	
Hayden	Limited organic matter content Potential for surface-water contamination Slope Water erosion
106C2:	
Lester	Potential for surface-water contamination Previously eroded Water erosion
106D2:	
Lester	Potential for surface-water contamination Previously eroded Slope Water erosion
106E:	
Lester	Potential for surface-water contamination Slope Water erosion
109:	
Cordova	Potential for ground-water contamination Potential poor tilth and compaction Water table
113:	
Webster	Potential for ground-water contamination Water table
114:	
Glencoe	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
130:	
Nicollet	Potential for ground-water contamination Potential poor tilth and compaction Water table
134:	
Okoboji	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
138B:	
Lerdal	Acid soil Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
138C:	
Lerdal	Acid soil Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion Water table
176:	
Garwin	Potential for ground-water contamination Water table
208:	
Kato	Excessive permeability Potential for ground-water contamination Potential poor tilth and compaction Water table
213B:	
Klinger	Potential for ground-water contamination Potential poor tilth and compaction Water erosion Water table
219:	
Rolfe	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
238B:	
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Water erosion
238C2:	
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
238D2:	
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
238E:	
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Slope Water erosion
238F:	
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
239:	
Le Sueur	Potential for ground-water contamination Potential poor tilth and compaction
253:	
Maxcreek	Potential for ground-water contamination Potential poor tilth and compaction Water table
256:	
Mazaska	Potential for ground-water contamination Potential poor tilth and compaction Water table
285A:	
Port Byron	No major limitations or hazards
285B:	
Port Byron	Potential for surface-water contamination Water erosion
301B:	
Lindstrom	Potential for surface-water contamination Water erosion
301C:	
Lindstrom	Potential for surface-water contamination Water erosion
307:	
Sargeant	Potential for ground-water contamination Water table
323:	
Shields	Potential for ground-water contamination Potential poor tilth and compaction Water table
376B:	
Moland	Water erosion
377:	
Merton	Potential for ground-water contamination Water table
378:	
Maxfield	Potential for ground-water contamination Potential poor tilth and compaction Water table
382B:	
Blooming	Potential for surface-water contamination Water erosion
382C2:	
Blooming	Potential for surface-water contamination Previously eroded Water erosion
392:	
Biscay	Excessive permeability Potential for ground-water contamination Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
408:	
Faxon	Depth to rock Potential for ground-water contamination Potential poor tilth and compaction Water table
411A:	
Waukegan	Excessive permeability Potential for ground-water contamination
411B:	
Waukegan	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion
414:	
Hamel	Potential for ground-water contamination Potential for surface-water contamination Water table
463A:	
Minneiska	Excessive permeability Flooding Lime content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
484D:	
Eyota	Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
523:	
Houghton	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
525:	
Muskego	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
528B:	
Klossner	High organic matter content Potential for ground-water contamination Water erosion Water table
529A:	
Ripon	Depth to rock Potential for ground-water contamination

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
529B:	
Ripon	Depth to rock Potential for ground-water contamination Potential for surface-water contamination Water erosion
548:	
Medo	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
572:	
Lowlein	Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
611D:	
Hawick	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
757:	
Nerwoods	Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table
761:	
Epsom	Flooding Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
764:	
Klossner	Flooding High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
783C2:	
Lester	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
783D2:	
Lester	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
783E:	
Lester	Potential for surface-water contamination Slope Water erosion
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Slope Water erosion
783F:	
Lester	Potential for surface-water contamination Slope Water erosion
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion
849B:	
Urban land-Estherville.	
860C:	
Urban land-Hayden.	
875B:	
Hawick	Excessive permeability Limited available water capacity Potential for ground-water contamination Water erosion Wind erosion
Estherville	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
875C:	
Hawick	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
875C:	
Estherville	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
945C2:	
Lester	Potential for surface-water contamination Previously eroded Water erosion
Storden	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
945D2:	
Lester	Potential for surface-water contamination Previously eroded Slope Water erosion
Storden	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
963C2:	
Timula	Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion
Bold	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
963D2:	
Timula	Limited organic matter content Potential for surface-water contamination Previously eroded Slope Water erosion
Bold	Lime content Limited organic matter content Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1013:	
Pits.	
1016:	
Udorthents.	
1030:	
Pits-Udipsamments.	
1058:	
Houghton	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Muskego	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1080:	
Klossner	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
Okoboji	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
Glencoe	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1116F:	
Brodale	Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Slope Surface rock fragments Water erosion
Eyota	Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion Wind erosion
1286:	
Prinsburg	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1360:	
Rushriver	Flooding Lime content Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1361:	
Le Sueur	Potential for ground-water contamination
1362B:	
Angus	Potential for ground-water contamination Potential for surface-water contamination Water erosion
1363:	
Dundas	Potential for ground-water contamination Water table
1366:	
Talcot	Excessive permeability Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
1367:	
Derrynane	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1387A:	
Collinwood	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1388B:	
Terril	Potential for ground-water contamination Potential for surface-water contamination Water erosion
1408B:	
Angus	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion
Kilkenny	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion
1409A:	
Kenyon	Potential for ground-water contamination
1409B:	
Kenyon	Potential for ground-water contamination Potential for surface-water contamination Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1410B:	
Racine	Acid soil Potential for ground-water contamination Potential for surface-water contamination Water erosion
1410C:	
Racine	Acid soil Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion
1411B:	
Urban land-Hayden-Estherville.	
1413B:	
Littleton	Potential for ground-water contamination Water erosion Water table
1416C:	
Renova	Acid soil Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion
1437B:	
Renova	Acid soil Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion
1501:	
Klossner	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1831:	
Colo	Channeled Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
1962:	
Mazaska	Potential for ground-water contamination Potential poor tilth and compaction Water table
Rolfe	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table

Land Capability and Yields per Acre of Crops

(Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Corn	Oats	Soybeans	Bromegrass-alfalfa hay
		Bu	Bu	Bu	Tons
4D---------- Renova	4e	102	61	35	4.1
4E---------- Renova	6e	74	48	26	2.9
17---------- Minneopa	3s	120	78	41	4.8
24---------- Kasson	2s	143	85	49	5.8
39A---------- Wadena	2s	144	87	49	5.7
41A---------- Estherville	3s	86	60	32	3.7
41B---------- Estherville	3s	77	54	26	3.1
44---------- Ankeny	2s	155	91	53	6.1
74B---------- Dickinson	3e	128	81	44	5.2
81B---------- Boone	4s	77	64	26	3.1
81D---------- Boone	7s	---	---	---	2.2
81E---------- Boone	7s	---	---	---	1.9
98---------- Colo	2w	131	77	44	4.5
99D2---------- Racine	4e	105	65	37	3.8
100A---------- Copaston	3s	73	56	25	2.9
102B---------- Clarion	2e	155	92	53	6.1
104B---------- Hayden	2e	135	80	46	5.3
104C2---------- Hayden	3e	121	72	41	4.7

Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn	Oats	Soybeans	Bromegrass-alfalfa hay
		Bu	Bu	Bu	Tons
104D2---------- Hayden	4e	103	61	35	4.0
104E---------- Hayden	6e	73	50	25	2.9
106C2---------- Lester	3e	139	83	48	5.5
106D2---------- Lester	4e	118	71	41	4.7
106E---------- Lester	6e	82	53	28	3.3
109---------- Cordova	2w	134	79	46	4.6
113---------- Webster	2w	134	79	46	4.6
114---------- Glencoe	3w	129	76	44	4.0
130---------- Nicollet	1	160	95	56	6.2
134---------- Okoboji	3w	115	69	39	3.5
138B---------- Lerdal	2e	119	71	41	4.3
138C---------- Lerdal	3e	105	63	36	3.8
176---------- Garwin	2w	134	79	46	4.6
208---------- Kato	2w	129	76	44	4.4
213B---------- Klinger	2e	129	76	44	4.7
219---------- Rolfe	3w	99	59	34	3.0
238B---------- Kilkenny	2e	132	78	45	5.3
238C2---------- Kilkenny	3e	119	70	41	4.8
238D2---------- Kilkenny	4e	101	60	35	4.1
238E---------- Kilkenny	6e	64	40	22	2.9

Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn	Oats	Soybeans	Bromegrass-alfalfa hay
		Bu	Bu	Bu	Tons
238F---------- Kilkenny	7e	---	---	---	2.5
239---------- Le Sueur	1	158	92	54	6.2
253---------- Maxcreek	2w	133	78	45	4.6
256---------- Mazaska	2w	124	73	42	4.2
285A---------- Port Byron	1	155	91	53	6.1
285B---------- Port Byron	2e	153	90	52	6.0
301B---------- Lindstrom	2e	153	90	52	6.0
301C---------- Lindstrom	3e	138	81	47	5.4
307---------- Sargeant	3w	118	70	41	4.1
323---------- Shields	3w	124	73	42	4.2
376B---------- Moland	2e	156	92	54	6.2
377---------- Merton	2e	159	94	55	6.4
378---------- Maxfield	2w	134	79	46	4.6
382B---------- Blooming	2e	153	90	52	6.0
382C2---------- Blooming	3e	138	81	47	5.4
392---------- Biscay	2w	129	76	44	4.4
408---------- Faxon	3w	107	67	37	3.5
411A---------- Waukegan	2s	152	89	52	6.0
411B---------- Waukegan	2e	133	82	45	5.2
414---------- Hamel	2w	135	80	46	4.7

Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn	Oats	Soybeans	Bromegrass-alfalfa hay
		Bu	Bu	Bu	Tons
463A---------- Minneiska	2w	118	74	40	4.8
484D---------- Eyota	4e	105	67	36	4.2
523---------- Houghton	3w	112	66	39	3.4
525---------- Muskego	4w	112	66	39	3.4
528B---------- Klossner	7w	---	---	---	---
529A---------- Ripon	2s	138	85	48	5.5
529B---------- Ripon	2e	138	85	48	5.5
548---------- Medo	3w	112	66	39	3.4
572---------- Lowlein	2e	158	94	54	6.4
611D---------- Hawick	7s	---	---	---	2.2
757---------- Nerwoods	2e	126	75	43	4.6
761---------- Epsom	6w	---	---	---	---
764---------- Klossner	8w	---	---	---	---
783C2---------- Lester-Kilkenny	3e	132	80	46	5.3
783D2---------- Lester-Kilkenny	4e	112	68	39	4.5
783E---------- Lester-Kilkenny	6e	68	43	24	3.1
783F---------- Lester-Kilkenny	7e	---	---	---	2.7
849B:					
Urban land.					
Estherville-----	3s	---	---	---	---
860C:					
Urban land.					
Hayden----------	3e	---	---	---	---

Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn	Oats	Soybeans	Bromegrass-alfalfa hay
		Bu	Bu	Bu	Tons
875B----------		86	62	30	3.5
Hawick----------	4s				
Estherville-----	3s				
875C----------	4s	68	52	23	2.8
Hawick-Estherville					
945C2----------	3e	135	79	46	5.3
Lester-Storden					
945D2----------	4e	109	65	37	4.3
Lester-Storden					
963C2----------	3e	124	75	43	4.9
Timula-Bold					
963D2----------		105	64	37	4.2
Timula----------	4e				
Bold----------	6e				
1013. Pits					
1016----------	6s	---	---	---	---
Udorthents					
1030: Pits.					
Udipsamments----	8s	---	---	---	---
1058----------	8w	---	---	---	---
Houghton and Muskego					
1080----------	8w	---	---	---	---
Klossner, Okoboji, and Glencoe					
1116F----------		---	---	---	---
Brodale---------	7s				
Eyota----------	6e				
1286----------	2w	129	76	42	4.4
Prinsburg					
1360----------	5w	---	---	---	---
Rushriver-------					
1361----------	1	155	90	52	6.2
Le Sueur					
1362B----------	2e	155	92	53	6.1
Angus					

Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn	Oats	Soybeans	Bromegrass-alfalfa hay
		Bu	Bu	Bu	Tons
1363---------- Dundas	2w	128	75	44	4.6
1366---------- Talcot	2w	127	75	41	4.4
1367---------- Derrynane	2w	120	71	41	4.2
1387A---------- Collinwood	2w	121	71	41	4.4
1388B---------- Terril	2e	157	94	54	6.3
1408B---------- Angus-Kilkenny	2e	145	86	50	5.8
1409A---------- Kenyon	1	142	84	49	5.7
1409B---------- Kenyon	2e	140	83	48	5.7
1410B---------- Racine	2e	137	81	47	5.4
1410C---------- Racine	3e	123	73	42	4.9
1411B:					
Urban land.					
Hayden----------	2e	---	---	---	---
Estherville-----	3s	---	---	---	---
1413B---------- Littleton	2e	143	85	49	5.2
1416C---------- Renova	3e	121	72	41	4.8
1437B---------- Renova	2e	135	80	46	5.3
1501---------- Klossner	3w	114	67	39	3.5
1831---------- Colo	5w	---	---	---	---
1962----------		118	70	40	3.9
Mazaska---------	2w				
Rolfe----------	3w				

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
24	Kasson silt loam, 1 to 3 percent slopes
39A	Wadena loam, 0 to 2 percent slopes
44	Ankeny sandy loam, 0 to 3 percent slopes
74B	Dickinson fine sandy loam, 1 to 6 percent slopes
98	Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded (where drained)
102B	Clarion loam, moderately fine substratum, 2 to 5 percent slopes
104B	Hayden loam, 2 to 6 percent slopes
109	Cordova clay loam, 0 to 2 percent slopes (where drained)
113	Webster clay loam, 0 to 2 percent slopes (where drained)
114	Glencoe clay loam, depressional, 0 to 1 percent slopes (where drained)
130	Nicollet clay loam, 1 to 3 percent slopes
134	Okoboji silty clay loam, depressional, 0 to 1 percent slopes (where drained)
138B	Lerdal clay loam, 2 to 6 percent slopes (where drained)
176	Garwin silt loam, 0 to 2 percent slopes (where drained)
208	Kato silty clay loam, 0 to 1 percent slopes (where drained)
213B	Klinger silty clay loam, 1 to 4 percent slopes
219	Rolfe silt loam, depressional, 0 to 1 percent slopes (where drained)
238B	Kilkenny loam, 2 to 6 percent slopes
239	Le Sueur clay loam, 1 to 3 percent slopes
253	Maxcreek silty clay loam, 0 to 1 percent slopes (where drained)
256	Mazaska silty clay loam, 0 to 2 percent slopes (where drained)
285A	Port Byron silt loam, 0 to 2 percent slopes
285B	Port Byron silt loam, 2 to 6 percent slopes
301B	Lindstrom silt loam, 2 to 6 percent slopes
307	Sargeant silt loam, 0 to 2 percent slopes (where drained)
323	Shields silty clay loam, 0 to 2 percent slopes (where drained)
376B	Moland silt loam, 1 to 4 percent slopes
377	Merton silt loam, 1 to 3 percent slopes
378	Maxfield silty clay loam, 0 to 2 percent slopes (where drained)
382B	Blooming silt loam, 2 to 6 percent slopes
392	Biscay loam, 0 to 2 percent slopes (where drained)
411A	Waukegan silt loam, 0 to 2 percent slopes
411B	Waukegan silt loam, 2 to 6 percent slopes
414	Hamel loam, 1 to 3 percent slopes (where drained)
463A	Minneiska loam, 0 to 2 percent slopes, occasionally flooded
529A	Ripon silt loam, 0 to 2 percent slopes
529B	Ripon silt loam, 2 to 6 percent slopes
572	Lowlein sandy loam, 1 to 5 percent slopes
1286	Prinsburg silty clay loam, 0 to 2 percent slopes (where drained)
1361	Le Sueur loam, moderately coarse substratum, 1 to 3 percent slopes
1362B	Angus loam, 2 to 5 percent slopes
1363	Dundas silt loam, moderately coarse substratum, 0 to 2 percent slopes (where drained)
1366	Talcot silty clay loam, 0 to 1 percent slopes (where drained)
1367	Derrynane clay loam, 1 to 3 percent slopes (where drained)
1387A	Collinwood silty clay loam, moderately wet, 0 to 3 percent slopes
1388B	Terril loam, moderately wet, 2 to 6 percent slopes
1408B	Angus-Kilkenny complex, 2 to 6 percent slopes
1409A	Kenyon silt loam, moderately wet, 0 to 3 percent slopes
1409B	Kenyon silt loam, moderately wet, 3 to 6 percent slopes
1410B	Racine silt loam, moderately wet, 2 to 6 percent slopes
1413B	Littleton silt loam, till substratum, 1 to 4 percent slopes
1437B	Renova silt loam, moderately wet, 2 to 6 percent slopes

Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
4D, 4E:					
Renova	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
17:					
Minneopa	---	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
24:					
Kasson	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
39A:					
Wadena	Siberian peashrub, lilac.	Hackberry, Russian-olive, eastern redcedar, Manchurian crabapple.	Green ash, jack pine, eastern white pine, bur oak.	---	---
41A, 41B:					
Estherville	Siberian peashrub	Eastern redcedar, lilac.	Russian-olive, green ash, honeylocust, jack pine, Austrian pine, red pine, Siberian elm.	Eastern white pine	---
44:					
Ankeny	Lilac	Siberian peashrub, Russian-olive, eastern redcedar.	Amur maple, hackberry, green ash, honeylocust, Norway spruce, red pine, eastern white pine.	---	---
74B:					
Dickinson	Lilac	Siberian peashrub, Russian-olive, eastern redcedar.	Amur maple, hackberry, green ash, honeylocust, Norway spruce, red pine, eastern white pine.	---	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
81B, 81D, 81E:					
Boone	Manyflower cotoneaster.	Amur maple, Siberian peashrub, silky dogwood, gray dogwood, eastern redcedar, lilac, American cranberrybush.	Norway spruce	Jack pine, red pine, eastern white pine.	---
98:					
Colo	---	Redosier dogwood, American plum.	White fir, Amur maple, hackberry, white spruce, tall purple willow.	Green ash, golden willow.	Silver maple, eastern cottonwood.
99D2:					
Racine	---	Amur maple, gray dogwood, lilac, northern whitecedar, American cranberrybush.	Norway spruce, white spruce, Black Hills spruce.	Red maple, white ash, red pine, eastern white pine.	---
102B:					
Clarion	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
104B, 104C2, 104D2, 104E:					
Hayden	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
106C2, 106D2, 106E:					
Lester	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
109:					
Cordova	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
113:					
Webster	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
114:					
Glencoe	---	Redosier dogwood	Black ash, tall purple willow.	White willow, golden willow, black willow.	---
130:					
Nicollet	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
134:					
Okoboji	---	Redosier dogwood	Black ash, tall purple willow.	White willow, golden willow, black willow.	---
138B, 138C:					
Lerdal	---	Siberian peashrub, eastern redcedar, lilac, northern whitecedar.	Hackberry, Russian-olive, white spruce, Austrian pine, bur oak.	Green ash, eastern white pine.	---
176:					
Garwin	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
208:					
Kato	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
213B:					
Klinger	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
219:					
Rolfe	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
238B, 238C2, 238D2, 238E, 238F:					
Kilkenny	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, eastern redcedar, blue spruce, northern whitecedar.	Green ash, Austrian pine, eastern white pine.	---
239:					
Le Sueur	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
253:					
Maxcreek	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
256:					
Mazaska	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
285A, 285B:					
Port Byron	---	Siberian peashrub, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
301B, 301C:					
Lindstrom	---	Amur maple, gray dogwood, lilac, northern whitecedar, American cranberrybush.	Norway spruce, white spruce, Black Hills spruce.	Red maple, white ash, red pine, eastern white pine.	---
307:					
Sargeant	---	Siberian peashrub, eastern redcedar, Tatarian honeysuckle, lilac, northern whitecedar.	Hackberry, Russian-olive, white spruce, Austrian pine, bur oak.	Green ash, eastern white pine.	---
323:					
Shields	---	Siberian peashrub, eastern redcedar, lilac, northern whitecedar.	Hackberry, Russian-olive, white spruce, Austrian pine, bur oak.	Green ash, eastern white pine.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
376B:					
Moland	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
377:					
Merton	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
378:					
Maxfield	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
382B, 382C2:					
Blooming	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
392:					
Biscay	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
408:					
Faxon	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
411A, 411B:					
Waukegan	Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, eastern redcedar, Manchurian crabapple.	Russian-olive, green ash, honeylocust, jack pine, eastern white pine, bur oak.	---	---
414:					
Hamel	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
463A:					
Minneiska	---	Siberian peashrub, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
484D:					
Eyota	Lilac	Siberian peashrub, Russian-olive, eastern redcedar, American plum.	Amur maple, hackberry, green ash, honeylocust, Norway spruce, red pine, eastern white pine.	---	---
523:					
Houghton	Whitebelle honeysuckle, common ninebark.	Silky dogwood, Amur privet.	Tall purple willow	White willow, golden willow, black willow.	Imperial Carolina poplar.
525:					
Muskego	---	Silky dogwood, redosier dogwood, common ninebark, late lilac, northern whitecedar, nannyberry viburnum, American cranberrybush.	Manchurian crabapple, white spruce, Japanese tree lilac.	Siberian crabapple	Imperial Carolina poplar.
548:					
Medo	---	Silky dogwood, honeysuckle.	Tall purple willow	Black willow	Imperial Carolina poplar.
572:					
Lowlein	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
611D:					
Hawick	Siberian peashrub	Honeysuckle, late lilac.	Russian-olive, green ash, thornless honeylocust, eastern redcedar, jack pine, Austrian pine.	Red pine, eastern white pine, Siberian elm.	---
757:					
Nerwoods	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
783C2, 783D2, 783E, 783F:					
Lester	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
Kilkenny	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, eastern redcedar, blue spruce, northern whitecedar.	Green ash, Austrian pine, eastern white pine.	---
849B:					
Urban land.					
Estherville	Siberian peashrub	Eastern redcedar, lilac.	Russian-olive, green ash, honeylocust, jack pine, Austrian pine, red pine, Siberian elm.	Eastern white pine	---
860C:					
Urban land.					
Hayden	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
875B, 875C:					
Hawick	Siberian peashrub	Honeysuckle, late lilac.	Russian-olive, green ash, thornless honeylocust, eastern redcedar, jack pine, Austrian pine.	Red pine, eastern white pine, Siberian elm.	---
Estherville	Siberian peashrub	Eastern redcedar, lilac.	Russian-olive, green ash, honeylocust, jack pine, Austrian pine, red pine, Siberian elm.	Eastern white pine	---
945C2, 945D2:					
Lester	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
945C2, 945D2:					
Storden	American plum	Siberian peashrub, hackberry, eastern redcedar.	Russian-olive, green ash, honeylocust.	Siberian elm	---
963C2, 963D2:					
Timula	American plum	Siberian peashrub, hackberry, eastern redcedar.	Russian-olive, green ash, honeylocust.	Siberian elm	---
Bold	American plum	Siberian peashrub, hackberry, eastern redcedar.	Russian-olive, green ash, honeylocust.	Siberian elm	---
1116F:					
Brodale.					
Eyota	Lilac	Siberian peashrub, Russian-olive, eastern redcedar, American plum.	Amur maple, hackberry, green ash, honeylocust, Norway spruce, red pine, eastern white pine.	---	---
1286:					
Prinsburg	---	Redosier dogwood	Hackberry, blue spruce, northern whitecedar.	Green ash, golden willow, black willow.	---
1360:					
Rushriver	---	Redosier dogwood, American plum.	Hackberry, eastern redcedar, white spruce, northern whitecedar.	Green ash, golden willow, black willow.	Silver maple, eastern cottonwood.
1361:					
Le Sueur	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
1362B:					
Angus	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
1363:					
Dundas	---	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
1366:					
Talcot	Lilac	Siberian peashrub	Hackberry, Russian-olive, eastern redcedar, ponderosa pine, blue spruce.	Green ash, honeylocust, golden willow.	Eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1367:					
Derrynane	---	Redosier dogwood	Amur maple, white spruce, American plum, tall purple willow.	Golden willow	Green ash.
1387A:					
Collinwood	---	Siberian peashrub, cotoneaster, eastern redcedar, lilac, northern whitecedar.	Hackberry, Russian-olive, white spruce, Austrian pine, bur oak.	Green ash, eastern white pine.	---
1388B:					
Terril	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, Russian-olive, honeylocust, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
1408B:					
Angus	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
Kilkenny	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, eastern redcedar, blue spruce, northern whitecedar.	Green ash, Austrian pine, eastern white pine.	---
1409A, 1409B:					
Kenyon	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
1411B:					
Urban land.					
Hayden	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
Estherville	Siberian peashrub	Eastern redcedar, lilac.	Russian-olive, green ash, honeylocust, jack pine, Austrian pine, red pine, Siberian elm.	Eastern white pine	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1413B:					
Littleton-------	---	Redosier dogwood, lilac, northern whitecedar, nannyberry viburnum, American cranberrybush.	Amur maple, white spruce.	Hackberry, green ash, red pine, eastern white pine.	Silver maple.
1416C, 1437B:					
Renova----------	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
1501:					
Klossner--------	---	Silky dogwood, nannyberry viburnum.	White spruce------	Green ash, Norway spruce.	Imperial Carolina poplar.
1831:					
Colo----------	---	Redosier dogwood, American plum.	White fir, Amur maple, hackberry, white spruce, tall purple willow.	Green ash, golden willow.	Silver maple, eastern cottonwood.
1962:					
Mazaska---------	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Rolfe----------	---	Redosier dogwood, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.

Windbreak Suitability Groups

(See text for descriptions of the groups listed in this table)

Map symbol and soil name	Windbreak suitability group
4D, 4E-------- Renova	3
17---------- Minneopa	1
24---------- Kasson	1
39A---------- Wadena	6G
41A, 41B------ Estherville	7
44---------- Ankeny	5
74B---------- Dickinson	5
81B, 81D, 81E- Boone	7
98---------- Colo	2
99D2---------- Racine	3
100A---------- Copaston	10
102B---------- Clarion	3
104B, 104C2, 104D2, 104E-- Hayden	3
106C2, 106D2, 106E--------- Lester	3
109---------- Cordova	2
113---------- Webster	2
114---------- Glencoe	2W, drained; 10, undrained
130---------- Nicollet	1
134---------- Okoboji	2W

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
138B, 138C---- Lerdal	4
176---------- Garwin	2
208---------- Kato	2
213B---------- Klinger	1
219---------- Rolfe	2
238B, 238C2, 238D2, 238E, 238F--------- Kilkenny	3
239---------- Le Sueur	1
253---------- Maxcreek	2
256---------- Mazaska	2
285A, 285B---- Port Byron	3
301B, 301C---- Lindstrom	3
307---------- Sargeant	4F
323---------- Shields	2
376B---------- Moland	3
377---------- Merton	1
378---------- Maxfield	2
382B, 382C2--- Blooming	3
392---------- Biscay	2
408---------- Faxon	2
411A, 411B---- Waukegan	6G

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
414 Hamel	2
463A Minneiska	1K
484D Eyota	5
523 Houghton	2H, drained; 10, undrained
525 Muskego	2H, drained; 10, undrained
528B Klossner	10
529A, 529B Ripon	6D
548 Medo	2H
572 Lowlein	1
611D Hawick	7
757 Nerwoods	1
761 Epsom	2
783C2, 783D2, 783E, 783F Lester-Kilkenny	3
849B:	
Urban land.	
Estherville	7
860C:	
Urban land.	
Hayden	3
875B, 875C Hawick-Estherville	7
945C2, 945D2:	
Lester	3
Storden	8

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
963C2, 963D2:	
Timula	3
Bold	8
1016 Udorthents	10
1058 Houghton and Muskego	10
1080 Klossner, Okoboji, and Glencoe	10
1116F:	
Brodale	10
Eyota	5
1286 Prinsburg	2K
1360 Rushriver	2K
1361 Le Sueur	1
1362B Angus	3
1363 Dundas	2
1366 Talcot	2K, drained; 10, undrained
1367 Derrynane	2
1387A Collinwood	4
1388B Terril	3
1408B Angus-Kilkenny	3
1409A, 1409B Kenyon	3
1410B, 1410C Racine	3

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
1411B:	
Urban land.	
Hayden-------	3
Estherville--	7
1413B--------- Littleton	1
1416C, 1437B-- Renova	3
1501---------- Klossner	2H
1831---------- Colo	2
1962---------- Mazaska-Rolfe	2

Recreation

The soils of the survey area are rated in the table "Recreational Development" 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, the ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These 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 soils are rated on the basis of soil properties that influence the ease of developing camp areas and performance of the areas after development. Also considered are the soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land that are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and that can withstand heavy foot traffic and maintain an adequate cover of vegetation. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. The areas should require little or no cutting and filling during site preparation. The soils are rated on the basis of soil properties that influence trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

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.

The interpretive ratings in this table help engineers, planners, and others to understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as slight, moderate, or severe.

Slight means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means that soil properties are moderately favorable for the rated use. The limitations can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance may be less desirable than that of soils rated *slight*.

Severe means that soil properties are unfavorable for the rated use. Examples of limitations are slope, bedrock near the surface, flooding, and a seasonal high water table. These limitations generally require major soil reclamation, special design, or intensive

maintenance. Overcoming the limitations generally is difficult and costly.

The information in the table “Recreational Development” can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in the table “Building Site Development” and interpretations for septic tank absorption fields in the table “Sanitary Facilities.”

Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
4D:					
Renova	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
4E:					
Renova	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
17:					
Minneopa	Severe: flooding.	Slight	Moderate: small stones.	Slight	Moderate: droughty.
24:					
Kasson	Moderate: percs slowly, wetness.	Moderate: percs slowly, wetness.	Moderate: percs slowly, slope, wetness.	Slight	Slight.
39A:					
Wadena	Slight	Slight	Slight	Slight	Slight.
41A:					
Estherville	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
41B:					
Estherville	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
44:					
Ankeny	Slight	Slight	Slight	Slight	Slight.
74B:					
Dickinson	Slight	Slight	Moderate: slope.	Slight	Slight.
81B:					
Boone	Severe: too acid.	Severe: too acid.	Severe: too acid.	Slight	Severe: too acid, droughty.
81D:					
Boone	Severe: too acid.	Severe: too acid.	Severe: slope, too acid.	Slight	Severe: too acid, droughty.
81E:					
Boone	Severe: slope, too acid.	Severe: slope, too acid.	Severe: slope, too acid.	Moderate: slope.	Severe: slope, too acid, droughty.
98:					
Colo	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
99D2:					
Racine	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
100A:					
Copaston	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
102B:					
Clarion	Slight	Slight	Moderate: slope.	Slight	Slight.
104B:					
Hayden	Slight	Slight	Moderate: slope.	Slight	Slight.
104C2:					
Hayden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
104D2:					
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
104E:					
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
106C2:					
Lester	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
106D2:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
106E:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
109:					
Cordova	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
113:					
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
114:					
Glencoe	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
130:					
Nicollet	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
134:					
Okoboji	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
138B:					
Lerdal	Moderate: percs slowly, wetness.	Moderate: percs slowly, wetness.	Moderate: percs slowly, slope, wetness.	Severe: erodes easily.	Moderate: wetness.
138C:					
Lerdal	Moderate: percs slowly, slope, wetness.	Moderate: percs slowly, slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: slope, wetness.
176:					
Garwin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
208:					
Kato	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
213B:					
Klinger	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
219:					
Rolfe	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
238B:					
Kilkenny	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Slight	Slight.
238C2:					
Kilkenny	Moderate: percs slowly, slope.	Moderate: percs slowly, slope.	Severe: slope.	Slight	Moderate: slope.
238D2:					
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
238E:					
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
238F:					
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
239:					
Le Sueur	Slight	Slight	Moderate: slope.	Slight	Slight.
253:					
Maxcreek	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
256:					
Mazaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
285A:					
Port Byron	Slight	Slight	Slight	Slight	Slight.
285B:					
Port Byron	Slight	Slight	Moderate: slope.	Slight	Slight.
301B:					
Lindstrom	Slight	Slight	Moderate: slope.	Slight	Slight.
301C:					
Lindstrom	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
307:					
Sargeant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
323:					
Shields	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
376B:					
Moland	Slight	Slight	Moderate: slope.	Slight	Slight.
377:					
Merton	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
378:					
Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
382B:					
Blooming	Slight	Slight	Moderate: slope.	Slight	Slight.
382C2:					
Blooming	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
392:					
Biscay	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
408:					
Faxon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
411A:					
Waukegan	Slight	Slight	Slight	Slight	Slight.
411B:					
Waukegan	Slight	Slight	Moderate: slope.	Slight	Slight.
414:					
Hamel	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
463A:					
Minneiska	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
484D:					
Eyota	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
523:					
Houghton	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
525:					
Muskego	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
528B:					
Klossner	Severe: excess humus, wetness.	Severe: excess humus, wetness.	Severe: excess humus, wetness.	Severe: excess humus, wetness.	Severe: excess humus, wetness.
529A:					
Ripon	Slight	Slight	Slight	Slight	Moderate: area reclaim, thin layer.
529B:					
Ripon	Slight	Slight	Moderate: area reclaim, slope, thin layer.	Slight	Moderate: area reclaim, thin layer.
548:					
Medo	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
572:					
Lowlein	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
611D:					
Hawick	Severe: slope.	Severe: slope.	Severe: slope.	Slight	Severe: slope.
757:					
Nerwoods	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
761:					
Epsom	Severe: flooding, ponding.	Severe: ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: flooding, ponding.
764:					
Klossner	Severe: excess humus, flooding, ponding.	Severe: excess humus, ponding.	Severe: excess humus, flooding, ponding.	Severe: excess humus, ponding.	Severe: excess humus, flooding, ponding.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
783C2:					
Lester	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Kilkenny	Moderate: percs slowly, slope.	Moderate: percs slowly, slope.	Severe: slope.	Slight	Moderate: slope.
783D2:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
783E:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
783F:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
849B:					
Urban land.					
Estherville	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
860C:					
Urban land.					
Hayden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
875B:					
Hawick	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
Estherville	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
875C:					
Hawick	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, droughty.
Estherville	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, droughty.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
945C2:					
Lester	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Storden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
945D2:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Storden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
963C2:					
Timula	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Bold	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
963D2:					
Timula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Bold	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
1013:					
Pits.					
1016:					
Udorthents	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
1030:					
Pits.					
Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
1058:					
Houghton	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Muskego	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
1080:					
Klossner	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Okoboji	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Glencoe	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1116F:					
Brodale	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones, droughty.
Eyota	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
1286:					
Prinsburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1360:					
Rushriver	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.
1361:					
Le Sueur	Slight	Slight	Moderate: slope.	Slight	Slight.
1362B:					
Angus	Slight	Slight	Moderate: slope.	Slight	Slight.
1363:					
Dundas	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
1366:					
Talcot	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
1367:					
Derrynane	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1387A:					
Collinwood	Moderate: percs slowly, wetness.	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
1388B:					
Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
1408B:					
Angus	Slight	Slight	Moderate: slope.	Slight	Slight.
Kilkenny	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Slight	Slight.
1409A:					
Kenyon	Slight	Slight	Slight	Slight	Slight.
1409B:					
Kenyon	Slight	Slight	Moderate: slope.	Slight	Slight.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1410B:					
Racine	Slight	Slight	Moderate: slope.	Slight	Slight.
1410C:					
Racine	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
1411B:					
Urban land.					
Hayden	Slight	Slight	Moderate: slope.	Slight	Slight.
Estherville	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
1413B:					
Littleton	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
1416C:					
Renova	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
1437B:					
Renova	Slight	Slight	Moderate: slope.	Slight	Slight.
1501:					
Klossner	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1831:					
Colo	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.
1962:					
Mazaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Rolfe	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

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. If food, cover, or water is missing, inadequate, or inaccessible, wildlife will be scarce or will not inhabit the area.

If the soils have potential for habitat development, wildlife habitat can be created or improved by planting appropriate vegetation, properly managing the existing plant cover, and fostering the natural establishment of desirable plants.

Elements of Wildlife Habitat

The elements of wildlife habitat (see the table "Wildlife Habitat") are as follows:

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples are corn, soybeans, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples are bromegrass, timothy, orchardgrass, clover, alfalfa, wheatgrass, and birdsfoot trefoil.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestems, indiangrass, blueberry, goldenrod, lambsquarters, dandelions, blackberry, ragweed, wheatgrass, and nightshade.

The major soil properties affecting the growth of grain and forage crops and wild herbaceous plants are depth of the root zone, texture of the surface layer, the amount of water available to plants, wetness, salinity, and flooding. The length of the growing season also is important.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage that wildlife eat. Examples are oak, poplar, box elder, birch, maple, green ash, willow, and American elm. Examples of fruit-producing shrubs that are suitable for planting on soils that have good potential for these plants are hawthorn, honeysuckle, American plum, redosier dogwood, chokecherry, highbush cranberry, elderberry, gooseberry, serviceberry, silver buffaloberry, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, and ground cover that provide habitat or supply food in the form of browse, seed, or fruit-like cones. Examples are pine, spruce, cedar, and tamarack.

The major soil properties affecting the growth of hardwood and coniferous trees and shrubs are depth of the root zone, the amount of water available to plants, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of these plants are smartweeds, wild millet, rushes, sedges, bulrushes, wild rice, arrowhead, waterplantain, cattail, prairie cordgrass, bluejoint grass, asters, and beggarticks.

The major soil properties affecting wetland plants are texture of the surface layer, wetness, acidity or alkalinity, and slope.

Shallow water areas have an average depth of less than 5 feet. They are useful as habitat for some wildlife species. They are naturally wet areas or are created by dams, levees, or water-control measures in marshes or streams. Examples are waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds.

The major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability.

Kinds of Wildlife Habitat

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include Hungarian partridge, ring-necked pheasant, bobwhite quail, sharp-tailed grouse, meadowlark, field sparrow, killdeer, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of

hardwoods or conifers or a mixture of these and associated grasses, legumes, and wild herbaceous plants. The wildlife attracted to this habitat include wild turkey, ruffed grouse, thrushes, woodpeckers, owls, tree squirrels, porcupine, raccoon, white-tailed deer, black bear, and moose.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas, bogs, or flood plains that support water-tolerant plants. The wildlife attracted to this habitat include ducks, geese, herons, bitterns, rails, kingfishers, muskrat, otter, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. The wildlife attracted to rangeland include antelope, deer, sage grouse, and meadowlark.

Wildlife Habitat

(See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
4D:										
Renova	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
4E:										
Renova	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
17:										
Minneopa	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor
24:										
Kasson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Fair	Very poor.
39A:										
Wadena	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
41A:										
Estherville	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
41B:										
Estherville	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
44:										
Ankeny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
74B:										
Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
81B:										
Boone	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
81D:										
Boone	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
81E:										
Boone	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
98:										
Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
99D2:										
Racine	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
100A:										
Copaston	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
102B:										
Clarion	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
104B:										
Hayden	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
104C2:										
Hayden	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
104D2:										
Hayden	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
104E:										
Hayden	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
106C2:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
106D2:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
106E:										
Lester	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
109:										
Cordova	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
113:										
Webster	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
114:										
Glencoe	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
130:										
Nicollet	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
134:										
Okoboji	Fair	Fair	Fair	Fair	Very poor.	Good	Good	Fair	Fair	Good.
138B:										
Lerdal	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
138C:										
Lerdal	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
176:										
Garwin	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
208:										
Kato	Good	Fair	Fair	Poor	Poor	Good	Good	Good	Poor	Good.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
213B:										
Klinger	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
219:										
Rolfe	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
238B:										
Kilkenny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
238C2:										
Kilkenny	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
238D2:										
Kilkenny	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
238E:										
Kilkenny	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
238F:										
Kilkenny	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
239:										
Le Sueur	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
253:										
Maxcreek	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
256:										
Mazaska	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
285A:										
Port Byron	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
285B:										
Port Byron	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
301B:										
Lindstrom	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
301C:										
Lindstrom	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
307:										
Sargeant	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
323:										
Shields	Fair	Good	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
376B:										
Moland	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
377:										
Merton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
378:										
Maxfield	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
382B:										
Blooming	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
382C2:										
Blooming	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Poor.
392:										
Biscay	Good	Good	Good	Good	Fair	Good	Good	Good	Fair	Good.
408:										
Faxon	Fair	Fair	Fair	Poor	Poor	Good	Fair	Fair	Poor	Fair.
411A:										
Waukegan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
411B:										
Waukegan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
414:										
Hamel	Good	Good	Fair	Good	Fair	Good	Good	Good	Fair	Good.
463A:										
Minneiska	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
484D:										
Eyota	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
523:										
Houghton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
525:										
Muskego	Good	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
528B:										
Klossner	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Fair	Poor	Good.
529A:										
Ripon	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
529B:										
Ripon	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
548:										
Medo	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
572:										
Lowlein	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
611D:										
Hawick	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
757:										
Nerwoods	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
761:										
Epsom.										
764:										
Klossner	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
783C2:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Kilkenny	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
783D2:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Kilkenny	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
783E:										
Lester	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kilkenny	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
783F:										
Lester	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kilkenny	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
849B:										
Urban land.										
Estherville	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
860C:										
Urban land.										
Hayden	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
875B:										
Hawick	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Estherville	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
875C:										
Hawick	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Estherville	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
945C2:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Storden	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
945D2:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Storden	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
963C2:										
Timula	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Bold	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
963D2:										
Timula	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Bold	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1013:										
Pits.										
1016:										
Udorthents	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Fair	Very poor.
1030:										
Pits-Udipsamments.										
1058:										
Houghton	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Muskego	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
1080:										
Klossner	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Okoboji	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Glencoe	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
1116F:										
Brodale	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.
Eyota	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
1286:										
Prinsburg	Good	Good	Fair	Fair	Poor	Good	Good	Good	Fair	Good.
1360:										
Rushriver	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
1361:										
Le Sueur	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1362B:										
Angus	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1363:										
Dundas	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
1366:										
Talcot	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
1367:										
Derrynane	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
1387A:										
Collinwood	Good	Good	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
1388B:										
Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1408B:										
Angus	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Kilkenny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1409A:										
Kenyon	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1409B:										
Kenyon	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1410B:										
Racine	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1410C:										
Racine	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1411B:										
Urban land.										
Hayden	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Estherville	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
1413B:										
Littleton	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
1416C:										
Renova	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1437B:										
Renova	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1501:										
Klossner	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
1831:										
Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
1962:										
Mazaska	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
Rolfe	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.

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. Ratings are given for 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 should 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 or 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 kinds 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and 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

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

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and

observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and 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, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 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 generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, 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 salts 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

The table “Sanitary Facilities” shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. It also shows the suitability of the soils for use as daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of *slight, moderate,* or *severe* are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of *good, fair,* and *poor* are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

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 or a cemented pan interfere with installation.

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

Sewage lagoons 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, relatively impervious soil material. Aerobic lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Relatively impervious soil material for the lagoon floor and sides

is desirable to minimize seepage and contamination of local ground water.

The table “Sanitary Facilities” 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 resulting from rapid permeability in 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.

Trench sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

Area sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2 feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. The ratings in the table “Sanitary Facilities” 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, soil reaction, and content of salts affect trench 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 sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

Soil texture, wetness, rock 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 the 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.

Waste Management

Soil properties are important when organic waste is applied as fertilizer and wastewater is applied in irrigated areas. They also are important when the soil is used as a medium for the treatment and disposal of the organic waste and wastewater. Unfavorable soil properties can result in environmental damage.

The use of organic waste and wastewater as production resources results in energy and resource conservation and minimizes the problems associated with waste disposal. If disposal is the goal, applying a maximum amount of the organic waste or the wastewater to a minimal area holds costs to a minimum and environmental damage is the main hazard. If reuse is the goal, a minimum amount should be applied to a maximum area and environmental damage is unlikely.

Interpretations developed for waste management may include ratings for manure- and food-processing waste, municipal sewage sludge, use of wastewater for irrigation, and treatment of wastewater by slow rate, overland flow, and rapid infiltration processes.

Specific information regarding waste management is available at the local office of the Natural Resources

Conservation Service or the Cooperative Extension Service.

Construction Materials

The table “Construction Materials” 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.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In the table “Construction Materials,” 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 to 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, a 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 a 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 one or more of the following characteristics: 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 have a water table at a depth of 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. They are used in many kinds of construction. Specifications for each use vary widely. In the table “Construction Materials,” only the probability of finding material in suitable quantity in or below the soil 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 as much as 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. Fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

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

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

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

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

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large

amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is 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

The table "Water Management" 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 generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In the table "Water Management," 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 more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

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

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 the potential for 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 or by toxic substances in the root zone, such as salts. Availability of drainage outlets is not considered in the ratings.

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

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control 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 wind erosion 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 wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
4D:						
Renova	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
4E:						
Renova	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
17:						
Minneopa	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Moderate: droughty.
24:						
Kasson	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.	Slight.
39A:						
Wadena	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
41A:						
Estherville	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
41B:						
Estherville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
44:						
Ankeny	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
74B:						
Dickinson	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
81B:						
Boone	Severe: cutbanks cave.	Slight	Moderate: depth to rock.	Slight	Slight	Severe: too acid, droughty.
81D:						
Boone	Severe: cutbanks cave.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Severe: too acid, droughty.
81E:						
Boone	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: too acid, droughty, slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
98:						
Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
99D2:						
Racine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
100A:						
Copaston	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
102B:						
Clarion	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Slight.
104B:						
Hayden	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
104C2:						
Hayden	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
104D2:						
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
104E:						
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
106C2:						
Lester	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
106D2:						
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
106E:						
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
109:						
Cordova	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
113:						
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
114:						
Glencoe	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.
130:						
Nicollet	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
134:						
Okoboji	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
138B:						
Lerdal	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
138C:						
Lerdal	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
176:						
Garwin	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
208:						
Kato	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
213B:						
Klinger	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
219:						
Rolfe	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
238B:						
Kilkenny	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
238C2:						
Kilkenny	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
238D2:						
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
238E:						
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
238F:						
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
239:						
Le Sueur	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
253:						
Maxcreek	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
256:						
Mazaska	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
285A:						
Port Byron	Slight	Slight	Slight	Slight	Severe: low strength, frost action.	Slight.
285B:						
Port Byron	Slight	Slight	Slight	Moderate: slope.	Severe: low strength, frost action.	Slight.
301B:						
Lindstrom	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.	Slight.
301C:						
Lindstrom	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
307:						
Sargeant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
323:						
Shields	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
376B:						
Moland	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
377:						
Merton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
378:						
Maxfield	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
382B:						
Blooming	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
382C2:						
Blooming	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
392:						
Biscay	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
408:						
Faxon	Severe: depth to rock, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
411A:						
Waukegan	Severe: cutbanks cave.	Slight	Slight	Slight	Severe: low strength.	Slight.
411B:						
Waukegan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
414:						
Hamel	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
463A:						
Minneiska	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
484D:						
Eyota	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
523:						
Houghton	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
525:						
Muskego	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
528B:						
Klossner	Severe: excess humus, wetness.	Severe: subsides, wetness, low strength.	Severe: subsides, wetness.	Severe: subsides, wetness, low strength.	Severe: subsides, wetness, frost action.	Severe: wetness, excess humus.
529A:						
Ripon	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength, frost action.	Moderate: thin layer, area reclaim.
529B:						
Ripon	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength, frost action.	Moderate: thin layer, area reclaim.
548:						
Medo	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
572:						
Lowlein	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Slight.
611D:						
Hawick	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
757:						
Nerwoods	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
761:						
Epsom	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
764:						
Klossner	Severe: excess humus, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, low strength, ponding.	Severe: ponding, flooding, excess humus.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
783C2:						
Lester	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Kilkenny	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
783D2:						
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
783E:						
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
783F:						
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Kilkenny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
849B:						
Urban land.						
Estherville	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
860C:						
Urban land.						
Hayden	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
875B:						
Hawick	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Estherville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
875C:						
Hawick	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
875C:						
Estherville	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
945C2:						
Lester	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Storden	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
945D2:						
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Storden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
963C2:						
Timula	Moderate: cutbanks cave, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
Bold	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
963D2:						
Timula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Bold	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
1013:						
Pits.						
1016:						
Udorthents	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
1030:						
Pits.						
Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1058:						
Houghton	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1058:						
Muskego	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
1080:						
Klossner	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, low strength, ponding.	Severe: ponding, excess humus.
Okoboji	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
Glencoe	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.
1116F:						
Brodale	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
Eyota	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1286:						
Prinsburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
1360:						
Rushriver	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
1361:						
Le Sueur	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
1362B:						
Angus	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
1363:						
Dundas	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
1366:						
Talcot	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1367:						
Derrynane	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
1387A:						
Collinwood	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
1388B:						
Terril	Moderate: wetness.	Slight	Moderate: wetness.	Moderate: slope.	Severe: low strength.	Slight.
1408B:						
Angus	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Kilkenny	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
1409A:						
Kenyon	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength, frost action.	Slight.
1409B:						
Kenyon	Moderate: wetness.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: low strength, frost action.	Slight.
1410B:						
Racine	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
1410C:						
Racine	Moderate: dense layer, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
1411B:						
Urban land.						
Hayden	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Estherville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
1413B:						
Littleton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength, frost action.	Moderate: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1416C:						
Renova	Moderate: dense layer, wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
1437B:						
Renova	Moderate: dense layer, wetness.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Slight.
1501:						
Klossner	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding.
1831:						
Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
1962:						
Mazaska	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Rolfe	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.

Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
4D:					
Renova	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
4E:					
Renova	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
17:					
Minneopa	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
24:					
Kasson	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
39A:					
Wadena	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
41A:					
Estherville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
41B:					
Estherville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
44:					
Ankeny	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
74B:					
Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
81B:					
Boone	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
81D:					
Boone	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.
81E:					
Boone	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
98:					
Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
99D2:					
Racine	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
100A:					
Copaston	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Poor: depth to rock.
102B:					
Clarion	Slight	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
104B:					
Hayden	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
104C2:					
Hayden	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
104D2:					
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
104E:					
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
106C2:					
Lester	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
106D2:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
106E:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
109:					
Cordova	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
113:					
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
114:					
Glencoe	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
130:					
Nicollet	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
134:					
Okoboji	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
138B:					
Lerdal	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
138C:					
Lerdal	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
176:					
Garwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
208:					
Kato	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
213B:					
Klinger	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
219:					
Rolfe	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
238B:					
Kilkenny	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
238C2:					
Kilkenny	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
238D2:					
Kilkenny	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
238E:					
Kilkenny	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
238F:					
Kilkenny	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
239:					
Le Sueur	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
253:					
Maxcreek	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
256:					
Mazaska	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
285A:					
Port Byron	Slight	Moderate: seepage.	Slight	Slight	Good.
285B:					
Port Byron	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
301B:					
Lindstrom	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
301C:					
Lindstrom	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
307:					
Sargeant	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
323:					
Shields	Severe: wetness, percs slowly.	Moderate: seepage, excess humus.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
376B:					
Moland	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
377:					
Merton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
378:					
Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
382B:					
Blooming	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
382C2:					
Blooming	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
392:					
Biscay	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
408:					
Faxon	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Poor: depth to rock, wetness.
411A:					
Waukegan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
411B:					
Waukegan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
414:					
Hamel	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
463A:					
Minneiska	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, depth to rock, seepage.	Severe: flooding, seepage, wetness.	Poor: too sandy.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
484D:					
Eyota	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
523:					
Houghton	Severe: subsides, ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
525:					
Muskego	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: hard to pack, ponding.
528B:					
Klossner	Severe: subsides, wetness, percs slowly.	Severe: seepage, excess humus.	Severe: wetness, excess humus.	Severe: seepage, wetness.	Poor: wetness, excess humus.
529A:					
Ripon	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
529B:					
Ripon	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
548:					
Medo	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
572:					
Lowlein	Severe: wetness, poor filter.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too clayey, wetness.
611D:					
Hawick	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
757:					
Nerwoods	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
761:					
Epsom	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
764:					
Klossner	Severe: subsides, flooding, ponding.	Severe: seepage, flooding, excess humus.	Severe: flooding, ponding.	Severe: flooding, seepage, ponding.	Poor: hard to pack, ponding.
783C2:					
Lester	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Kilkenny	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
783D2:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Kilkenny	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
783E:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Kilkenny	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
783F:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Kilkenny	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
849B:					
Urban land.					
Estherville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
860C:					
Urban land.					
Hayden	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
875B:					
Hawick	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
875B:					
Estherville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
875C:					
Hawick	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Estherville	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
945C2:					
Lester	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Storden	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
945D2:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Storden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
963C2:					
Timula	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Bold	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
963D2:					
Timula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Bold	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
1013:					
Pits.					
1016:					
Udorthents	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
1030:					
Pits.					
Udipsamments	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1058:					
Houghton	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Muskego	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: hard to pack, ponding.
1080:					
Klossner	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
Okoboji	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Glencoe	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.
1116F:					
Brodale	Severe: slope.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
Eyota	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
1286:					
Prinsburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1360:					
Rushriver	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
1361:					
Le Sueur	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, wetness.
1362B:					
Angus	Severe: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
1363:					
Dundas	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: hard to pack.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1366:					
Talcot	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
1367:					
Derrynane	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
1387A:					
Collinwood	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
1388B:					
Terril	Severe: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
1408B:					
Angus	Severe: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Kilkenny	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
1409A:					
Kenyon	Severe: wetness.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
1409B:					
Kenyon	Severe: wetness.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
1410B:					
Racine	Severe: wetness, percs slowly.	Moderate: seepage, slope, wetness.	Moderate: wetness.	Slight	Good.
1410C:					
Racine	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope.	Moderate: slope.	Fair: slope.
1411B:					
Urban land.					
Hayden	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1411B:					
Estherville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
1413B:					
Littleton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
1416C:					
Renova	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
1437B:					
Renova	Severe: wetness, percs slowly.	Moderate: seepage, slope, wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey.
1501:					
Klossner	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
1831:					
Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
1962:					
Mazaska	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Rolfe	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.

Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
4D:				
Renova	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
4E:				
Renova	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
17:				
Minneopa	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
24:				
Kasson	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
39A:				
Wadena	Good	Probable	Probable	Poor: small stones, area reclaim.
41A:				
Estherville	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
41B:				
Estherville	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
44:				
Ankeny	Good	Probable	Improbable: too sandy.	Fair: large stones.
74B:				
Dickinson	Good	Probable	Improbable: too sandy.	Fair: thin layer.
81B:				
Boone	Poor: depth to rock.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones.
81D:				
Boone	Poor: depth to rock.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
81E:				
Boone	Poor: depth to rock.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, slope.
98:				
Colo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
99D2:				
Racine	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
100A:				
Copaston	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
102B:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
104B:				
Hayden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
104C2:				
Hayden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
104D2:				
Hayden	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
104E:				
Hayden	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
106C2:				
Lester	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
106D2:				
Lester	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
106E:				
Lester	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
109:				
Cordova	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
113:				
Webster	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
114:				
Glencoe	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
130:				
Nicollet	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
134:				
Okoboji	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
138B:				
Lerdal	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
138C:				
Lerdal	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
176:				
Garwin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
208:				
Kato	Fair: wetness.	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
213B:				
Klinger	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
219:				
Rolfe	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
238B:				
Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
238C2:				
Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
238D2:				
Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
238E:				
Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
238F:				
Kilkenny	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
239:				
Le Sueur	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
253:				
Maxcreek	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
256:				
Mazaska	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
285A:				
Port Byron	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
285B:				
Port Byron	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
301B:				
Lindstrom	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
301C:				
Lindstrom	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
307:				
Sargeant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
323:				
Shields	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
376B:				
Moland	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
377:				
Merton	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
378:				
Maxfield	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
382B:				
Blooming	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
382C2:				
Blooming	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
392:				
Biscay	Poor: wetness.	Probable	Probable	Poor: area reclaim, wetness.
408:				
Faxon	Poor: depth to rock, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
411A:				
Waukegan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim.
411B:				
Waukegan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim.
414:				
Hamel	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
463A:				
Minneiska	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
484D:				
Eyota	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
523:				
Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
525:				
Muskego	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
528B:				
Klossner	Poor: thin layer, wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
529A:				
Ripon	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, thin layer.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
529B:				
Ripon	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, thin layer.
548:				
Medo	Poor: wetness.	Probable	Probable	Poor: excess humus, wetness.
572:				
Lowlein	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
611D:				
Hawick	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
757:				
Nerwoods	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
761:				
Epsom	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
764:				
Klossner	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
783C2:				
Lester	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
783D2:				
Lester	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
783E:				
Lester	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
783F:				
Lester	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Kilkenny	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
849B:				
Urban land.				
Estherville	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
860C:				
Urban land.				
Hayden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
875B:				
Hawick	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Estherville	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
875C:				
Hawick	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Estherville	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
945C2:				
Lester	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Storden	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
945D2:				
Lester	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
945D2:				
Storden	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
963C2:				
Timula	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Bold	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
963D2:				
Timula	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Bold	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
1013:				
Pits.				
1016:				
Udorthents	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
1030:				
Pits.				
Udipsamments	Fair: slope.	Probable	Probable	Poor: too sandy, slope.
1058:				
Houghton	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Muskego	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
1080:				
Klossner	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Okoboji	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Glencoe	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1116F:				
Brodale	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1116F:				
Eyota	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
1286:				
Prinsburg	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1360:				
Rushriver	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
1361:				
Le Sueur	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
1362B:				
Angus	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1363:				
Dundas	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1366:				
Talcot	Fair: wetness.	Probable	Probable	Fair: small stones, area reclaim, thin layer.
1367:				
Derrynane	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1387A:				
Collinwood	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
1388B:				
Terril	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
1408B:				
Angus	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Kilkenny	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
1409A:				
Kenyon	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1409B:				
Kenyon	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
1410B:				
Racine	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1410C:				
Racine	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
1411B:				
Urban land.				
Hayden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Estherville	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1413B:				
Littleton	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
1416C:				
Renova	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
1437B:				
Renova	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
1501:				
Klossner	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
1831:				
Colo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1962:				
Mazaska	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1962:				
Rolfe	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.

Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
4D:							
Renova	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
4E:							
Renova	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
17:							
Minneopa	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
24:							
Kasson	Slight	Severe: piping.	Severe: no water.	Frost action	Wetness, rooting depth.	Wetness	Rooting depth.
39A:							
Wadena	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable	Too sandy	Favorable.
41A:							
Estherville	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
41B:							
Estherville	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
44:							
Ankeny	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing	Soil blowing	Favorable.
74B:							
Dickinson	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
81B:							
Boone	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Depth to rock, too sandy.	Droughty, depth to rock.
81D:							
Boone	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, depth to rock, too sandy.	Slope, droughty, depth to rock.
81E:							
Boone	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, depth to rock, too sandy.	Slope, droughty, depth to rock.
98:							
Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
99D2:							
Racine	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
100A:							
Copaston	Severe: depth to rock.	Severe: piping.	Severe: no water.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
102B:							
Clarion	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Slope	Erodes easily	Erodes easily.
104B:							
Hayden	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.
104C2:							
Hayden	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
104D2:							
Hayden	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
104E:							
Hayden	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
106C2:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
106D2:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
106E:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
109:							
Cordova	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
113:							
Webster	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
114:							
Glencoe	Moderate: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
130:							
Nicollet	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Wetness	Wetness	Favorable.
134:							
Okoboji	Slight	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
138B:							
Lerdal	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
138C:							
Lerdal	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
176:							
Garwin	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
208:							
Kato	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
213B:							
Klinger	Moderate: seepage.	Moderate: piping, wetness.	Severe: slow refill.	Frost action	Wetness, rooting depth.	Erodes easily, wetness.	Erodes easily, rooting depth.
219:							
Rolfe	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
238B:							
Kilkenny	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
238C2:							
Kilkenny	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.
238D2:							
Kilkenny	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.
238E:							
Kilkenny	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
238F:							
Kilkenny	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.
239:							
Le Sueur	Moderate: seepage.	Severe: thin layer.	Moderate: deep to water, slow refill.	Frost action	Wetness	Wetness	Favorable.
253:							
Maxcreek	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
256:							
Mazaska	Moderate: seepage.	Severe: wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
285A:							
Port Byron	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Erodes easily	Erodes easily.
285B:							
Port Byron	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
301B:							
Lindstrom	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
301C:							
Lindstrom	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
307:							
Sargeant	Slight	Severe: wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
323:							
Shields	Moderate: seepage.	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
376B:							
Moland	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Favorable	Favorable.
377:							
Merton	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action	Wetness	Wetness	Favorable.
378:							
Maxfield	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness, rooting depth.	Wetness	Wetness, rooting depth.
382B:							
Blooming	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
382C2:							
Blooming	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope	Slope.
392:							
Biscay	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
408:							
Faxon	Moderate: seepage, depth to rock.	Severe: piping, wetness.	Severe: depth to rock.	Depth to rock, frost action.	Wetness, depth to rock.	Depth to rock, wetness.	Wetness, depth to rock.
411A:							
Waukegan	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Favorable	Erodes easily, too sandy.	Erodes easily.
411B:							
Waukegan	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope	Erodes easily, too sandy.	Erodes easily.
414:							
Hamel	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
463A:							
Minneiska	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness	Wetness, too sandy.	Favorable.
484D:							
Eyota	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
523:							
Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
525:							
Muskego	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, percs slowly.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
528B:							
Klossner	Severe: seepage.	Severe: excess humus, wetness.	Severe: slow refill.	Subsides, frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Wetness, erodes easily.
529A:							
Ripon	Moderate: seepage, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Thin layer	Depth to rock, area reclaim.	Erodes easily, depth to rock.
529B:							
Ripon	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, thin layer.	Depth to rock, area reclaim.	Erodes easily, depth to rock.
548:							
Medo	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
572:							
Lowlein	Severe: seepage.	Severe: piping.	Severe: no water.	Slope	Slope, wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
611D:							
Hawick	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.
757:							
Nerwoods	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Frost action, slope.	Slope, wetness.	Wetness	Favorable.
761:							
Epsom	Moderate: seepage.	Severe: ponding.	Severe: no water.	Ponding, flooding, frost action.	Ponding, flooding.	Ponding	Wetness.
764:							
Klossner	Severe: seepage.	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, flooding, subsides.	Ponding, soil blowing, flooding.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily.
783C2:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Kilkenny	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.
783D2:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Kilkenny	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.
783E:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Kilkenny	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
783F:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Kilkenny	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Slope, erodes easily, wetness.	Slope, erodes easily.
849B:							
Urban land.							
Estherville	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
860C:							
Urban land.							
Hayden	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
875B:							
Hawick	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.
Estherville	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
875C:							
Hawick	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, too sandy, soil blowing.	Slope, droughty.
Estherville	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
945C2:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
945C2:							
Storden	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
945D2:							
Lester	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Storden	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
963C2:							
Timula	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Bold	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
963D2:							
Timula	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Bold	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
1013:							
Pits.							
1016:							
Udorthents	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty.	Slope, soil blowing.	Slope, droughty.
1030:							
Pits.							
Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
1058:							
Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding	Ponding	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1058:							
Muskego	Severe: seepage.	Severe: piping, excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding	Ponding	Wetness.
1080:							
Klossner	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding	Ponding	Wetness.
Okoboji	Slight	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Erodes easily, ponding.	Wetness, erodes easily.
Glencoe	Moderate: seepage.	Severe: excess humus, hard to pack, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
1116F:							
Brodale	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Eyota	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
1286:							
Prinsburg	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
1360:							
Rushriver	Severe: seepage.	Severe: piping, wetness.	Moderate: cutbanks cave.	Flooding, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
1361:							
Le Sueur	Severe: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Wetness	Wetness	Favorable.
1362B:							
Angus	Moderate: seepage, slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Deep to water	Slope	Favorable	Favorable.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1363:							
Dundas	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Favorable.
1366:							
Talcot	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
1367:							
Derrynane	Moderate: seepage.	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly, rooting depth.	Wetness, percs slowly.	Wetness, rooting depth, percs slowly.
1387A:							
Collinwood	Slight	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.
1388B:							
Terril	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Slope	Favorable	Favorable.
1408B:							
Angus	Moderate: seepage, slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Deep to water	Slope	Favorable	Favorable.
Kilkenny	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
1409A:							
Kenyon	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Favorable	Wetness	Wetness	Favorable.
1409B:							
Kenyon	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Slope	Slope, wetness.	Wetness	Favorable.
1410B:							
Racine	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1410C:							
Racine	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
1411B:							
Urban land.							
Hayden	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.
Estherville	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
1413B:							
Littleton	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
1416C:							
Renova	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
1437B:							
Renova	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.
1501:							
Klossner	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing, erodes easily.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily.
1831:							
Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1962:							
Mazaska	Moderate: seepage.	Severe: wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Rolfe	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.

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 to characterize key soils.

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

Engineering Index Properties

The table “Engineering Index Properties” 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 in the series descriptions in Part I of this survey.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 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 (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

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

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

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

Rock fragments larger than 10 inches in diameter and 3 to 10 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

The tables “Physical Properties of the Soils” and “Chemical Properties of the Soils” show 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.

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 in the series descriptions in Part I of this survey.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. 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, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In the table “Physical Properties of the Soils,” the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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 and septic tank absorption fields.

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.

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 classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table "Physical Properties of the Soils," 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 in 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.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average 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. Coarse sands, sands, fine sands, and very fine sands. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Coarse sandy loams, 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 loams, silt loams, clay loams, and silty clay loams that have more than 5 percent finely divided calcium carbonate. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous 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. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if measures to control soil blowing are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if ordinary measures to control soil blowing are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils have less than 5 percent finely divided calcium carbonate. They are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
8. Soils that are not subject to soil blowing because of rock fragments on the surface or because of surface wetness.

The *wind erodibility index* is a number that is determined based on the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. It is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles.

In the table "Chemical Properties of the Soils," *cation-exchange capacity* is the total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. It is a measurement of the nutrient-holding capacity of the soil.

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.

Calcium carbonate is expressed as a weighted percentage of the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients, such as phosphorus, is affected by the amount of carbonates in the soil.

Water Features

The table “Water Features” gives estimates of several important water features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. The soil properties that affect the runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include the depth to a seasonal high water table, the infiltration rate, permeability after prolonged wetting, and the depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

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

If a soil is assigned to two hydrologic groups in the table, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered to be ponding.

The table “Water Features” gives the frequency and duration of flooding and the time of year when flooding is most likely to occur. Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is 50 percent in any year).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year that flooding is most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding 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 little or no horizon development.

Also considered are local information about the extent and level 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 a zone of saturation at the highest average depth during the wettest season. It is at least 6 inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Indicated in the table “Water Features” are the depth to the seasonal high water table, the kind of water table, and the months of the year when the water table usually is highest.

An *apparent* water table is indicated by the level at which water stands in a freshly dug, unlined borehole after adequate time for adjustments in the surrounding soil.

A *perched* water table is one that is above an unsaturated zone in the soil. The basis for determining that a water table is perched may be general knowledge of the area. The water table is proven to be

perched if the water level in a borehole is observed to fall when the borehole is extended.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. “More than 6.0” indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. *Ponding duration* classes are the same as those for flooding duration. *Maximum ponding depth* refers to the depth of the water above the surface of the soil.

Soil Features

The table “Soil Features” gives estimates of several important soil features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Depth to bedrock is given if bedrock is within a depth of 60 inches. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table “Soil Features” shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

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.

A *low* potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a *moderate* potential indicates that the soil is susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a *high* potential indicates that the soil is highly susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

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 content, texture, moisture content, and acidity of the soil.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

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

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

Engineering Index Properties

(Absence of an entry indicates that the data were not estimated)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
4D:												
Renova----------	0-7	Loam----------	ML, CL, CL-ML	A-4	0	0	100	98-100	90-95	75-90	20-40	NP-10
	7-12	Silty clay loam, silt loam, loam.	CL	A-6	0	0	100	98-100	90-95	80-95	30-40	10-20
	12-40	Loam, sandy clay loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0-2	95-100	85-95	65-85	45-65	20-35	5-15
	40-80	Loam----------	CL	A-6	0	0-1	95-100	85-95	70-85	50-70	25-40	10-20
4E:												
Renova----------	0-12	Loam----------	ML, CL, CL-ML	A-4	0	0	100	98-100	90-95	75-90	20-40	NP-10
	12-22	Silty clay loam, silt loam, loam.	CL	A-6	0	0	100	98-100	90-95	80-95	30-40	10-20
	22-55	Loam, sandy clay loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0-2	95-100	85-95	65-85	45-65	20-35	5-15
	55-80	Loam----------	CL	A-6	0	0-1	95-100	85-95	70-85	50-70	25-40	10-20
17:												
Minneopa--------	0-12	Sandy loam-----	SM	A-2, A-4	0	0	100	85-100	60-70	30-40	0-14	NP
	12-47	Sandy loam, loamy sand, coarse sandy loam.	SM	A-2, A-1	0	0	80-100	50-100	30-70	15-30	0-14	NP
	47-60	Loamy sand, sand, gravelly coarse sand.	SM, SP-SM	A-2, A-3, A-1	0	0	80-100	50-100	25-75	5-15	0-14	NP
24:												
Kasson----------	0-13	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	75-95	25-40	4-15
	13-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	95-100	90-100	75-95	35-45	15-25
	30-80	Loam, sandy clay loam.	CL, ML	A-4, A-6	0	0-5	95-100	85-95	70-90	50-70	25-40	8-18

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
39A:												
Wadena----------	0-24	Loam----------	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	24-30	Loam, sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	30-80	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-3	0-5	45-100	35-100	10-80	2-10	---	NP
41A:												
Estherville-----	0-14	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0	0-5	90-100	80-100	50-75	25-50	20-30	2-10
	14-27	Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1	0	0-5	85-100	80-95	40-75	15-45	20-30	2-8
	27-60	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, SM, GP	A-1	0	0-10	55-90	50-85	10-40	2-25	0-14	NP
41B:												
Estherville-----	0-11	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0	0-5	90-100	80-100	50-75	25-50	20-30	2-10
	11-16	Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1	0	0-5	85-100	80-95	40-75	15-45	20-30	2-8
	16-80	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, SM, GP	A-1	0	0-10	55-90	50-85	10-40	2-25	0-14	NP
44:												
Ankeny----------	0-27	Sandy loam-----	SM, SC, SC-SM	A-4, A-2	0	0-5	95-100	95-100	75-90	30-50	0-25	2-10
	27-44	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4, A-2	0	0-5	95-100	95-100	75-90	25-45	0-25	2-10
	44-80	Loamy fine sand, fine sandy loam, fine sand.	SM, SC, SC-SM, SW-SM	A-4, A-2, A-3	0	0-5	95-100	95-100	70-80	5-40	0-25	NP-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
74B:												
Dickinson-------	0-13	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0	100	100	85-95	30-50	15-30	NP-10
	13-26	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	26-52	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SC-SM	A-2, A-3	0	0	100	100	80-95	5-20	10-20	NP-5
	52-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
81B:												
Boone----------	0-8	Loamy fine sand	SM, ML, SP-SM	A-2, A-4, A-1	0	0-9	80-100	75-100	40-90	10-60	0-14	NP
	8-15	Sand, channery coarse sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0-9	55-100	50-100	25-75	2-35	0-14	NP
	15-38	Fine sand, coarse sand, channery sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0-9	55-100	50-100	20-75	1-35	0-14	NP
	38-80	Weathered bedrock.	---	---	0	0	0	0	20-75	1-35	---	NP
81D:												
Boone----------	0-6	Loamy fine sand	SM, ML, SP-SM	A-2, A-4, A-1	0	0-9	80-100	75-100	40-90	10-60	0-14	NP
	6-12	Sand, channery coarse sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0-9	55-100	50-100	25-75	2-35	0-14	NP
	12-38	Fine sand, coarse sand, channery sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0-9	55-100	50-100	20-75	1-35	0-14	NP
	38-80	Weathered bedrock.	---	---	0	0	0	0	20-75	1-35	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
81E:												
Boone----------	0-4	Loamy fine sand	SM, ML, SP-SM	A-2, A-4, A-1	0	0-9	80-100	75-100	40-90	10-60	0-14	NP
	4-9	Sand, channery coarse sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0-9	55-100	50-100	25-75	2-35	0-14	NP
	9-26	Fine sand, coarse sand, channery sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0-9	55-100	50-100	20-75	1-35	0-14	NP
	26-80	Weathered bedrock.	---	---	0	0	0	0	20-75	1-35	---	NP
98:												
Colo----------	0-16	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-60	15-30
	16-39	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	20-30
	39-80	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	80-100	40-55	15-30
99D2:												
Racine----------	0-7	Loam----------	ML	A-4, A-6	0	0	95-100	95-100	90-100	55-85	30-40	5-14
	7-12	Silt loam, clay loam, silty clay loam.	CL	A-6	0	0	95-100	95-100	90-100	55-85	30-40	10-20
	12-40	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	2-5	95-100	75-100	65-90	45-65	25-35	10-15
	40-80	Loam, clay loam	ML, CL	A-6	0	1-5	95-100	90-100	80-95	50-75	25-40	10-20
100A:												
Copaston--------	0-7	Sandy clay loam	SM, ML	A-4	0	0-5	95-100	75-100	65-80	40-80	30-40	NP-10
	7-11	Fine sandy loam, sandy loam, loam.	SM	A-2, A-4	0	0-5	95-100	75-100	55-75	25-50	0-35	NP-10
	11-18	Sandy loam, gravelly sandy loam.	SM	A-2	0-1	0-5	90-100	75-100	50-70	20-35	0-14	NP
	18-28	Unweathered bedrock.	---	---	0	0	0	0	0	0	---	NP
102B:												
Clarion---------	0-10	Loam----------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	10-44	Loam, sandy loam.	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-90	50-75	25-40	5-15
	44-80	Loam, clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-98	70-85	50-75	25-40	5-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
104B:												
Hayden----------	0-9	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	9-43	Clay loam, loam, sandy clay loam.	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	43-80	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
104C2:												
Hayden----------	0-7	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	7-32	Clay loam, loam, sandy clay loam.	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	32-80	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
104D2:												
Hayden----------	0-7	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	7-38	Clay loam, loam, sandy clay loam.	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	38-80	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
104E:												
Hayden----------	0-5	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	5-30	Clay loam, loam, sandy clay loam.	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	30-80	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
106C2:												
Lester----------	0-6	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	6-24	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	24-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
106D2:												
Lester----------	0-7	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	7-42	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	42-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
106E:												
Lester	0-8	Loam	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	8-38	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	38-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
109:												
Cordova	0-13	Clay loam	CL, ML, MH, OH	A-6, A-7	0	0	95-100	95-100	90-100	70-85	38-60	12-25
	13-36	Silty clay loam, clay loam.	CL	A-7	0	0	90-100	90-100	85-95	65-90	40-50	20-30
	36-60	Clay loam, loam	CL	A-6	0	0-5	90-100	90-100	80-95	55-70	30-40	12-20
113:												
Webster	0-13	Clay loam	CL, CH	A-7, A-6	0	0-5	95-100	95-100	85-95	75-85	35-45	15-25
	13-48	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0	0-5	95-100	95-100	85-95	65-85	35-45	15-25
	48-80	Loam, clay loam	CL, CL-ML, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	40-70	25-35	8-15
114:												
Glencoe	0-12	Clay loam	OL, ML, CL	A-6, A-7	0	0	95-100	90-100	75-100	60-90	35-45	15-20
	12-27	Silty clay loam, clay loam, loam.	OL, ML, CL	A-6, A-7	0	0	95-100	90-100	75-100	60-90	30-45	10-20
	27-36	Loam, clay loam, silty clay loam.	CL, ML	A-6, A-7	0	0	95-100	90-100	75-100	60-90	30-45	10-20
	36-80	Loam, clay loam	CL, ML	A-6	0	0	90-100	85-100	60-95	55-75	30-40	10-20
130:												
Nicollet	0-20	Clay loam	ML, CL	A-6, A-7	0-1	0-5	95-100	90-100	85-100	55-85	35-50	10-25
	20-40	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-1	0-5	95-100	90-100	80-95	55-80	35-50	15-25
	40-80	Loam, clay loam	CL	A-6	0-1	0-5	95-100	90-100	75-90	50-75	30-40	15-25
134:												
Okoboji	0-7	Silty clay loam	CH	A-7	0	0	100	100	90-100	80-95	50-60	30-35
	7-40	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	90-100	80-95	50-60	30-35
	40-80	Silty clay loam, silty clay.	CH, CL	A-7	0	0	95-100	95-100	90-100	80-95	50-60	30-35

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
138B:												
Lerdal----------	0-12	Clay loam------	CL, ML	A-6, A-7	0	0	95-100	90-100	80-95	60-90	35-50	10-20
	12-41	Silty clay, clay loam, silty clay loam.	MH, CH, CL, ML	A-7	0	0	95-100	90-100	80-95	70-90	45-70	20-35
	41-80	Clay loam------	CL	A-7	0	0-5	90-100	85-95	75-90	60-75	40-50	15-25
138C:												
Lerdal----------	0-8	Clay loam------	CL, ML	A-6, A-7	0	0	95-100	90-100	80-95	60-90	35-50	10-20
	8-42	Silty clay, clay loam, silty clay loam.	MH, CH, CL, ML	A-7	0	0	95-100	90-100	80-95	70-90	45-70	20-35
	42-80	Clay loam------	CL	A-7	0	0-5	90-100	85-95	75-90	60-75	40-50	15-25
176:												
Garwin----------	0-8	Silt loam------	CL, ML	A-6, A-7	0	0	100	100	100	95-100	30-45	10-20
	8-22	Silty clay loam	CH, CL	A-7	0	0	100	100	100	95-100	45-55	25-35
	22-80	Silt loam------	CL	A-6	0	0	100	100	100	95-100	30-40	15-20
208:												
Kato----------	0-14	Silty clay loam	CL, ML	A-6, A-7	0	0	100	95-100	90-95	70-95	35-50	10-23
	14-29	Silty clay loam, silt loam.	ML, CL	A-6, A-7, A-4	0	0	100	95-100	90-95	70-95	35-50	8-23
	29-80	Sand, coarse sand, gravelly coarse sand.	SP, SW, SP-SM, SW-SM	A-1, A-3, A-2	0	0-5	75-100	70-95	25-70	2-12	0-20	NP
213B:												
Klinger---------	0-21	Silty clay loam	CL	A-7	0	0	100	100	100	95-100	40-50	15-25
	21-43	Silty clay loam	CL	A-7	0	0	100	100	100	95-100	40-50	20-30
	43-80	Loam, clay loam	CL	A-6	0	0-5	90-95	85-90	75-85	55-65	25-35	10-20
219:												
Rolfe----------	0-12	Silt loam------	OL, CL, ML	A-6, A-4	0	0	100	95-100	90-100	80-95	30-40	5-15
	12-33	Clay, silty clay, clay loam.	CH	A-7	0	0	100	95-100	90-100	75-95	50-65	25-35
	33-80	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-90	55-75	30-45	10-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
238B:												
Kilkenny--------	0-9	Loam----------	CL	A-6	0	0	95-100	95-100	80-95	60-75	30-40	10-20
	9-54	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	54-60	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
238C2:												
Kilkenny--------	0-9	Clay loam------	ML, MH	A-7, A-6	0	0	95-100	95-100	80-95	70-85	35-60	10-25
	9-53	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	53-60	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
238D2:												
Kilkenny--------	0-8	Clay loam------	ML, MH	A-7, A-6	0	0	95-100	95-100	80-95	70-85	35-60	10-25
	8-46	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	46-60	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
238E:												
Kilkenny--------	0-7	Clay loam------	ML, MH	A-7, A-6	0	0	95-100	95-100	80-95	70-85	35-60	10-25
	7-38	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	38-60	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
238F:												
Kilkenny--------	0-5	Loam----------	CL	A-6	0	0	95-100	95-100	80-95	60-75	30-40	10-20
	5-34	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	34-80	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
239:												
Le Sueur--------	0-11	Clay loam------	CL, ML	A-6, A-7	0	0	95-100	95-100	90-100	75-90	35-50	10-25
	11-42	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	0	95-100	95-100	85-100	60-80	35-50	15-25
	42-80	Loam, clay loam	CL-ML, CL	A-6, A-4	0-1	0-5	95-100	90-100	80-95	55-75	20-40	5-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
253:												
Maxcreek--------	0-18	Silty clay loam	CL, MH, ML, CH	A-7	0	0	100	100	95-100	92-100	40-55	15-25
	18-36	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	95-100	85-95	75-90	35-50	15-25
	36-80	Loam, sandy clay loam.	CL, ML, CL-ML	A-4, A-6	0	0-5	95-100	90-95	60-80	50-75	25-40	5-20
256:												
Mazaska---------	0-15	Clay loam------	CL, CH	A-6, A-7	0	0	95-100	95-100	85-100	70-95	35-55	12-28
	15-42	Clay loam, clay, silty clay loam.	CH, CL	A-7	0	0	90-100	85-100	75-95	60-90	40-65	15-35
	42-80	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	0-5	90-100	85-100	70-95	50-80	30-50	10-25
285A:												
Port Byron------	0-12	Silt loam------	CL	A-4, A-6	0	0	100	100	100	95-100	25-40	7-18
	12-40	Silt loam------	CL	A-4, A-6	0	0	100	100	100	95-100	25-40	7-18
	40-80	Silt loam------	CL	A-4, A-6	0	0	100	100	100	90-100	25-40	7-17
285B:												
Port Byron------	0-14	Silt loam------	CL	A-4, A-6	0	0	100	100	100	95-100	25-40	7-18
	14-42	Silt loam------	CL	A-4, A-6	0	0	100	100	100	95-100	25-40	7-18
	42-80	Silt loam------	CL	A-4, A-6	0	0	100	100	100	90-100	25-40	7-17
301B:												
Lindstrom-------	0-16	Silt loam------	ML	A-4	0	0	100	100	95-100	85-95	30-40	5-10
	16-30	Silt loam, loam	ML	A-4	0	0	100	100	95-100	85-95	30-40	5-10
	30-60	Silt loam------	ML, CL	A-4, A-6	0	0	100	100	95-100	85-95	30-40	9-14
	60-80	Loam, silt loam, very fine sandy loam.	ML	A-4	0	0	100	95-100	75-95	50-90	25-35	NP-5
301C:												
Lindstrom-------	0-10	Silt loam------	ML	A-4	0	0	100	100	95-100	85-95	30-40	5-10
	10-26	Silt loam, loam	ML	A-4	0	0	100	100	95-100	85-95	30-40	5-10
	26-43	Silt loam------	ML, CL	A-4, A-6	0	0	100	100	95-100	85-95	30-40	9-14
	43-80	Loam, silt loam, very fine sandy loam.	ML	A-4	0	0	100	95-100	75-95	50-90	25-35	NP-5

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
307:												
Sargeant--------	0-7	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	95-100	90-100	75-90	25-40	5-15
	7-25	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	0	100	95-100	90-100	75-95	30-45	10-25
	25-55	Clay loam, loam	CL	A-6, A-7	0	0-5	95-100	90-100	75-90	50-80	30-45	10-20
	55-80	Loam----------	CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	75-90	50-70	25-40	5-15
323:												
Shields---------	0-8	Silty clay loam	OL, ML	A-7, A-6	0	0	95-100	95-100	90-100	85-95	35-50	10-20
	8-53	Silty clay, clay.	CH, MH, CL	A-7	0	0	95-100	95-100	90-100	85-95	45-70	20-35
	53-80	Silty clay loam, clay loam, clay.	CL, ML, MH	A-7, A-6	0	0	95-100	90-100	85-100	80-95	35-65	10-30
376B:												
Moland----------	0-14	Silt loam------	ML, CL	A-6, A-4	0	0	100	100	85-100	50-85	30-40	5-15
	14-20	Silt loam, silty clay loam, loam.	ML, CL	A-6, A-4, A-7	0	0	100	100	85-100	50-85	30-45	5-20
	20-49	Loam, clay loam	CL, ML, CL-ML	A-6, A-4	0	0-5	95-100	90-98	60-75	50-65	25-40	5-15
	49-80	Loam----------	CL, ML, CL-ML	A-6, A-4	0	0-5	95-100	90-98	60-80	50-75	25-40	5-15
377:												
Merton----------	0-15	Silt loam------	CL-ML, CL	A-6, A-4	0	0	100	100	85-100	75-90	25-40	5-15
	15-55	Silt loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	0	100	100	85-100	65-80	25-40	5-15
	55-80	Loam----------	CL, ML, CL-ML	A-6, A-4	0	0-2	95-100	90-100	75-85	50-75	20-40	5-15
378:												
Maxfield--------	0-15	Silty clay loam	CL, CH	A-7	0	0	100	100	100	95-100	45-55	20-30
	15-27	Silty clay loam, silt loam.	CH, CL	A-7	0	0	100	100	100	95-100	45-55	25-35
	27-80	Loam----------	CL	A-6	0	0-5	90-95	85-90	75-85	55-65	25-35	10-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
382B:												
Blooming--------	0-9	Silt loam------	ML, CL, CL-ML	A-4, A-6	0	0	100	100	90-95	60-85	25-40	5-20
	9-19	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	0	100	100	90-95	70-95	35-45	15-25
	19-44	Sandy clay loam, loam, clay loam.	CL, CL-ML, SC, SC-SM	A-6, A-4, A-7	0	0-5	95-100	90-100	70-90	40-80	25-45	5-20
	44-70	Loam----------	CL, CL-ML	A-4, A-6	0	0-5	95-100	90-100	65-80	50-70	25-40	5-15
382C2:												
Blooming--------	0-7	Silt loam------	ML, CL, CL-ML	A-4, A-6	0	0	100	100	90-95	60-85	25-40	5-20
	7-23	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	0	100	100	90-95	70-95	35-45	15-25
	23-45	Sandy clay loam, loam, clay loam.	CL, CL-ML, SC, SC-SM	A-6, A-4, A-7	0	0-5	95-100	90-100	70-90	40-80	25-45	5-20
	45-70	Loam----------	CL, CL-ML	A-4, A-6	0	0-5	95-100	90-100	65-80	50-70	25-40	5-15
392:												
Biscay----------	0-20	Loam----------	CL, ML	A-7, A-6	0	0	95-100	95-100	70-95	50-80	35-50	10-25
	20-25	Loam, clay loam, sandy clay loam.	CL, ML	A-6, A-7	0	0	95-100	90-100	70-90	50-75	30-50	10-20
	25-33	Gravelly loam, sandy loam, gravelly sandy loam.	SM, SC-SM, SC	A-4	0	0-5	95-100	70-95	50-80	35-50	15-30	2-10
	33-80	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	45-95	35-95	20-45	2-10	---	NP
408:												
Faxon----------	0-15	Clay loam------	CL	A-7, A-6	0	0-10	95-100	90-100	85-100	50-80	30-45	10-20
	15-34	Loam, sandy loam, clay loam.	CL, ML, SC, SM	A-7, A-6	0	0-10	95-100	70-100	65-95	40-85	30-50	10-20
	34-60	Unweathered bedrock.	---	---	0	0	0	0	0	0	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
411A:												
Waukegan	0-12	Silt loam	ML	A-4	0	0	95-100	95-100	95-100	85-95	25-40	3-10
	12-33	Silt loam, loam	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	95-100	85-95	25-40	5-15
	33-80	Gravelly coarse sand, gravelly sand.	SP, SW, SP-SM	A-1	0	0-2	80-95	65-85	30-50	3-10	0-14	NP
411B:												
Waukegan	0-10	Silt loam	ML	A-4	0	0	95-100	95-100	95-100	85-95	25-40	3-10
	10-22	Silt loam, loam	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	95-100	85-95	25-40	5-15
	22-80	Gravelly coarse sand, gravelly sand.	SP, SW, SP-SM	A-1	0	0-2	80-95	65-85	30-50	3-10	0-14	NP
414:												
Hamel	0-21	Loam	ML, CL	A-6, A-4	0	0	100	95-100	85-100	60-85	25-40	8-16
	21-51	Clay loam, loam, silty clay loam.	CH, CL	A-7	0	0	95-100	95-100	85-95	65-80	40-55	25-35
	51-80	Loam, clay loam	CL	A-6, A-7	0	0-5	95-100	95-100	80-95	60-80	30-45	10-25
463A:												
Minneiska	0-9	Loam	ML, CL, CL-ML	A-4	0	0	100	95-100	70-90	50-75	20-35	3-10
	9-20	Stratified silt loam to sand.	SM, ML	A-4	0	0	100	85-100	50-90	35-60	15-20	NP-4
	20-60	Loamy sand, sand, fine sand.	SP-SM, SM	A-2, A-3	0	0	100	85-100	50-75	5-30	15-20	NP
484D:												
Eyota	0-35	Fine sandy loam	SM, SC-SM	A-4	0	0	90-100	85-100	60-90	35-50	0-20	NP-5
	35-48	Silt loam, loam	CL, CL-ML	A-4	0	0	95-100	90-100	80-100	60-100	20-30	5-10
	48-80	Fine sandy loam, loamy sand, sand.	ML, SM, CL-ML, SC-SM	A-4, A-2	0	0	95-100	85-100	50-90	15-70	0-20	NP-5
523:												
Houghton	0-8	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	8-66	Muck	PT	A-8	0	0	0	0	0	0	---	NP
525:												
Muskego	0-27	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	27-80	Coprogenous earth.	OL	A-5	0	0	95-100	95-100	85-100	75-96	40-50	2-8

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
528B:												
Klossner--------	0-12	Muck----------	PT	A-8	0	0	0	0	0	0	0-14	NP
	12-42	Mucky silt loam, mucky silty clay loam.	MH	A-7	0	0	100	95-100	90-100	85-95	60-90	10-30
	42-55	Clay loam, loam, silty clay loam.	CL-ML, CL	A-7, A-6	0	0	95-100	90-100	80-100	60-90	35-65	20-30
	55-80	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	0-5	90-100	85-100	60-95	55-80	30-55	10-25
529A:												
Ripon----------	0-15	Silt loam------	ML, CL-ML, CL	A-4	0	0	100	100	90-100	85-100	20-30	3-10
	15-28	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	85-100	30-45	10-25
	28-32	Clay loam, sandy clay loam, loam.	SC, CL	A-6, A-7	0-1	0-3	90-100	90-100	75-100	35-80	30-50	10-25
	32-42	Unweathered bedrock.	---	---	0	0	0	0	0	0	---	NP
529B:												
Ripon----------	0-27	Silt loam------	ML, CL-ML, CL	A-4	0	0	100	100	90-100	85-100	20-30	3-10
	27-31	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	85-100	30-45	10-25
	31-38	Clay loam, sandy clay loam, loam.	SC, CL	A-6, A-7	0-1	0-3	90-100	90-100	75-100	35-80	30-50	10-25
	38-48	Unweathered bedrock.	---	---	0	0	0	0	0	0	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
548:												
Medo	0-25	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	25-31	Sandy clay loam, mucky loam, mucky silt loam.	CL-ML, CL, MH	A-7, A-6	0	0	85-100	75-100	55-95	45-85	35-65	7-25
	31-45	Silt loam, sandy loam, silty clay loam.	CL-ML, CL, ML	A-6	0	0	85-100	75-100	55-95	45-85	25-39	7-18
	45-80	Gravelly coarse sand, gravelly loamy coarse sand, fine sand.	SM, SP-SM, SP, GP	A-2, A-4, A-3, A-1	0-2	0-5	75-95	60-95	20-75	2-40	15-25	NP-7
572:												
Lowlein	0-13	Sandy loam	SM, SC-SM	A-4	0	0	90-100	85-100	60-75	35-50	15-20	NP-5
	13-24	Sandy loam, fine sandy loam.	SM, SC-SM	A-4, A-6	0	0	90-100	85-100	60-90	35-80	15-20	NP-5
	24-46	Loamy sand, sand, fine sand.	SM, SP-SM	A-2, A-3	0	0	90-100	85-100	50-75	5-35	---	NP
	46-80	Loam, silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	0-5	90-100	85-100	80-90	55-80	25-40	5-15
611D:												
Hawick	0-8	Sandy loam	SM	A-2	0-2	0-5	85-100	80-95	50-65	25-35	0-20	NP-4
	8-16	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP
	16-60	Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	0-14	NP
757:												
Nerwoods	0-12	Loam	CL	A-6	0	0	100	100	85-100	85-100	25-35	10-20
	12-44	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	85-100	85-100	30-40	10-20
	44-50	Loam, clay loam	CL	A-6	0	0-5	90-100	90-100	85-90	60-70	40-50	20-30
	50-80	Loam, clay loam	CL	A-6	0	0-5	90-100	90-100	85-90	55-65	25-35	10-17

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
761:												
Epsom----------	0-8	Silty clay loam	CL	A-7	0	0	100	100	100	90-98	25-45	10-20
	8-30	Silty clay loam, loam, silt loam.	CL	A-7	0	0	100	100	95-100	90-98	25-45	7-20
	30-60	Silt loam, silty clay loam.	CL	A-6	0	0	90-98	88-95	80-90	65-75	20-40	10-20
	60-80	Clay loam, loam	CL	A-7	0	0-1	90-100	90-100	85-95	60-70	25-35	10-20
764:												
Klossner--------	0-42	Muck----------	PT	A-8	0	0	0	0	0	0	---	NP
	42-56	Mucky silt loam, mucky silty clay loam.	MH	A-7	0	0	100	95-100	90-100	85-95	60-90	35-65
	56-80	Silt loam, loam, silty clay loam.	CL, ML	A-7, A-6	0	0-5	90-100	85-100	60-100	55-90	35-65	10-25
783C2:												
Lester----------	0-9	Clay loam------	CL	A-6	0	0-5	95-100	90-100	80-95	70-75	37-39	16-18
	9-21	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	21-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
Kilkenny--------	0-7	Clay loam------	ML, MH	A-7, A-6	0	0	95-100	95-100	80-95	70-85	35-60	10-25
	7-35	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	35-80	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
783D2:												
Lester----------	0-9	Clay loam------	CL	A-6	0	0-5	95-100	90-100	80-95	70-75	37-39	16-18
	9-40	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	40-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
Kilkenny--------	0-7	Clay loam------	ML, MH	A-7, A-6	0	0	95-100	95-100	80-95	70-85	35-60	10-25
	7-15	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	15-80	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
783E:												
Lester----------	0-10	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	10-30	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	30-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
Kilkenny--------	0-9	Clay loam------	ML, MH	A-7, A-6	0	0	95-100	95-100	80-95	70-85	35-60	10-25
	9-47	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	47-80	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
783F:												
Lester----------	0-9	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	9-45	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	45-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
Kilkenny--------	0-11	Loam----------	CL	A-6	0	0	95-100	95-100	80-95	60-75	30-40	10-20
	11-34	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	34-80	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
849B:												
Urban land.												
Estherville-----	0-11	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0	0-5	90-100	80-100	50-75	25-50	20-30	2-10
	11-16	Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1	0	0-5	85-100	80-95	40-75	15-45	20-30	2-8
	16-80	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, SM, GP	A-1	0	0-10	55-90	50-85	10-40	2-25	0-14	NP
860C:												
Urban land.												
Hayden----------	0-6	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	6-36	Clay loam, loam, sandy clay loam.	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	36-80	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
875B:												
Hawick----------	0-9	Sandy loam-----	SM	A-2	0-2	0-5	85-100	80-95	50-65	25-35	0-20	NP-4
	9-16	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP
	16-60	Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	0-14	NP
Estherville-----	0-8	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0	0-5	90-100	80-100	50-75	25-50	20-30	2-10
	8-23	Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1	0	0-5	85-100	80-95	40-75	15-45	20-30	2-8
	23-60	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, SM, GP	A-1	0	0-10	55-90	50-85	10-40	2-25	0-14	NP
875C:												
Hawick----------	0-9	Sandy loam-----	SM	A-2	0-2	0-5	85-100	80-95	50-65	25-35	0-20	NP-4
	9-15	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-2	0-5	75-95	60-95	35-70	5-25	0-14	NP
	15-60	Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-2	0-5	60-95	50-95	30-65	2-10	0-14	NP
Estherville-----	0-6	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0	0-5	90-100	80-100	50-75	25-50	20-30	2-10
	6-14	Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1	0	0-5	85-100	80-95	40-75	15-45	20-30	2-8
	14-60	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, SM, GP	A-1	0	0-10	55-90	50-85	10-40	2-25	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
945C2:												
Lester----------	0-9	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	9-55	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	55-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
Storden---------	0-7	Loam----------	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15
	7-47	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
	47-80	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
945D2:												
Lester----------	0-9	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	9-23	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	23-80	Loam, clay loam	CL, CL-ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
Storden---------	0-10	Loam----------	CL	A-6	0	0-5	95-100	95-98	75-95	60-75	28-36	9-15
	10-30	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
	30-80	Loam, clay loam	CL, ML	A-6	0	0-5	95-100	90-98	70-95	55-70	28-39	9-18
963C2:												
Timula----------	0-25	Silt loam------	ML	A-4	0	0	100	100	95-100	85-100	25-35	NP-10
	25-80	Silt loam, silt	ML	A-4	0	0	100	100	95-100	85-100	25-35	NP-10
Bold----------	0-8	Silt loam------	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	3-15
	8-60	Silt loam------	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	3-15
963D2:												
Timula----------	0-30	Silt loam------	ML	A-4	0	0	100	100	95-100	85-100	25-35	NP-10
	30-80	Silt loam, silt	ML	A-4	0	0	100	100	95-100	85-100	25-35	NP-10
Bold----------	0-8	Silt loam------	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	3-15
	8-60	Silt loam------	ML, CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	3-15
1013:												
Pits.												
1016:												
Udorthents------	0-60	Loam----------	ML, SM, SC-SM, CL-ML	A-4, A-6	0	0-10	95-100	90-100	65-95	35-75	0-30	NP-15
	60-80	Variable-------	---	---	0	0	0	0	0	0	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1030:												
Pits.												
Udipsamments----	0-14	Sand----------	SM, SP-SM	A-2	0	0	95-100	85-100	75-90	10-35	---	NP
	14-60	Sand, fine sand	SP-SM, SP	A-2, A-3	0	0	95-100	85-100	50-75	5-25	---	NP
	60-80	Coarse sand, gravelly coarse sand.	SP, SP-SM, GP-GM	A-1, A-2	0	0	75-100	65-85	40-65	1-10	---	NP
1058:												
Houghton--------	0-72	Muck----------	PT	A-8	0	0	0	0	0	0	---	NP
	72-80	Muck----------	PT	A-8	0	0	0	0	0	0	---	NP
Muskego---------	0-35	Muck----------	PT	A-8	0	0	0	0	0	0	---	NP
	35-60	Coprogenous earth.	OL, ML	A-5	0	0	95-100	95-100	85-100	75-96	41-50	2-8
1080:												
Klossner--------	0-40	Muck----------	PT	A-8	0	0	0	0	0	0	0-14	NP
	40-80	Clay loam, loam, mucky silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	0	90-100	85-100	80-100	60-90	25-55	10-30
Okoboji---------	0-15	Mucky silty clay loam.	MH	A-7	0	0	100	100	95-100	90-95	60-90	10-30
	15-45	Silty clay loam, silty clay.	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	45-80	Silty clay loam, silty clay.	CH	A-7	0	0	95-100	95-100	90-100	80-95	55-65	30-40
Glencoe---------	0-24	Mucky loam-----	CL, MH, OL, OH	A-6, A-7	0	0	95-100	90-100	75-100	60-90	30-55	10-25
	24-34	Loam, clay loam, silty clay loam.	MH, CL	A-6, A-7	0	0	95-100	90-100	75-100	60-90	30-50	10-25
	34-80	Loam, clay loam	CL, ML	A-6, A-7	0	0	90-100	85-100	60-95	55-75	30-50	10-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1116F:												
Brodale---------	0-3	Flaggy loam----	SM, SP-SM, SC, GM	A-2, A-1	0	7-30	30-65	20-55	15-45	8-35	0-25	NP-8
	3-47	Very flaggy very fine sandy loam, flaggy silt loam, cobbly sandy loam.	SM, SC, SC-SM, GM	A-2, A-1	0	20-50	45-80	40-75	25-50	10-35	0-25	NP-8
	47-57	Unweathered bedrock.	---	---	0	0	0	0	0	0	---	NP
Eyota----------	0-12	Loamy fine sand	SM	A-2	0	0	90-100	85-100	50-90	15-35	0-14	NP
	12-43	Loam, sandy loam, fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	0	90-100	85-100	60-90	35-70	0-20	NP-5
	43-65	Silt loam, loam	CL, CL-ML	A-4	0	0	95-100	90-100	80-100	60-100	20-30	5-10
	65-80	Fine sandy loam, loamy sand, sand.	ML, SM, CL-ML, SC-SM	A-4, A-2	0	0	95-100	85-100	50-90	15-70	0-20	NP-5
1286:												
Prinsburg-------	0-20	Silty clay loam	ML, OL	A-7, A-6	0	0	100	100	100	90-100	35-45	15-20
	20-25	Silt loam, silty clay loam.	ML, CL, CL-ML	A-7, A-6, A-4	0	0	100	100	100	90-100	25-45	10-20
	25-42	Silt loam, silty clay loam.	ML, CL, CL-ML	A-6, A-4	0	0	100	100	100	90-100	25-45	10-20
	42-80	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	0-5	90-100	85-95	80-90	55-80	30-40	10-20
1360:												
Rushriver-------	0-31	Fine sandy loam	SC-SM, ML, SM	A-4	0	0	95-100	75-90	45-75	30-45	0-28	NP-9
	31-80	Stratified silt loam to coarse sand.	SP, SM, SC-SM, CL-ML	A-3, A-2, A-1, A-4	0	0-2	95-100	90-100	40-80	5-60	10-20	NP-5
1361:												
Le Sueur--------	0-13	Loam----------	CL, ML, CL-ML	A-6, A-4	0	0	95-100	95-100	90-100	70-85	20-40	5-15
	13-42	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	0	95-100	95-100	85-100	60-80	35-50	15-25
	42-80	Loam, fine sandy loam, sandy loam.	CL, SC, SC-SM	A-6	0-1	0-5	95-100	90-98	80-95	35-75	20-35	8-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1362B:												
Angus----------	0-9	Loam----------	CL	A-6	0	0-5	95-100	90-100	80-95	50-85	30-40	11-15
	9-42	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	42-80	Loam, clay loam	CL	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
1363:												
Dundas----------	0-15	Silt loam------	ML, CL	A-6, A-4	0	0	100	95-98	85-97	60-80	30-40	6-16
	15-40	Clay loam, silty clay loam, sandy clay loam.	CL, CH	A-6, A-7	0	0-2	97-100	90-98	85-97	50-90	35-60	15-30
	40-80	Loam, fine sandy loam, sandy loam.	CL, SC	A-6	0-1	0-5	95-100	90-98	80-95	35-70	20-35	8-15
1366:												
Talcot----------	0-25	Silty clay loam	CL	A-7	0	0	100	100	80-90	60-85	40-50	15-25
	25-48	Clay loam, silty clay loam, loam.	CL	A-7	0	0	95-100	85-100	70-90	60-85	40-50	15-25
	48-80	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, SW	A-1	0	0	65-90	50-85	20-50	2-10	0-14	NP
1367:												
Derrynane-------	0-18	Clay loam------	CL, CH, MH	A-7	0	0	100	95-100	80-90	75-90	46-56	25-33
	18-36	Silty clay, silty clay loam, clay loam.	CH, MH, CL	A-7, A-6	0	0	100	95-100	85-95	70-90	40-65	20-35
	36-55	Clay loam------	CL	A-7	0	0	95-100	95-100	85-95	70-90	43-50	22-28
	55-80	Clay loam, loam	CL	A-6	0	0-5	95-100	95-100	80-95	60-80	30-39	11-18
1387A:												
Collinwood------	0-14	Silty clay loam	CL, CH, ML, MH	A-7	0	0	100	100	95-100	90-95	40-55	15-25
	14-41	Silty clay, clay, silty clay loam.	MH, CH	A-7	0	0	100	100	95-100	90-95	50-65	20-35
	41-80	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	0	100	100	95-100	90-95	40-60	15-30

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1388B:												
Terril----------	0-9	Loam----------	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	9-44	Loam, clay loam	CL, CL-ML	A-6, A-7	0	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	44-80	Clay loam, loam	CL, CL-ML	A-6, A-7	0	0-5	95-100	90-100	65-95	50-85	20-40	5-20
1408B:												
Angus----------	0-9	Clay loam------	CL	A-6	0	0-5	95-100	90-100	80-95	70-75	37-39	16-18
	9-30	Clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-40	15-20
	30-80	Loam, clay loam	CL	A-6	0-1	0-5	95-100	90-100	75-90	50-70	32-39	13-18
Kilkenny--------	0-9	Clay loam------	ML, MH	A-7, A-6	0	0	95-100	95-100	80-95	70-85	35-60	10-25
	9-28	Clay loam, clay, silty clay loam.	MH, CH	A-7	0	0	95-100	90-100	80-95	65-80	50-70	25-35
	28-80	Clay loam, loam	CL, ML	A-7, A-6	0	0-5	95-100	90-100	75-90	60-75	35-50	10-25
1409A:												
Kenyon----------	0-14	Silt loam------	CL	A-6	0	0	100	95-100	85-95	65-75	30-40	10-20
	14-37	Loam, clay loam, sandy clay loam.	CL	A-6	0	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	37-80	Loam, clay loam	CL	A-6	0	0-5	90-95	85-95	80-90	50-65	25-35	10-20
1409B:												
Kenyon----------	0-14	Silt loam------	CL	A-6	0	0	100	95-100	85-95	65-75	30-40	10-20
	14-54	Loam, clay loam, sandy clay loam.	CL	A-6	0	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	54-76	Loam----------	CL	A-6	0	0-5	90-95	85-95	80-90	50-65	25-35	10-20
	76-80	Loam, clay loam	CL	A-6	0	0-5	90-95	85-95	80-90	50-65	25-35	10-20
1410B:												
Racine----------	0-7	Silt loam------	CL	A-6	0	0	95-100	95-100	90-100	55-85	30-40	5-14
	7-29	Silt loam, clay loam, silty clay loam.	CL	A-6	0	0	95-100	95-100	90-100	55-85	30-40	10-20
	29-48	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	2-5	95-100	75-100	65-90	45-65	25-35	10-15
	48-80	Loam----------	CL	A-6	0	1-5	95-100	90-100	80-95	50-75	25-40	10-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1410C:												
Racine----------	0-7	Silt loam------	CL	A-6	0	0	95-100	95-100	90-100	55-85	30-40	5-14
	7-20	Silt loam, clay loam, silty clay loam.	CL	A-6	0	0	95-100	95-100	90-100	55-85	30-40	10-20
	20-48	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	2-5	95-100	75-100	65-90	45-65	25-35	10-15
	48-80	Loam----------	CL	A-6	0	1-5	95-100	90-100	80-95	50-75	25-40	10-20
1411B:												
Urban land.												
Hayden----------	0-7	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	7-60	Clay loam, loam, sandy clay loam.	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	60-80	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
Estherville-----	0-11	Sandy loam-----	SM, SC-SM, SC	A-2, A-4	0	0-5	90-100	80-100	50-75	25-50	20-30	2-10
	11-16	Sandy loam, loam, coarse sandy loam.	SM, SC-SM, SC	A-2, A-4, A-1	0	0-5	85-100	80-95	40-75	15-45	20-30	2-8
	16-80	Coarse sand, gravelly coarse sand, loamy coarse sand.	SP, SP-SM, SM, GP	A-1	0	0-10	55-90	50-85	10-40	2-25	0-14	NP
1413B:												
Littleton-------	0-9	Silt loam------	CL	A-4, A-6	0	0	100	100	95-100	90-100	25-40	7-20
	9-26	Silt loam------	CL	A-4, A-6	0	0	100	100	95-100	90-100	25-40	7-20
	26-66	Silt loam------	CL-ML, CL	A-4, A-6, A-7	0	0	100	100	95-100	80-100	20-45	5-20
	66-80	Loam, clay loam	CL	A-6	0	0-5	90-100	85-95	80-90	55-70	25-35	10-20
1416C:												
Renova----------	0-10	Loam----------	ML, CL, CL-ML	A-4	0	0	100	98-100	90-95	75-90	20-40	NP-10
	10-17	Silty clay loam, silt loam, loam.	CL	A-6	0	0	100	98-100	90-95	80-95	30-40	10-20
	17-54	Loam, sandy clay loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0-2	95-100	85-95	65-85	45-65	20-35	5-15
	54-80	Loam, clay loam	CL	A-6	0	0-2	95-100	85-95	70-85	50-70	25-40	10-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1437B:												
Renova----------	0-10	Silt loam------	ML, CL, CL-ML	A-4	0	0	100	98-100	90-95	75-90	20-40	NP-10
	10-19	Silty clay loam, silt loam, loam.	CL	A-6	0	0	100	98-100	90-95	80-95	30-40	10-20
	19-52	Loam, sandy clay loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0-2	95-100	85-95	65-85	45-65	20-35	5-15
	52-80	Loam, clay loam	CL	A-6	0	0-2	95-100	85-95	70-85	50-70	25-40	10-20
1501:												
Klossner--------	0-7	Mucky silty clay loam.	MH		0	0	100	95-100	90-100	85-95	60-90	10-30
	7-44	Muck, sapric material.	PT	A-8	0	0	0	0	0	0	---	NP
	44-58	Mucky silt loam, mucky silty clay loam.	MH	A-7	0	0	100	95-100	90-100	85-95	60-90	10-30
	58-80	Clay loam, loam, silt loam.	CL	A-6, A-7	0	0-5	90-100	85-100	60-95	55-80	30-55	10-25
1831:												
Colo----------	0-23	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	95-100	25-40	5-15
	23-37	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	20-30
	37-80	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	80-100	40-55	15-30
1962:												
Mazaska---------	0-10	Clay loam------	CL, CH	A-6, A-7	0	0	95-100	95-100	85-100	70-95	35-55	12-28
	10-50	Clay loam, clay, silty clay loam.	CH, CL	A-7	0	0	90-100	85-100	75-95	60-90	40-65	15-35
	50-80	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	0-5	90-100	85-100	70-95	50-80	30-50	10-25
Rolfe----------	0-22	Silt loam------	OL, CL, ML	A-6, A-4	0	0	100	95-100	90-100	80-95	30-40	5-15
	22-49	Clay, silty clay, clay loam.	CH	A-7	0	0	100	95-100	90-100	75-95	50-65	25-35
	49-80	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-90	55-75	30-45	10-20

Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
4D:												
Renova----------	0-7	20-27	1.30-1.40	0.60-2.00	0.22-0.24	Low------	1.0-2.0	0.32	0.32	5	6	48
	7-12	24-32	1.35-1.45	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.37	0.37			
	12-40	20-30	1.55-1.75	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.37	0.37			
	40-80	20-27	1.70-1.90	0.20-0.60	0.10-0.15	Low------	0.0-0.5	0.37	0.37			
4E:												
Renova----------	0-12	20-27	1.30-1.40	0.60-2.00	0.22-0.24	Low------	1.0-2.0	0.32	0.32	5	6	48
	12-22	24-32	1.35-1.45	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.37	0.37			
	22-55	20-30	1.55-1.75	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.37	0.37			
	55-80	20-27	1.70-1.90	0.20-0.60	0.10-0.15	Low------	0.0-0.5	0.37	0.37			
17:												
Minneopa--------	0-12	5-15	1.30-1.50	2.00-6.00	0.13-0.15	Low------	4.0-6.0	0.20	0.20	4	3	86
	12-47	5-15	1.40-1.60	2.00-6.00	0.07-0.11	Low------	0.5-1.0	0.20	0.20			
	47-60	1-10	1.50-1.70	6.00-20.00	0.04-0.09	Low------	0.0-0.5	0.15	0.15			
24:												
Kasson----------	0-13	18-27	1.45-1.55	0.60-2.00	0.22-0.24	Low------	2.0-4.0	0.32	0.32	5	5	56
	13-30	24-32	1.45-1.55	0.60-2.00	0.18-0.22	Moderate	---	0.32	0.32			
	30-80	18-30	1.75-1.95	0.20-0.60	0.09-0.13	Moderate	---	0.32	0.32			
39A:												
Wadena----------	0-24	18-27	1.30-1.50	0.60-2.00	0.20-0.22	Low------	3.0-6.0	0.24	0.24	4	6	48
	24-30	18-30	1.35-1.50	0.60-2.00	0.14-0.19	Low------	0.5-1.0	0.32	0.32			
	30-80	1-5	1.55-1.65	20.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.10			
41A:												
Estherville-----	0-14	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low------	2.0-4.0	0.20	0.20	3	3	86
	14-27	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low------	0.0-0.5	0.20	0.20			
	27-60	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.10			
41B:												
Estherville-----	0-11	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low------	2.0-4.0	0.20	0.20	3	3	86
	11-16	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low------	0.0-0.5	0.20	0.20			
	16-80	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.10			
44:												
Ankeny----------	0-27	10-18	1.50-1.55	2.00-6.00	0.16-0.18	Low------	2.0-3.0	0.20	0.20	4	3	86
	27-44	10-16	1.55-1.65	2.00-6.00	0.15-0.17	Low------	0.5-1.0	0.20	0.20			
	44-80	2-10	1.65-1.75	6.00-20.00	0.12-0.14	Low------	0.0-0.5	0.20	0.20			
74B:												
Dickinson-------	0-13	10-18	1.50-1.55	2.00-6.00	0.12-0.15	Low------	1.0-2.0	0.20	0.20	4	3	86
	13-26	10-15	1.45-1.55	2.00-6.00	0.12-0.15	Low------	0.5-1.0	0.17	0.17			
	26-52	4-10	1.55-1.65	6.00-20.00	0.08-0.10	Low------	0.0-0.5	0.20	0.20			
	52-60	4-10	1.60-1.70	6.00-20.00	0.02-0.04	Low------	0.0-0.5	0.15	0.15			
81B:												
Boone----------	0-8	2-6	1.55-1.65	6.00-20.00	0.10-0.13	Low------	0.5-1.0	0.17	0.17	3	2	134
	8-15	1-5	1.55-1.70	6.00-20.00	0.03-0.12	Low------	0.0-0.5	0.15	0.15			
	15-38	0-3	1.55-1.70	6.00-20.00	0.02-0.11	Low------	0.0-0.5	0.15	0.15			
	38-80	---	---	0.20-2.00	---	---------	---	---	---			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
81D:												
Boone----------	0-6	2-6	1.55-1.65	6.00-20.00	0.10-0.13	Low------	0.5-1.0	0.17	0.17	3	2	134
	6-12	1-5	1.55-1.70	6.00-20.00	0.03-0.12	Low------	0.0-0.5	0.15	0.15			
	12-38	0-3	1.55-1.70	6.00-20.00	0.02-0.11	Low------	0.0-0.5	0.15	0.15			
	38-80	---	---	0.20-2.00	---	---------	---	---	---			
81E:												
Boone----------	0-4	2-6	1.55-1.65	6.00-20.00	0.10-0.13	Low------	0.5-1.0	0.17	0.17	3	2	134
	4-9	1-5	1.55-1.70	6.00-20.00	0.03-0.12	Low------	0.0-0.5	0.15	0.15			
	9-26	0-3	1.55-1.70	6.00-20.00	0.02-0.11	Low------	0.0-0.5	0.15	0.15			
	26-80	---	---	0.20-2.00	---	---------	---	---	---			
98:												
Colo----------	0-16	27-36	1.28-1.32	0.60-2.00	0.21-0.23	Moderate	5.0-7.0	0.28	0.28	5	7	38
	16-39	30-35	1.25-1.35	0.60-2.00	0.18-0.20	Moderate	3.0-4.0	0.28	0.28			
	39-80	25-35	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.32	0.32			
99D2:												
Racine----------	0-7	18-26	1.35-1.45	0.60-2.00	0.22-0.24	Low------	2.0-4.0	0.32	0.32	5	6	48
	7-12	22-32	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	0.5-2.0	0.37	0.37			
	12-40	18-32	1.55-1.75	0.60-2.00	0.15-0.19	Low------	0.0-0.5	0.37	0.37			
	40-80	22-32	1.70-1.90	0.20-0.60	0.10-0.15	Moderate	0.0-0.5	0.37	0.37			
100A:												
Copaston--------	0-7	14-23	1.30-1.45	0.60-2.00	0.18-0.20	Low------	2.0-5.0	0.24	0.24	1	5	56
	7-11	14-20	1.40-1.60	2.00-6.00	0.15-0.17	Low------	0.5-1.0	0.28	0.28			
	11-18	14-30	1.45-1.65	2.00-6.00	0.12-0.14	Low------	0.0-0.5	0.28	0.28			
	18-28	---	---	2.00-20.00	---	---------	---	---	---			
102B:												
Clarion---------	0-10	20-27	1.30-1.55	0.60-2.00	0.20-0.22	Low------	3.0-6.0	0.24	0.24	5	6	48
	10-44	23-30	1.30-1.55	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.37	0.37			
	44-80	22-30	1.30-1.55	0.60-2.00	0.17-0.19	Moderate	0.0-0.5	0.37	0.37			
104B:												
Hayden----------	0-9	12-20	1.40-1.60	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.32	0.32	5	5	56
	9-43	18-32	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
	43-80	12-22	1.65-1.80	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.28	0.28			
104C2:												
Hayden----------	0-7	12-20	1.40-1.60	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.32	0.32	5	5	56
	7-32	18-32	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
	32-80	12-22	1.65-1.80	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.28	0.28			
104D2:												
Hayden----------	0-7	12-20	1.40-1.60	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.32	0.32	5	5	56
	7-38	18-32	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
	38-80	12-22	1.65-1.80	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.28	0.28			
104E:												
Hayden----------	0-5	12-20	1.40-1.60	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.32	0.32	5	5	56
	5-30	18-32	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
	30-80	12-22	1.65-1.80	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.28	0.28			
106C2:												
Lester----------	0-6	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low------	1.0-4.0	0.28	0.28	5	6	48
	6-24	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	24-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
106D2:												
Lester----------	0-7	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low------	1.0-4.0	0.28	0.28	5	6	48
	7-42	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	42-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
106E:												
Lester----------	0-8	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low------	1.0-4.0	0.28	0.28	5	6	48
	8-38	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	38-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
109:												
Cordova---------	0-13	27-30	1.25-1.45	0.20-0.60	0.18-0.22	Moderate	4.0-7.0	0.28	0.28	5	6	48
	13-36	28-35	1.35-1.50	0.20-0.60	0.15-0.19	Moderate	1.0-4.0	0.28	0.28			
	36-60	18-30	1.45-1.70	0.60-2.00	0.14-0.16	Moderate	0.0-1.0	0.28	0.28			
113:												
Webster---------	0-13	26-35	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	4.0-7.0	0.24	0.24	5	6	48
	13-48	25-35	1.40-1.50	0.60-2.00	0.16-0.18	Moderate	2.0-4.0	0.32	0.32			
	48-80	22-30	1.35-1.55	0.60-2.00	0.14-0.19	Moderate	1.0-2.0	0.32	0.32			
114:												
Glencoe---------	0-12	27-35	1.35-1.45	0.20-2.00	0.18-0.22	Moderate	5.0-10	0.28	0.28	5	6	48
	12-27	25-35	1.35-1.45	0.20-2.00	0.18-0.22	Moderate	2.0-5.0	0.28	0.28			
	27-36	25-35	1.35-1.50	0.20-2.00	0.15-0.19	Moderate	1.0-4.0	0.28	0.28			
	36-80	22-32	1.35-1.50	0.60-2.00	0.15-0.19	Low------	0.0-3.0	0.28	0.28			
130:												
Nicollet--------	0-20	27-35	1.15-1.25	0.60-2.00	0.17-0.22	Moderate	4.0-8.0	0.24	0.24	5	6	48
	20-40	25-35	1.25-1.35	0.60-2.00	0.15-0.19	Moderate	1.0-2.0	0.32	0.32			
	40-80	22-30	1.35-1.55	0.60-2.00	0.14-0.19	Low------	0.0-1.0	0.32	0.32			
134:												
Okoboji---------	0-7	35-42	1.30-1.40	0.20-0.60	0.21-0.23	High-----	7.0-10	0.32	0.32	5	4	86
	7-40	35-45	1.30-1.40	0.20-0.60	0.18-0.20	High-----	7.0-10	0.32	0.32			
	40-80	25-35	1.35-1.40	0.20-0.60	0.18-0.20	High-----	3.0-4.0	0.32	0.32			
138B:												
Lerdal----------	0-12	27-32	1.15-1.25	0.20-2.00	0.18-0.22	Moderate	2.0-4.0	0.37	0.37	5	6	48
	12-41	35-55	1.25-1.35	0.06-0.20	0.13-0.19	High-----	0.5-1.0	0.32	0.32			
	41-80	27-35	1.35-1.45	0.20-0.60	0.14-0.19	Moderate	0.0-0.5	0.37	0.37			
138C:												
Lerdal----------	0-8	27-32	1.15-1.25	0.20-2.00	0.18-0.22	Moderate	2.0-4.0	0.37	0.37	5	6	48
	8-42	35-55	1.25-1.35	0.06-0.20	0.13-0.19	High-----	0.5-1.0	0.32	0.32			
	42-80	27-35	1.35-1.45	0.20-0.60	0.14-0.19	Moderate	0.0-0.5	0.37	0.37			
176:												
Garwin----------	0-8	22-27	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	6.0-7.0	0.28	0.28	5	6	48
	8-22	27-35	1.28-1.35	0.60-2.00	0.18-0.20	High-----	1.0-2.0	0.28	0.28			
	22-80	20-26	1.35-1.45	0.60-2.00	0.20-0.22	Moderate	0.0-0.5	0.43	0.43			
208:												
Kato----------	0-14	27-35	1.25-1.40	0.60-2.00	0.18-0.24	Moderate	5.0-8.0	0.28	0.28	4	7	38
	14-29	24-35	1.30-1.40	0.60-2.00	0.18-0.22	Moderate	---	0.28	0.28			
	29-80	0-5	1.55-1.65	6.00-20.00	0.02-0.07	Low------	---	0.15	0.15			
213B:												
Klinger---------	0-21	27-30	1.30-1.35	0.60-2.00	0.22-0.24	Moderate	4.0-6.0	0.28	0.28	5	7	38
	21-43	28-35	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	43-80	20-32	1.70-1.90	0.20-0.60	0.10-0.15	Low------	0.0-0.5	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
219:												
Rolfe----------	0-12	22-27	1.35-1.40	0.60-2.00	0.22-0.24	Low------	3.0-5.0	0.37	0.37	5	6	48
	12-33	38-45	1.40-1.50	0.06-0.20	0.11-0.13	High-----	1.0-2.0	0.28	0.28			
	33-80	24-35	1.50-1.60	0.20-2.00	0.14-0.16	Moderate	0.0-1.0	0.28	0.28			
238B:												
Kilkenny--------	0-9	20-27	1.15-1.25	0.60-2.00	0.18-0.22	Low------	2.0-4.0	0.28	0.28	5	6	48
	9-54	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	54-60	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
238C2:												
Kilkenny--------	0-9	27-30	1.15-1.25	0.20-0.60	0.17-0.19	Moderate	2.0-4.0	0.28	0.28	5	6	48
	9-53	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	53-60	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
238D2:												
Kilkenny--------	0-8	27-30	1.15-1.25	0.20-0.60	0.17-0.19	Moderate	2.0-4.0	0.28	0.28	5	6	48
	8-46	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	46-60	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
238E:												
Kilkenny--------	0-7	27-30	1.15-1.25	0.20-0.60	0.17-0.19	Moderate	2.0-4.0	0.28	0.28	5	6	48
	7-38	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	38-60	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
238F:												
Kilkenny--------	0-5	20-27	1.15-1.25	0.60-2.00	0.18-0.22	Low------	2.0-4.0	0.28	0.28	5	6	48
	5-34	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	34-80	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
239:												
Le Sueur--------	0-11	28-30	1.50-1.70	0.60-2.00	0.17-0.20	Moderate	3.0-7.0	0.24	0.24	5	6	48
	11-42	24-35	1.30-1.45	0.60-2.00	0.15-0.19	Moderate	0.5-2.0	0.32	0.32			
	42-80	20-30	1.45-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.32	0.32			
253:												
Maxcreek--------	0-18	28-32	1.30-1.45	0.60-2.00	0.18-0.22	High-----	6.0-8.0	0.28	0.28	5	7	38
	18-36	25-32	1.40-1.55	0.60-2.00	0.20-0.22	High-----	---	0.28	0.28			
	36-80	18-27	1.50-1.70	0.60-2.00	0.17-0.19	Moderate	---	0.28	0.28			
256:												
Mazaska---------	0-15	27-40	1.15-1.30	0.20-0.60	0.17-0.22	High-----	4.0-7.0	0.28	0.28	5	4	86
	15-42	35-50	1.25-1.40	0.06-0.20	0.10-0.16	High-----	0.5-2.0	0.28	0.28			
	42-80	20-35	1.40-1.60	0.20-2.00	0.14-0.16	Moderate	0.0-0.5	0.28	0.28			
285A:												
Port Byron------	0-12	18-27	1.10-1.20	0.60-2.00	0.22-0.24	Low------	2.0-4.0	0.32	0.32	5	6	48
	12-40	18-27	1.15-1.30	0.60-2.00	0.20-0.22	Low------	---	0.43	0.43			
	40-80	18-27	1.20-1.40	0.60-2.00	0.20-0.22	Low------	---	0.43	0.43			
285B:												
Port Byron------	0-14	18-27	1.10-1.20	0.60-2.00	0.22-0.24	Low------	2.0-4.0	0.32	0.32	5	6	48
	14-42	18-27	1.15-1.30	0.60-2.00	0.20-0.22	Low------	---	0.43	0.43			
	42-80	18-27	1.20-1.40	0.60-2.00	0.20-0.22	Low------	---	0.43	0.43			
301B:												
Lindstrom-------	0-16	10-20	1.20-1.30	0.60-2.00	0.20-0.22	Low------	3.0-5.0	0.28	0.28	5	5	56
	16-30	18-24	1.20-1.30	0.60-2.00	0.22-0.26	Low------	---	0.28	0.28			
	30-60	18-24	1.30-1.40	0.60-2.00	0.20-0.22	Low------	---	0.43	0.43			
	60-80	12-20	1.40-1.50	0.60-2.00	0.17-0.19	Low------	---	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
301C:												
Lindstrom-------	0-10	10-20	1.20-1.30	0.60-2.00	0.20-0.22	Low------	3.0-5.0	0.28	0.28	5	5	56
	10-26	18-24	1.20-1.30	0.60-2.00	0.22-0.26	Low------	---	0.28	0.28			
	26-43	18-24	1.30-1.40	0.60-2.00	0.20-0.22	Low------	---	0.43	0.43			
	43-80	12-20	1.40-1.50	0.60-2.00	0.17-0.19	Low------	---	0.43	0.43			
307:												
Sargeant--------	0-7	18-27	1.30-1.50	0.60-2.00	0.22-0.24	Low------	1.0-3.0	0.37	0.37	5	6	48
	7-25	24-32	1.40-1.55	0.60-2.00	0.20-0.24	Moderate	---	0.37	0.37			
	25-55	24-32	1.60-1.80	0.06-0.20	0.10-0.15	Moderate	---	0.37	0.37			
	55-80	18-27	1.75-2.00	0.06-0.20	0.08-0.14	Low------	---	0.37	0.37			
323:												
Shields---------	0-8	27-40	1.15-1.25	0.60-2.00	0.18-0.22	Moderate	2.0-4.0	0.37	0.37	5	7	38
	8-53	40-60	1.25-1.35	0.06-0.20	0.10-0.16	High-----	0.5-2.0	0.37	0.37			
	53-80	27-50	1.35-1.45	0.20-2.00	0.11-0.19	High-----	0.0-0.5	0.37	0.37			
376B:												
Moland----------	0-14	18-27	1.30-1.45	0.60-2.00	0.22-0.24	Moderate	4.0-6.0	0.32	0.32	5	6	48
	14-20	28-32	1.30-1.45	0.60-2.00	0.20-0.22	Moderate	---	0.32	0.32			
	20-49	18-30	1.35-1.50	0.60-2.00	0.17-0.19	Low------	---	0.32	0.32			
	49-80	18-27	1.50-1.70	0.60-2.00	0.17-0.19	Low------	---	0.32	0.32			
377:												
Merton----------	0-15	18-27	1.30-1.45	0.60-2.00	0.22-0.24	Low------	4.0-6.0	0.32	0.32	5	6	48
	15-55	18-30	1.35-1.50	0.60-2.00	0.20-0.22	Low------	---	0.32	0.32			
	55-80	18-27	1.50-1.70	0.60-2.00	0.17-0.19	Low------	---	0.32	0.32			
378:												
Maxfield--------	0-15	27-35	1.35-1.40	0.60-2.00	0.21-0.23	High-----	6.0-8.0	0.28	0.28	5	7	38
	15-27	25-34	1.40-1.50	0.60-2.00	0.18-0.20	High-----	0.0-1.0	0.32	0.32			
	27-80	20-26	1.65-1.75	0.60-2.00	0.17-0.19	Low------	0.0-1.0	0.32	0.32			
382B:												
Blooming--------	0-9	18-27	1.30-1.45	0.60-2.00	0.24-0.30	Moderate	2.0-4.0	0.32	0.32	5	6	48
	9-19	24-32	1.35-1.50	0.60-2.00	0.18-0.22	Moderate	---	0.32	0.32			
	19-44	20-30	1.50-1.65	0.60-2.00	0.16-0.19	Moderate	---	0.32	0.32			
	44-70	18-27	1.50-1.70	0.60-2.00	0.17-0.19	Low------	---	0.32	0.32			
382C2:												
Blooming--------	0-7	18-27	1.30-1.45	0.60-2.00	0.24-0.30	Moderate	2.0-4.0	0.32	0.32	5	6	48
	7-23	24-32	1.35-1.50	0.60-2.00	0.18-0.22	Moderate	---	0.32	0.32			
	23-45	20-30	1.50-1.65	0.60-2.00	0.16-0.19	Moderate	---	0.32	0.32			
	45-70	18-27	1.50-1.70	0.60-2.00	0.17-0.19	Low------	---	0.32	0.32			
392:												
Biscay----------	0-20	18-30	1.20-1.30	0.60-2.00	0.20-0.22	Moderate	4.0-8.0	0.28	0.28	4	6	48
	20-25	18-30	1.25-1.35	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.28	0.28			
	25-33	10-28	1.35-1.55	2.00-6.00	0.11-0.17	Low------	0.5-1.0	0.28	0.32			
	33-80	1-6	1.55-1.65	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.05	0.10			
408:												
Faxon----------	0-15	28-30	1.30-1.45	0.60-2.00	0.20-0.24	Moderate	5.0-15	0.28	0.28	2	6	48
	15-34	18-30	1.40-1.60	0.60-2.00	0.12-0.19	Moderate	---	0.28	0.28			
	34-60	---	---	2.00-20.00	---	---------	---	---	---			
411A:												
Waukegan--------	0-12	18-27	1.35-1.55	0.60-2.00	0.22-0.24	Low------	2.0-5.0	0.32	0.32	4	6	48
	12-33	18-27	1.35-1.55	0.60-2.00	0.20-0.22	Low------	1.0-2.0	0.43	0.43			
	33-80	1-10	1.50-1.70	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.15			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
411B:												
Waukegan--------	0-10	18-27	1.35-1.55	0.60-2.00	0.22-0.24	Low------	2.0-5.0	0.32	0.32	4	6	48
	10-22	18-27	1.35-1.55	0.60-2.00	0.20-0.22	Low------	1.0-2.0	0.43	0.43			
	22-80	1-10	1.50-1.70	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.15			
414:												
Hamel----------	0-21	20-27	1.30-1.40	0.60-2.00	0.20-0.24	Low------	5.0-7.0	0.28	0.28	5	6	48
	21-51	24-35	1.45-1.60	0.20-0.60	0.16-0.19	Moderate	2.0-5.0	0.28	0.28			
	51-80	20-30	1.55-1.75	0.60-2.00	0.14-0.18	Moderate	0.0-3.0	0.28	0.28			
463A:												
Minneiska-------	0-9	10-27	1.30-1.40	2.00-6.00	0.20-0.22	Low------	2.0-5.0	0.28	0.28	5	4L	86
	9-20	5-18	1.40-1.60	2.00-6.00	0.13-0.18	Low------	1.0-2.0	0.28	0.28			
	20-60	2-5	1.50-1.65	6.00-20.00	0.05-0.08	Low------	0.0-1.0	0.10	0.10			
484D:												
Eyota----------	0-35	5-18	1.45-1.60	2.00-6.00	0.13-0.16	Low------	2.0-3.0	0.20	0.20	5	3	86
	35-48	15-25	1.35-1.45	0.60-2.00	0.20-0.22	Low------	---	0.43	0.43			
	48-80	1-18	1.40-1.60	2.00-20.00	0.08-0.14	Low------	---	0.43	0.43			
523:												
Houghton--------	0-8	---	0.20-0.35	0.20-6.00	0.35-0.45	---------	70-99	---	---	3	2	134
	8-66	---	0.15-0.25	0.20-6.00	0.35-0.45	---------	70-99	---	---			
525:												
Muskego---------	0-27	---	0.10-0.21	0.60-6.00	0.35-0.45	---------	60-90	0.10	0.10	1	2	134
	27-80	18-35	0.30-1.10	0.06-0.20	0.18-0.24	Moderate	6.0-20	0.28	0.28			
528B:												
Klossner--------	0-12	---	0.25-0.55	0.20-6.00	0.35-0.48	---------	25-60	---	---	2	8	---
	12-42	22-35	1.10-1.25	0.60-2.00	0.22-0.26	Moderate	10-20	0.37	0.37			
	42-55	22-35	1.30-1.40	0.20-2.00	0.18-0.22	Moderate	5.0-10	0.28	0.28			
	55-80	15-32	1.35-1.50	0.60-2.00	0.15-0.19	Moderate	0.0-5.0	0.28	0.28			
529A:												
Ripon----------	0-15	10-18	1.35-1.55	0.60-2.00	0.22-0.24	Low------	2.0-4.0	0.28	0.28	2	5	56
	15-28	25-35	1.55-1.65	0.60-2.00	0.18-0.22	Moderate	0.5-1.0	0.43	0.43			
	28-32	22-40	1.55-1.70	0.60-2.00	0.14-0.19	Moderate	0.0-0.5	0.32	0.32			
	32-42	---	---	0.06-2.00	---	---------	---	---	---			
529B:												
Ripon----------	0-27	10-18	1.35-1.55	0.60-2.00	0.22-0.24	Low------	2.0-4.0	0.28	0.28	2	5	56
	27-31	25-35	1.55-1.65	0.60-2.00	0.18-0.22	Moderate	0.5-1.0	0.43	0.43			
	31-38	22-40	1.55-1.70	0.60-2.00	0.14-0.19	Moderate	0.0-0.5	0.32	0.32			
	38-48	---	---	0.06-2.00	---	---------	---	---	---			
548:												
Medo----------	0-25	---	0.25-0.45	0.20-6.00	0.35-0.45	---------	20-50	---	---	2	2	134
	25-31	15-30	1.15-1.65	0.60-6.00	0.13-0.20	Moderate	5.0-20	0.24	0.24			
	31-45	15-30	1.35-1.65	0.60-6.00	0.13-0.20	Moderate	1.0-4.0	0.32	0.32			
	45-80	0-10	1.50-1.65	2.00-20.00	0.03-0.10	Low------	0.5-2.0	0.10	0.10			
572:												
Lowlein---------	0-13	10-18	1.30-1.50	2.00-6.00	0.13-0.15	Low------	4.0-7.0	0.20	0.20	5	3	86
	13-24	10-18	1.35-1.45	2.00-6.00	0.12-0.14	Low------	1.0-2.0	0.24	0.24			
	24-46	1-10	1.55-1.65	6.00-20.00	0.06-0.11	Low------	0.0-1.0	0.15	0.15			
	46-80	18-32	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
611D:												
Hawick----------	0-8	5-15	1.35-1.55	2.00-6.00	0.13-0.15	Low------	1.0-4.0	0.17	0.17	3	3	86
	8-16	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low------	0.0-0.5	0.10	0.15			
	16-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low------	0.0-0.5	0.10	0.15			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
757:												
Nerwoods--------	0-12	18-27	1.30-1.35	0.60-2.00	0.20-0.22	Moderate	3.0-6.0	0.24	0.24	5	6	48
	12-44	20-27	1.30-1.50	0.60-2.00	0.21-0.23	Moderate	1.0-3.0	0.28	0.28			
	44-50	22-32	1.40-1.65	0.60-2.00	0.20-0.23	Moderate	0.0-0.5	0.28	0.28			
	50-80	22-32	1.70-1.90	0.20-0.60	0.05-0.10	Moderate	0.0-0.5	0.37	0.37			
761:												
Epsom----------	0-8	28-35	1.00-1.35	0.60-2.00	0.21-0.23	Moderate	6.0-12	0.28	0.28	5	6	48
	8-30	28-35	1.20-1.35	0.60-2.00	0.18-0.21	Moderate	6.0-10	0.28	0.28			
	30-60	22-27	1.30-1.55	0.60-2.00	0.18-0.21	Moderate	0.5-2.0	0.32	0.32			
	60-80	22-32	1.70-1.90	0.20-0.60	0.05-0.10	Low------	0.0-0.5	0.37	0.37			
764:												
Klossner--------	0-42	---	0.25-0.55	0.20-6.00	0.35-0.48	---------	25-60	---	---	2	2	134
	42-56	22-35	1.10-1.25	0.60-2.00	0.22-0.26	Moderate	10-20	0.37	0.37			
	56-80	15-32	1.30-1.40	0.20-2.00	0.18-0.22	Moderate	5.0-10	0.28	0.28			
783C2:												
Lester----------	0-9	28-30	1.35-1.50	0.60-2.00	0.17-0.19	Moderate	1.0-4.0	0.28	0.28	5	6	48
	9-21	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	21-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
Kilkenny--------	0-7	27-30	1.15-1.25	0.20-0.60	0.17-0.19	Moderate	2.0-4.0	0.28	0.28	5	6	48
	7-35	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	35-80	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
783D2:												
Lester----------	0-9	28-30	1.35-1.50	0.60-2.00	0.17-0.19	Moderate	1.0-4.0	0.28	0.28	5	6	48
	9-40	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	40-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
Kilkenny--------	0-7	27-30	1.15-1.25	0.20-0.60	0.17-0.19	Moderate	2.0-4.0	0.28	0.28	5	6	48
	7-15	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	15-80	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
783E:												
Lester----------	0-10	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low------	1.0-4.0	0.28	0.28	5	6	48
	10-30	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	30-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
Kilkenny--------	0-9	27-30	1.15-1.25	0.20-0.60	0.17-0.19	Moderate	2.0-4.0	0.28	0.28	5	6	48
	9-47	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	47-80	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
783F:												
Lester----------	0-9	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low------	1.0-4.0	0.28	0.28	5	6	48
	9-45	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	45-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
Kilkenny--------	0-11	20-27	1.15-1.25	0.60-2.00	0.18-0.22	Low------	2.0-4.0	0.28	0.28	5	6	48
	11-34	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	34-80	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
849B:												
Urban land.												
Estherville-----	0-11	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low------	2.0-4.0	0.20	0.20	3	3	86
	11-16	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low------	0.0-0.5	0.20	0.20			
	16-80	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.10			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
860C:												
Urban land.												
Hayden----------	0-6	12-20	1.40-1.60	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.32	0.32	5	5	56
	6-36	18-32	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
	36-80	12-22	1.65-1.80	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.28	0.28			
875B:												
Hawick----------	0-9	5-15	1.35-1.55	2.00-6.00	0.13-0.15	Low------	1.0-4.0	0.17	0.17	3	3	86
	9-16	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low------	0.0-0.5	0.10	0.15			
	16-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low------	0.0-0.5	0.10	0.15			
Estherville-----	0-8	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low------	2.0-4.0	0.20	0.20	3	3	86
	8-23	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low------	0.0-0.5	0.20	0.20			
	23-60	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.10			
875C:												
Hawick----------	0-9	5-15	1.35-1.55	2.00-6.00	0.13-0.15	Low------	1.0-4.0	0.17	0.17	3	3	86
	9-15	1-10	1.50-1.65	6.00-20.00	0.03-0.10	Low------	0.0-0.5	0.10	0.15			
	15-60	1-5	1.55-1.65	20.00-40.00	0.02-0.06	Low------	0.0-0.5	0.10	0.15			
Estherville-----	0-6	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low------	2.0-4.0	0.20	0.20	3	3	86
	6-14	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low------	0.0-0.5	0.20	0.20			
	14-60	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.10			
945C2:												
Lester----------	0-9	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low------	1.0-4.0	0.28	0.28	5	6	48
	9-55	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	55-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
Storden---------	0-7	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low------	1.0-2.0	0.28	0.28	5	4L	86
	7-47	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
	47-80	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
945D2:												
Lester----------	0-9	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low------	1.0-4.0	0.28	0.28	5	6	48
	9-23	24-32	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	23-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
Storden---------	0-10	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low------	1.0-2.0	0.28	0.28	5	4L	86
	10-30	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.37	0.37			
	30-80	18-30	1.35-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
963C2:												
Timula----------	0-25	10-18	1.30-1.60	0.60-2.00	0.20-0.24	Low------	1.0-2.0	0.37	0.37	5	5	56
	25-80	10-18	1.40-1.60	0.60-2.00	0.18-0.20	Low------	0.2-0.5	0.37	0.37			
Bold----------	0-8	12-18	1.40-1.60	0.60-2.00	0.21-0.24	Low------	0.5-2.0	0.43	0.43	5	4L	86
	8-60	12-18	1.10-1.30	0.60-2.00	0.20-0.24	Low------	0.0-0.5	0.43	0.43			
963D2:												
Timula----------	0-30	10-18	1.30-1.60	0.60-2.00	0.20-0.24	Low------	1.0-2.0	0.37	0.37	5	5	56
	30-80	10-18	1.40-1.60	0.60-2.00	0.18-0.20	Low------	0.2-0.5	0.37	0.37			
Bold----------	0-8	12-18	1.40-1.60	0.60-2.00	0.21-0.24	Low------	0.5-2.0	0.43	0.43	5	4L	86
	8-60	12-18	1.10-1.30	0.60-2.00	0.20-0.24	Low------	0.0-0.5	0.43	0.43			
1013:												
Pits.												

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
1016:												
Udorthents------	0-60	2-18	1.50-1.70	0.60-6.00	0.08-0.14	Low------	0.5-1.0	0.24	0.28	5	3	86
	60-80	---	---	0.06-6.00	---	---------	---	---	---			
1030:												
Pits.												
Udipsamments----	0-14	1-15	1.50-1.70	2.00-20.00	0.05-0.10	Low------	0.0-0.5	0.15	0.15	5	2	220
	14-60	1-10	1.50-1.70	6.00-20.00	0.05-0.08	Low------	---	0.10	0.10			
	60-80	1-10	1.50-1.70	20.00-63.00	0.03-0.05	Low------	---	0.05	0.10			
1058:												
Houghton--------	0-72	---	0.08-0.30	0.20-6.00	0.35-0.45	---------	70-99	---	---	3	8	---
	72-80	---	0.13-0.23	0.20-6.00	0.35-0.45	---------	70-99	---	---			
Muskego---------	0-35	2-4	0.10-0.21	0.20-6.00	0.35-0.45	Low------	25-60	0.10	0.10	1	8	---
	35-60	18-35	0.30-1.10	0.60-2.00	0.18-0.24	Moderate	6.0-20	0.28	0.28			
1080:												
Klossner--------	0-40	---	0.25-0.45	0.20-6.00	0.35-0.45	---------	25-60	---	---	2	8	---
	40-80	20-35	1.45-1.70	0.20-2.00	0.14-0.22	Moderate	5.0-20	0.28	0.28			
Okoboji---------	0-15	30-40	1.20-1.25	0.60-2.00	0.22-0.25	Moderate	10-18	0.32	0.32	5	6	48
	15-45	35-45	1.35-1.40	0.20-0.60	0.18-0.20	High-----	---	0.37	0.37			
	45-80	35-45	1.35-1.40	0.20-0.60	0.18-0.20	High-----	---	0.37	0.37			
Glencoe---------	0-24	27-35	1.25-1.35	0.60-2.00	0.18-0.22	Moderate	8.0-15	0.28	0.28	5	8	---
	24-34	25-35	1.35-1.50	0.20-2.00	0.15-0.19	Moderate	2.0-6.0	0.28	0.28			
	34-80	22-32	1.35-1.50	0.60-2.00	0.15-0.19	Low------	0.0-3.0	0.28	0.28			
1116F:												
Brodale---------	0-3	5-18	1.15-1.30	0.60-2.00	0.06-0.12	Low------	2.0-5.0	0.17	0.28	5	8	---
	3-47	5-18	1.20-1.35	0.60-6.00	0.04-0.09	Low------	---	0.20	0.24			
	47-57	---	---	2.00-20.00	---	---------	---	---	---			
Eyota----------	0-12	1-10	1.40-1.50	2.00-6.00	0.10-0.14	Low------	1.0-2.0	0.20	0.20	5	2	134
	12-43	5-18	1.50-1.60	2.00-6.00	0.12-0.14	Low------	---	0.20	0.20			
	43-65	15-25	1.35-1.45	0.60-2.00	0.20-0.22	Low------	---	0.43	0.43			
	65-80	1-18	1.40-1.60	2.00-20.00	0.08-0.14	Low------	---	0.43	0.43			
1286:												
Prinsburg-------	0-20	27-35	1.20-1.30	0.60-2.00	0.18-0.24	Moderate	4.0-8.0	0.28	0.28	5	4L	86
	20-25	18-35	1.25-1.35	0.60-2.00	0.16-0.22	Moderate	1.0-2.0	0.37	0.37			
	25-42	18-35	1.25-1.40	0.60-2.00	0.16-0.22	Low------	0.5-1.0	0.37	0.37			
	42-80	22-32	1.35-1.55	0.60-2.00	0.15-0.19	Low------	0.0-0.5	0.28	0.28			
1360:												
Rushriver-------	0-31	5-18	1.40-1.60	2.00-6.00	0.11-0.17	Low------	1.0-4.0	0.24	0.24	5	3	86
	31-80	2-10	1.55-1.65	2.00-20.00	0.06-0.15	Low------	0.5-2.0	0.17	0.17			
1361:												
Le Sueur--------	0-13	20-27	1.30-1.40	0.60-2.00	0.20-0.24	Low------	3.0-7.0	0.24	0.24	5	6	48
	13-42	24-35	1.30-1.45	0.60-2.00	0.15-0.19	Moderate	0.5-2.0	0.32	0.32			
	42-80	12-22	1.50-1.65	2.00-6.00	0.14-0.19	Moderate	0.0-0.5	0.32	0.32			
1362B:												
Angus----------	0-9	20-27	1.30-1.40	0.60-2.00	0.20-0.22	Low------	1.0-4.0	0.28	0.28	5	6	48
	9-42	24-35	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	42-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
1363:												
Dundas----------	0-15	10-27	1.40-1.60	0.60-2.00	0.22-0.24	Moderate	2.0-4.0	0.28	0.28	5	6	48
	15-40	20-35	1.50-1.65	0.20-0.60	0.15-0.19	Moderate	0.5-2.0	0.28	0.28			
	40-80	12-22	1.60-1.80	2.00-6.00	0.14-0.19	Moderate	0.0-0.5	0.28	0.28			
1366:												
Talcot----------	0-25	30-35	1.20-1.30	0.60-2.00	0.18-0.22	Moderate	4.0-8.0	0.28	0.28	4	4L	86
	25-48	30-35	1.25-1.35	0.60-2.00	0.17-0.20	Moderate	2.0-6.0	0.28	0.28			
	48-80	1-6	1.55-1.65	6.00-20.00	0.02-0.04	Low------	0.5-1.0	0.15	0.15			
1367:												
Derrynane-------	0-18	30-40	1.20-1.40	0.06-0.60	0.17-0.19	High-----	5.0-10	0.28	0.28	5	4	86
	18-36	35-45	1.40-1.60	0.06-0.60	0.13-0.16	High-----	5.0-10	0.28	0.28			
	36-55	27-35	1.40-1.75	0.20-0.60	0.15-0.19	Moderate	3.0-5.0	0.28	0.28			
	55-80	20-30	1.40-1.75	0.60-2.00	0.14-0.18	Moderate	0.0-0.5	0.28	0.28			
1387A:												
Collinwood------	0-14	35-40	1.20-1.30	0.20-0.60	0.14-0.17	Moderate	5.0-8.0	0.28	0.28	5	4	86
	14-41	35-60	1.25-1.35	0.06-0.60	0.13-0.16	High-----	1.0-4.0	0.32	0.32			
	41-80	35-45	1.25-1.40	0.06-0.60	0.11-0.15	High-----	0.0-2.0	0.32	0.32			
1388B:												
Terril----------	0-9	18-26	1.35-1.40	0.60-2.00	0.20-0.22	Low------	3.0-5.0	0.24	0.24	5	6	48
	9-44	24-30	1.40-1.45	0.60-2.00	0.17-0.19	Low------	2.0-3.0	0.28	0.28			
	44-80	22-30	1.45-1.70	0.60-2.00	0.16-0.18	Low------	0.0-1.0	0.32	0.32			
1408B:												
Angus----------	0-9	28-30	1.35-1.50	0.60-2.00	0.17-0.19	Moderate	1.0-4.0	0.28	0.28	5	6	48
	9-30	24-35	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	30-80	22-30	1.55-1.75	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.37	0.37			
Kilkenny--------	0-9	27-30	1.15-1.25	0.20-0.60	0.17-0.19	Moderate	2.0-4.0	0.28	0.28	5	6	48
	9-28	35-45	1.25-1.35	0.20-0.60	0.15-0.19	Moderate	0.0-2.0	0.28	0.28			
	28-80	22-32	1.35-1.45	0.60-2.00	0.14-0.16	Moderate	0.0-0.5	0.37	0.37			
1409A:												
Kenyon----------	0-14	18-26	1.40-1.45	0.60-2.00	0.20-0.22	Low------	3.0-4.0	0.24	0.24	5	6	48
	14-37	20-30	1.45-1.65	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.28	0.28			
	37-80	22-32	1.70-1.90	0.20-0.60	0.10-0.15	Low------	0.0-0.5	0.37	0.37			
1409B:												
Kenyon----------	0-14	18-26	1.40-1.45	0.60-2.00	0.20-0.22	Low------	3.0-4.0	0.24	0.24	5	6	48
	14-54	20-30	1.45-1.65	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.28	0.28			
	54-76	20-24	1.65-1.75	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
	76-80	22-32	1.70-1.90	0.20-0.60	0.10-0.15	Low------	0.0-0.5	0.37	0.37			
1410B:												
Racine----------	0-7	18-26	1.35-1.45	0.60-2.00	0.22-0.24	Low------	2.0-4.0	0.32	0.32	5	6	48
	7-29	22-32	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	0.5-2.0	0.37	0.37			
	29-48	18-32	1.55-1.75	0.60-2.00	0.15-0.19	Low------	0.0-0.5	0.37	0.37			
	48-80	22-28	1.70-1.90	0.20-0.60	0.10-0.15	Moderate	0.0-0.5	0.37	0.37			
1410C:												
Racine----------	0-7	18-26	1.35-1.45	0.60-2.00	0.22-0.24	Low------	2.0-4.0	0.32	0.32	5	6	48
	7-20	22-32	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	0.5-2.0	0.37	0.37			
	20-48	18-32	1.55-1.75	0.60-2.00	0.15-0.19	Low------	0.0-0.5	0.37	0.37			
	48-80	22-28	1.70-1.90	0.20-0.60	0.10-0.15	Moderate	0.0-0.5	0.37	0.37			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
1411B:												
Urban land.												
Hayden----------	0-7	12-20	1.40-1.60	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.32	0.32	5	5	56
	7-60	18-32	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	0.0-0.5	0.37	0.37			
	60-80	12-22	1.65-1.80	0.60-2.00	0.14-0.19	Low------	0.0-0.5	0.28	0.28			
Estherville-----	0-11	5-15	1.25-1.35	2.00-6.00	0.13-0.18	Low------	2.0-4.0	0.20	0.20	3	3	86
	11-16	10-18	1.35-1.60	2.00-6.00	0.13-0.18	Low------	0.0-0.5	0.20	0.20			
	16-80	0-8	1.50-1.65	6.00-63.00	0.02-0.04	Low------	0.0-0.5	0.10	0.10			
1413B:												
Littleton-------	0-9	18-27	1.20-1.45	0.60-2.00	0.20-0.24	Low------	3.0-4.0	0.32	0.32	5	6	48
	9-26	22-27	1.20-1.40	0.60-2.00	0.22-0.24	Low------	1.0-3.0	0.32	0.32			
	26-66	18-27	1.20-1.40	0.60-2.00	0.20-0.22	Low------	0.0-0.5	0.43	0.43			
	66-80	22-32	1.55-1.70	0.60-2.00	0.17-0.19	Moderate	0.0-0.5	0.37	0.32			
1416C:												
Renova----------	0-10	18-26	1.30-1.40	0.60-2.00	0.22-0.24	Low------	1.0-2.0	0.32	0.32	5	6	48
	10-17	24-32	1.35-1.45	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.37	0.37			
	17-54	18-32	1.55-1.75	0.60-2.00	0.15-0.19	Low------	0.5-1.0	0.37	0.37			
	54-80	22-28	1.70-1.90	0.20-0.60	0.10-0.15	Low------	0.0-0.5	0.37	0.37			
1437B:												
Renova----------	0-10	18-26	1.30-1.40	0.60-2.00	0.22-0.24	Low------	1.0-2.0	0.32	0.32	5	6	48
	10-19	24-32	1.35-1.45	0.60-2.00	0.20-0.22	Low------	0.5-1.0	0.37	0.37			
	19-52	18-32	1.55-1.75	0.60-2.00	0.15-0.19	Low------	0.5-1.0	0.37	0.37			
	52-80	22-28	1.70-1.90	0.20-0.60	0.10-0.15	Low------	0.0-0.5	0.37	0.37			
1501:												
Klossner--------	0-7	22-35	1.10-1.25	0.60-2.00	0.22-0.26	Moderate	10-20	0.37	0.37	2	2	134
	7-44	---	0.25-0.55	0.20-6.00	0.35-0.48	---------	25-60	---	---			
	44-58	22-35	1.10-1.25	0.60-2.00	0.22-0.26	Moderate	10-20	0.37	0.37			
	58-80	15-32	1.35-1.50	0.60-2.00	0.15-0.19	Moderate	0.0-5.0	0.28	0.28			
1831:												
Colo----------	0-23	20-26	1.25-1.30	0.60-2.00	0.22-0.24	Moderate	3.0-5.0	0.28	0.28	5	6	48
	23-37	30-35	1.25-1.35	0.60-2.00	0.18-0.20	Moderate	3.0-4.0	0.28	0.28			
	37-80	25-35	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.32	0.32			
1962:												
Mazaska---------	0-10	27-40	1.15-1.30	0.20-0.60	0.17-0.22	High-----	4.0-7.0	0.28	0.28	5	4	86
	10-50	35-50	1.25-1.40	0.06-0.20	0.10-0.16	High-----	0.5-2.0	0.28	0.28			
	50-80	20-35	1.40-1.60	0.20-2.00	0.14-0.16	Moderate	0.0-0.5	0.28	0.28			
Rolfe----------	0-22	22-27	1.35-1.40	0.60-2.00	0.22-0.24	Low------	3.0-5.0	0.37	0.37	5	6	48
	22-49	38-45	1.40-1.50	0.06-0.20	0.11-0.13	High-----	1.0-2.0	0.28	0.28			
	49-80	24-35	1.50-1.60	0.20-2.00	0.14-0.16	Moderate	0.0-1.0	0.28	0.28			

Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
4D:					
Renova----------	0-7	20-27	12.0-18.0	5.6-6.5	---
	7-12	24-32	13.0-18.0	4.5-6.0	---
	12-40	20-30	11.0-17.0	4.5-7.3	---
	40-80	20-27	10.0-15.0	7.4-8.4	5-20
4E:					
Renova----------	0-12	20-27	12.0-18.0	5.6-6.5	---
	12-22	24-32	13.0-18.0	4.5-6.0	---
	22-55	20-30	11.0-17.0	4.5-7.3	---
	55-80	20-27	10.0-15.0	7.4-8.4	5-20
17:					
Minneopa--------	0-12	5-15	11.0-20.0	5.6-7.3	---
	12-47	5-15	4.0-10.0	6.1-7.3	---
	47-60	1-10	1.0-6.0	6.1-8.4	0-15
24:					
Kasson----------	0-13	18-27	---	5.6-6.5	---
	13-30	24-32	---	4.5-6.0	---
	30-80	18-30	---	7.4-8.4	---
39A:					
Wadena----------	0-24	18-27	5.0-25.0	6.1-7.3	---
	24-30	18-30	5.0-20.0	5.6-7.3	---
	30-80	1-5	0.0-5.0	6.6-8.4	0-15
41A:					
Estherville-----	0-14	5-15	2.0-20.0	5.6-7.3	---
	14-27	10-18	4.0-20.0	5.6-7.3	---
	27-60	0-8	0.0-5.0	6.6-8.4	0-15
41B:					
Estherville-----	0-11	5-15	2.0-20.0	5.6-7.3	---
	11-16	10-18	4.0-20.0	5.6-7.3	---
	16-80	0-8	0.0-5.0	6.6-8.4	0-15
44:					
Ankeny----------	0-27	10-18	15.0-20.0	6.1-7.3	---
	27-44	10-16	15.0-20.0	6.1-7.3	---
	44-80	2-10	5.0-10.0	6.1-7.3	---
74B:					
Dickinson-------	0-13	10-18	15.0-20.0	5.6-7.3	---
	13-26	10-15	15.0-20.0	5.1-6.5	---
	26-52	4-10	5.0-10.0	5.1-6.5	---
	52-60	4-10	5.0-10.0	5.6-7.3	---
81B:					
Boone----------	0-8	2-6	0.0-7.0	3.5-7.3	---
	8-15	1-5	0.0-6.0	3.5-7.3	---
	15-38	0-3	0.0-3.0	4.5-6.5	---
	38-80	---	---	---	---
81D:					
Boone----------	0-6	2-6	0.0-7.0	3.5-7.3	---
	6-12	1-5	0.0-6.0	3.5-7.3	---
	12-38	0-3	0.0-3.0	4.5-6.5	---
	38-80	---	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
81E:					
Boone	0-4	2-6	0.0-7.0	3.5-7.3	---
	4-9	1-5	0.0-6.0	3.5-7.3	---
	9-26	0-3	0.0-3.0	4.5-6.5	---
	26-80	---	---	---	---
98:					
Colo	0-16	27-36	36.0-41.0	5.6-7.3	---
	16-39	30-35	36.0-41.0	5.6-7.3	---
	39-80	25-35	30.0-36.0	6.1-7.3	---
99D2:					
Racine	0-7	18-26	20.0-25.0	5.1-7.3	---
	7-12	22-32	20.0-25.0	4.5-6.0	---
	12-40	18-32	18.0-23.0	4.5-6.0	0-5
	40-80	22-32	13.0-18.0	6.6-8.4	0-15
100A:					
Copaston	0-7	14-23	10.0-25.0	5.6-7.3	---
	7-11	14-20	5.0-15.0	5.6-7.3	---
	11-18	14-30	5.0-15.0	5.6-7.8	0-15
	18-28	---	---	---	---
102B:					
Clarion	0-10	20-27	20.0-25.0	5.6-7.3	---
	10-44	23-30	20.0-25.0	5.6-7.8	0-15
	44-80	22-30	20.0-25.0	7.4-8.4	5-30
104B:					
Hayden	0-9	12-20	10.0-24.0	5.6-7.3	---
	9-43	18-32	10.0-23.0	5.1-7.3	---
	43-80	12-22	8.0-16.0	7.4-8.4	5-25
104C2:					
Hayden	0-7	12-20	10.0-24.0	5.6-7.3	---
	7-32	18-32	10.0-23.0	5.1-7.3	---
	32-80	12-22	8.0-16.0	7.4-8.4	5-25
104D2:					
Hayden	0-7	12-20	10.0-24.0	5.6-7.3	---
	7-38	18-32	10.0-23.0	5.1-7.3	---
	38-80	12-22	8.0-16.0	7.4-8.4	5-25
104E:					
Hayden	0-5	12-20	10.0-24.0	5.6-7.3	---
	5-30	18-32	10.0-23.0	5.1-7.3	---
	30-80	12-22	8.0-16.0	7.4-8.4	5-25
106C2:					
Lester	0-6	20-27	10.0-24.0	5.6-7.3	---
	6-24	24-32	10.0-23.0	5.1-7.3	---
	24-80	22-30	8.0-18.0	7.4-8.4	5-30
106D2:					
Lester	0-7	20-27	10.0-24.0	5.6-7.3	---
	7-42	24-32	10.0-23.0	5.1-7.3	---
	42-80	22-30	8.0-18.0	7.4-8.4	5-30
106E:					
Lester	0-8	20-27	10.0-24.0	5.6-7.3	---
	8-38	24-32	10.0-23.0	5.1-7.3	---
	38-80	22-30	8.0-18.0	7.4-8.4	5-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
109:					
Cordova---------	0-13	27-30	20.0-30.0	6.1-7.3	---
	13-36	28-35	15.0-25.0	5.1-6.5	---
	36-60	18-30	10.0-17.0	7.4-8.4	5-20
113:					
Webster---------	0-13	26-35	22.0-32.0	6.6-7.3	---
	13-48	25-35	15.0-25.0	6.6-7.8	0-10
	48-80	22-30	13.0-20.0	7.4-8.4	5-30
114:					
Glencoe---------	0-12	27-35	23.0-37.0	6.1-7.8	0-5
	12-27	25-35	16.0-27.0	6.1-7.8	0-5
	27-36	25-35	14.0-25.0	6.6-7.8	0-5
	36-80	22-32	11.0-22.0	6.6-7.8	0-20
130:					
Nicollet--------	0-20	27-35	25.0-40.0	5.6-7.3	---
	20-40	25-35	15.0-25.0	5.6-7.8	0-15
	40-80	22-30	10.0-20.0	7.4-8.4	5-30
134:					
Okoboji---------	0-7	35-42	41.0-45.0	6.1-7.8	0-15
	7-40	35-45	41.0-45.0	6.6-7.8	0-15
	40-80	25-35	36.0-41.0	6.6-8.4	0-30
138B:					
Lerdal----------	0-12	27-32	18.0-24.0	5.6-6.5	---
	12-41	35-55	19.0-30.0	4.5-6.0	---
	41-80	27-35	14.0-19.0	6.6-7.8	5-20
138C:					
Lerdal----------	0-8	27-32	18.0-24.0	5.6-6.5	---
	8-42	35-55	19.0-30.0	4.5-6.0	---
	42-80	27-35	14.0-19.0	6.6-7.8	5-20
176:					
Garwin----------	0-8	22-27	36.0-41.0	5.6-7.3	---
	8-22	27-35	36.0-41.0	6.1-7.3	---
	22-80	20-26	30.0-36.0	6.6-7.8	0-15
208:					
Kato----------	0-14	27-35	---	6.1-7.8	---
	14-29	24-35	---	5.1-7.3	---
	29-80	0-5	---	6.1-7.8	---
213B:					
Klinger---------	0-21	27-30	30.0-36.0	5.1-7.3	---
	21-43	28-35	25.0-30.0	5.1-6.5	---
	43-80	20-32	15.0-20.0	6.1-7.8	0-15
219:					
Rolfe----------	0-12	22-27	20.0-25.0	5.1-7.3	---
	12-33	38-45	20.0-30.0	6.1-7.3	---
	33-80	24-35	20.0-25.0	6.1-8.4	0-25
238B:					
Kilkenny--------	0-9	20-27	15.0-25.0	5.6-7.3	---
	9-54	35-45	25.0-35.0	5.6-7.3	---
	54-60	22-32	20.0-25.0	7.4-7.8	5-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
238C2:					
Kilkenny--------	0-9	27-30	20.0-30.0	5.6-7.3	---
	9-53	35-45	25.0-35.0	5.6-7.3	---
	53-60	22-32	20.0-25.0	7.4-7.8	5-30
238D2:					
Kilkenny--------	0-8	27-30	20.0-30.0	5.6-7.3	---
	8-46	35-45	25.0-35.0	5.6-7.3	---
	46-60	22-32	20.0-25.0	7.4-7.8	5-30
238E:					
Kilkenny--------	0-7	27-30	20.0-30.0	5.6-7.3	---
	7-38	35-45	25.0-35.0	5.6-7.3	---
	38-60	22-32	20.0-25.0	7.4-7.8	5-30
238F:					
Kilkenny--------	0-5	20-27	15.0-25.0	5.6-7.3	---
	5-34	35-45	25.0-35.0	5.6-7.3	---
	34-80	22-32	20.0-25.0	7.4-7.8	5-30
239:					
Le Sueur--------	0-11	28-30	15.0-26.0	5.6-7.3	---
	11-42	24-35	11.0-25.0	5.1-7.3	---
	42-80	20-30	8.0-18.0	7.4-8.4	5-30
253:					
Maxcreek--------	0-18	28-32	---	6.1-7.3	---
	18-36	25-32	---	6.1-7.3	---
	36-80	18-27	---	7.4-7.8	---
256:					
Mazaska---------	0-15	27-40	22.0-34.0	6.1-7.3	---
	15-42	35-50	19.0-29.0	4.5-6.5	---
	42-80	20-35	10.0-19.0	7.4-7.8	5-20
285A:					
Port Byron------	0-12	18-27	---	5.1-8.4	---
	12-40	18-27	---	5.6-7.3	---
	40-80	18-27	---	5.6-8.4	---
285B:					
Port Byron------	0-14	18-27	---	5.1-8.4	---
	14-42	18-27	---	5.6-7.3	---
	42-80	18-27	---	5.6-8.4	---
301B:					
Lindstrom-------	0-16	10-20	---	5.6-7.3	---
	16-30	18-24	---	5.6-7.3	---
	30-60	18-24	---	5.6-7.3	---
	60-80	12-20	---	6.6-7.8	---
301C:					
Lindstrom-------	0-10	10-20	---	5.6-7.3	---
	10-26	18-24	---	5.6-7.3	---
	26-43	18-24	---	5.6-7.3	---
	43-80	12-20	---	6.6-7.8	---
307:					
Sargeant--------	0-7	18-27	---	5.1-6.5	---
	7-25	24-32	---	4.5-6.5	---
	25-55	24-32	---	4.5-6.5	---
	55-80	18-27	---	6.1-7.8	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
323:					
Shields---------	0-8	27-40	18.0-28.0	5.6-6.5	---
	8-53	40-60	21.0-34.0	4.5-6.5	---
	53-80	27-50	14.0-26.0	7.4-7.8	5-20
376B:					
Moland----------	0-14	18-27	---	5.6-7.3	---
	14-20	28-32	---	5.6-6.5	---
	20-49	18-30	---	5.6-7.3	---
	49-80	18-27	---	6.6-7.8	---
377:					
Merton----------	0-15	18-27	---	5.6-7.3	---
	15-55	18-30	---	5.6-7.3	---
	55-80	18-27	---	5.6-7.8	---
378:					
Maxfield--------	0-15	27-35	36.0-41.0	6.6-7.3	---
	15-27	25-34	30.0-36.0	6.1-7.3	---
	27-80	20-26	25.0-30.0	6.1-7.8	10-20
382B:					
Blooming--------	0-9	18-27	---	5.6-6.5	---
	9-19	24-32	---	5.6-6.5	---
	19-44	20-30	---	5.1-7.3	---
	44-70	18-27	---	6.6-7.8	---
382C2:					
Blooming--------	0-7	18-27	---	5.6-6.5	---
	7-23	24-32	---	5.6-6.5	---
	23-45	20-30	---	5.1-7.3	---
	45-70	18-27	---	6.6-7.8	---
392:					
Biscay----------	0-20	18-30	20.0-35.0	6.1-7.8	0-15
	20-25	18-30	12.0-25.0	6.6-7.8	0-15
	25-33	10-28	5.0-20.0	6.6-7.8	0-15
	33-80	1-6	1.0-5.0	7.4-8.4	5-30
408:					
Faxon----------	0-15	28-30	---	6.6-7.8	---
	15-34	18-30	---	6.6-7.8	---
	34-60	---	---	---	---
411A:					
Waukegan--------	0-12	18-27	13.0-24.0	5.6-7.3	---
	12-33	18-27	11.0-18.0	5.1-7.3	---
	33-80	1-10	1.0-6.0	5.6-7.8	0-15
411B:					
Waukegan--------	0-10	18-27	13.0-24.0	5.6-7.3	---
	10-22	18-27	11.0-18.0	5.1-7.3	---
	22-80	1-10	1.0-6.0	5.6-7.8	0-15
414:					
Hamel----------	0-21	20-27	15.0-30.0	5.6-7.3	---
	21-51	24-35	15.0-30.0	5.6-7.3	---
	51-80	20-30	10.0-20.0	7.4-7.8	5-25

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
463A:					
Minneiska	0-9	10-27	10.0-30.0	7.4-8.4	10-20
	9-20	5-18	5.0-15.0	7.4-8.4	5-20
	20-60	2-5	0.0-5.0	7.4-8.4	5-15
484D:					
Eyota	0-35	5-18	---	5.1-7.3	---
	35-48	15-25	---	4.5-6.5	---
	48-80	1-18	---	6.1-7.3	---
523:					
Houghton	0-8	---	140-200	4.5-7.8	---
	8-66	---	100-200	4.5-7.8	---
525:					
Muskego	0-27	---	140-180	5.6-7.3	---
	27-80	18-35	10.0-45.0	6.6-8.4	60-80
528B:					
Klossner	0-12	---	150-200	5.6-7.8	0-15
	12-42	22-35	150-200	6.1-7.8	0-15
	42-55	22-35	20.0-50.0	6.1-7.8	0-15
	55-80	15-32	20.0-50.0	6.1-8.4	0-30
529A:					
Ripon	0-15	10-18	6.0-20.0	5.6-7.8	0-5
	15-28	25-35	5.0-30.0	5.1-6.5	---
	28-32	22-40	4.0-35.0	6.1-8.4	0-20
	32-42	---	---	---	---
529B:					
Ripon	0-27	10-18	6.0-20.0	5.6-7.8	0-5
	27-31	25-35	5.0-30.0	5.1-6.5	---
	31-38	22-40	4.0-35.0	6.1-8.4	0-20
	38-48	---	---	---	---
548:					
Medo	0-25	---	40-100	6.1-7.8	0-10
	25-31	15-30	20.0-55.0	6.1-7.8	0-5
	31-45	15-30	10.0-25.0	6.1-7.8	0-5
	45-80	0-10	1.0-9.0	6.1-8.4	0-15
572:					
Lowlein	0-13	10-18	10.0-25.0	6.1-7.3	---
	13-24	10-18	5.0-15.0	6.1-7.3	---
	24-46	1-10	0.0-10.0	6.1-7.3	---
	46-80	18-32	10.0-20.0	7.4-8.4	5-20
611D:					
Hawick	0-8	5-15	1.0-10.0	6.1-7.8	0-10
	8-16	1-10	1.0-5.0	6.1-7.8	0-10
	16-60	1-5	1.0-5.0	7.4-8.4	5-15
757:					
Nerwoods	0-12	18-27	19.0-31.0	5.1-7.3	---
	12-44	20-27	16.0-25.0	5.1-7.3	---
	44-50	22-32	10.0-17.0	5.6-7.8	---
	50-80	22-32	10.0-17.0	7.4-8.4	5-15

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
761:					
Epsom----------	0-8	28-35	32.0-49.0	6.1-7.3	---
	8-30	28-35	32.0-45.0	6.1-7.3	---
	30-60	22-27	16.0-36.0	6.1-7.3	---
	60-80	22-32	19.0-23.0	7.4-8.4	5-15
764:					
Klossner--------	0-42	---	150-200	5.6-7.8	0-15
	42-56	22-35	150-200	6.1-7.8	0-15
	56-80	15-32	20.0-50.0	6.1-7.8	0-30
783C2:					
Lester----------	0-9	28-30	13.0-27.0	5.6-7.3	---
	9-21	24-32	10.0-23.0	5.1-7.3	---
	21-80	22-30	8.0-18.0	7.4-8.4	5-30
Kilkenny--------	0-7	27-30	20.0-30.0	5.6-7.3	---
	7-35	35-45	25.0-35.0	5.6-7.3	---
	35-80	22-32	20.0-25.0	7.4-7.8	5-30
783D2:					
Lester----------	0-9	28-30	13.0-27.0	5.6-7.3	---
	9-40	24-32	10.0-23.0	5.1-7.3	---
	40-80	22-30	8.0-18.0	7.4-8.4	5-30
Kilkenny--------	0-7	27-30	20.0-30.0	5.6-7.3	---
	7-15	35-45	25.0-35.0	5.6-7.3	---
	15-80	22-32	20.0-25.0	7.4-7.8	5-30
783E:					
Lester----------	0-10	20-27	10.0-24.0	5.6-7.3	---
	10-30	24-32	10.0-23.0	5.1-7.3	---
	30-80	22-30	8.0-18.0	7.4-8.4	5-30
Kilkenny--------	0-9	27-30	20.0-30.0	5.6-7.3	---
	9-47	35-45	25.0-35.0	5.6-7.3	---
	47-80	22-32	20.0-25.0	7.4-7.8	5-30
783F:					
Lester----------	0-9	20-27	10.0-24.0	5.6-7.3	---
	9-45	24-32	10.0-23.0	5.1-7.3	---
	45-80	22-30	8.0-18.0	7.4-8.4	5-30
Kilkenny--------	0-11	20-27	15.0-25.0	5.6-7.3	---
	11-34	35-45	25.0-35.0	5.6-7.3	---
	34-80	22-32	20.0-25.0	7.4-7.8	5-30
849B:					
Urban land.					
Estherville-----	0-11	5-15	2.0-20.0	5.6-7.3	---
	11-16	10-18	4.0-20.0	5.6-7.3	---
	16-80	0-8	0.0-5.0	6.6-8.4	0-15
860C:					
Urban land.					
Hayden----------	0-6	12-20	10.0-24.0	5.6-7.3	---
	6-36	18-32	10.0-23.0	5.1-7.3	---
	36-80	12-22	8.0-16.0	7.4-8.4	5-25

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
875B:					
Hawick----------	0-9	5-15	1.0-10.0	6.1-7.8	0-10
	9-16	1-10	1.0-5.0	6.1-7.8	0-10
	16-60	1-5	1.0-5.0	7.4-8.4	5-15
Estherville-----	0-8	5-15	2.0-20.0	5.6-7.3	---
	8-23	10-18	4.0-20.0	5.6-7.3	---
	23-60	0-8	0.0-5.0	6.6-8.4	0-15
875C:					
Hawick----------	0-9	5-15	1.0-10.0	6.1-7.8	0-10
	9-15	1-10	1.0-5.0	6.1-7.8	0-10
	15-60	1-5	1.0-5.0	7.4-8.4	5-15
Estherville-----	0-6	5-15	2.0-20.0	5.6-7.3	---
	6-14	10-18	4.0-20.0	5.6-7.3	---
	14-60	0-8	0.0-5.0	6.6-8.4	0-15
945C2:					
Lester----------	0-9	20-27	10.0-24.0	5.6-7.3	---
	9-55	24-32	10.0-23.0	5.1-7.3	---
	55-80	22-30	8.0-18.0	7.4-8.4	5-30
Storden---------	0-7	18-27	11.0-18.0	7.4-8.4	5-30
	7-47	18-30	9.0-18.0	7.4-8.4	15-30
	47-80	18-30	9.0-18.0	7.4-8.4	10-20
945D2:					
Lester----------	0-9	20-27	10.0-24.0	5.6-7.3	---
	9-23	24-32	10.0-23.0	5.1-7.3	---
	23-80	22-30	8.0-18.0	7.4-8.4	5-30
Storden---------	0-10	18-27	11.0-18.0	7.4-8.4	5-30
	10-30	18-30	9.0-18.0	7.4-8.4	15-30
	30-80	18-30	9.0-18.0	7.4-8.4	10-20
963C2:					
Timula----------	0-25	10-18	8.0-15.0	6.1-7.8	0-5
	25-80	10-18	6.0-12.0	7.4-8.4	5-35
Bold----------	0-8	12-18	6.0-15.0	7.4-8.4	10-40
	8-60	12-18	5.0-12.0	7.4-8.4	10-50
963D2:					
Timula----------	0-30	10-18	8.0-15.0	6.1-7.8	0-5
	30-80	10-18	6.0-12.0	7.4-8.4	5-35
Bold----------	0-8	12-18	6.0-15.0	7.4-8.4	10-40
	8-60	12-18	5.0-12.0	7.4-8.4	10-50
1013:					
Pits.					
1016:					
Udorthents------	0-60	2-18	1.0-15.0	6.6-9.0	---
	60-80	---	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1030:					
Pits.					
Udipsamments----	0-14	1-15	1.0-5.0	6.6-7.3	---
	14-60	1-10	1.0-3.0	6.6-7.3	---
	60-80	1-10	1.0-3.0	7.4-8.4	0-5
1058:					
Houghton--------	0-72	---	150-230	6.6-7.3	---
	72-80	---	150-230	6.6-7.3	---
Muskego---------	0-35	2-4	140-180	5.6-7.3	---
	35-60	18-35	10.0-45.0	6.6-8.4	60-80
1080:					
Klossner--------	0-40	---	50-150	5.1-7.8	0-5
	40-80	20-35	20.0-60.0	6.1-8.4	0-20
Okoboji---------	0-15	30-40	41.0-50.0	6.1-7.8	0-15
	15-45	35-45	41.0-45.0	6.6-7.8	0-15
	45-80	35-45	36.0-41.0	6.6-7.8	0-30
Glencoe---------	0-24	24-27	30.0-50.0	6.1-7.8	0-5
	24-34	25-35	15.0-30.0	6.6-7.8	0-5
	34-80	22-32	10.0-20.0	7.4-7.8	5-20
1116F:					
Brodale---------	0-3	5-18	---	6.6-8.4	---
	3-47	5-18	---	7.4-8.4	---
	47-57	---	---	---	---
Eyota----------	0-12	1-10	---	5.1-7.3	---
	12-43	5-18	---	4.5-6.5	---
	43-65	15-25	---	4.5-6.5	---
	65-80	1-18	---	6.1-7.3	---
1286:					
Prinsburg-------	0-20	27-35	22.0-35.0	7.4-8.4	5-25
	20-25	18-35	14.0-28.0	7.4-8.4	5-25
	25-42	18-35	10.0-20.0	7.4-8.4	5-25
	42-80	22-32	10.0-20.0	7.4-8.4	5-20
1360:					
Rushriver-------	0-31	5-18	3.0-13.0	7.4-8.4	5-20
	31-80	2-10	3.0-13.0	7.4-8.4	5-20
1361:					
Le Sueur--------	0-13	20-27	12.0-24.0	5.6-7.3	---
	13-42	24-35	11.0-25.0	5.1-7.3	---
	42-80	12-22	8.0-16.0	7.4-8.4	5-30
1362B:					
Angus----------	0-9	20-27	10.0-24.0	5.6-7.3	---
	9-42	24-35	10.0-23.0	5.1-7.3	---
	42-80	22-30	8.0-18.0	7.4-8.4	5-30
1363:					
Dundas----------	0-15	10-27	9.0-22.0	5.6-7.3	---
	15-40	20-35	11.0-26.0	5.1-7.3	---
	40-80	12-22	6.0-12.0	7.4-8.4	5-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1366:					
Talcot----------	0-25	30-35	---	7.4-8.4	5-30
	25-48	30-35	---	7.4-8.4	5-30
	48-80	1-6	---	7.4-8.4	5-30
1367:					
Derrynane-------	0-18	30-40	25.0-40.0	6.1-7.3	---
	18-36	35-45	25.0-45.0	6.1-7.3	---
	36-55	27-35	20.0-30.0	6.1-7.3	---
	55-80	20-30	10.0-20.0	6.1-7.8	0-15
1387A:					
Collinwood------	0-14	35-40	35.0-44.0	5.6-7.3	---
	14-41	35-60	26.0-52.0	5.6-7.3	---
	41-80	35-45	25.0-35.0	7.4-8.4	5-15
1388B:					
Terril----------	0-9	18-26	20.0-25.0	6.1-7.3	---
	9-44	24-30	20.0-25.0	6.1-7.3	---
	44-80	22-30	15.0-25.0	6.1-7.8	0-15
1408B:					
Angus-----------	0-9	28-30	13.0-27.0	5.6-7.3	---
	9-30	24-35	10.0-23.0	5.1-7.3	---
	30-80	22-30	8.0-18.0	7.4-8.4	5-30
Kilkenny--------	0-9	27-30	20.0-30.0	5.6-7.3	---
	9-28	35-45	25.0-35.0	5.6-7.3	---
	28-80	22-32	20.0-25.0	7.4-7.8	5-30
1409A:					
Kenyon----------	0-14	18-26	20.0-25.0	5.6-7.3	---
	14-37	20-30	20.0-25.0	5.1-7.3	---
	37-80	22-32	20.0-25.0	6.6-8.4	0-25
1409B:					
Kenyon----------	0-14	18-26	20.0-25.0	5.6-7.3	---
	14-54	20-30	20.0-25.0	5.1-7.3	---
	54-76	20-24	20.0-25.0	6.6-8.4	0-25
	76-80	22-32	20.0-25.0	6.6-8.4	0-25
1410B:					
Racine----------	0-7	18-26	20.0-25.0	5.1-7.3	---
	7-29	22-32	20.0-25.0	4.5-6.0	---
	29-48	18-32	18.0-23.0	4.5-6.0	0-5
	48-80	22-28	13.0-18.0	7.4-8.4	5-20
1410C:					
Racine----------	0-7	18-26	20.0-25.0	5.1-7.3	---
	7-20	22-32	20.0-25.0	4.5-6.0	---
	20-48	18-32	18.0-23.0	4.5-6.0	0-5
	48-80	22-28	13.0-18.0	7.4-8.4	5-20
1411B:					
Urban land.					
Hayden----------	0-7	12-20	10.0-24.0	5.6-7.3	---
	7-60	18-32	10.0-23.0	5.1-7.3	---
	60-80	12-22	8.0-16.0	7.4-8.4	5-25

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
1411B:					
Estherville-----	0-11	5-15	2.0-20.0	5.6-7.3	---
	11-16	10-18	4.0-20.0	5.6-7.3	---
	16-80	0-8	0.0-5.0	6.6-8.4	0-15
1413B:					
Littleton-------	0-9	18-27	19.0-27.0	5.6-7.8	---
	9-26	22-27	17.0-25.0	5.6-7.8	---
	26-66	18-27	13.0-20.0	5.6-7.8	---
	66-80	22-32	11.0-17.0	7.4-7.8	5-15
1416C:					
Renova----------	0-10	18-26	11.0-17.0	5.6-6.5	---
	10-17	24-32	13.0-18.0	4.5-6.0	---
	17-54	18-32	10.0-18.0	4.5-7.3	---
	54-80	22-28	11.0-15.0	7.4-8.4	5-20
1437B:					
Renova----------	0-10	18-26	11.0-17.0	5.6-6.5	---
	10-19	24-32	13.0-18.0	4.5-6.0	---
	19-52	18-32	10.0-18.0	4.5-7.3	---
	52-80	22-28	11.0-15.0	7.4-8.4	5-20
1501:					
Klossner--------	0-7	22-35	150-200	6.1-7.8	0-15
	7-44	---	150-200	5.6-7.8	0-15
	44-58	22-35	35.0-65.0	6.1-7.8	0-5
	58-80	15-32	5.0-25.0	6.1-8.4	0-20
1831:					
Colo----------	0-23	20-26	25.0-30.0	5.6-7.3	---
	23-37	30-35	36.0-41.0	5.6-7.3	---
	37-80	25-35	30.0-36.0	6.1-7.3	---
1962:					
Mazaska---------	0-10	27-40	22.0-34.0	6.1-7.3	---
	10-50	35-50	19.0-29.0	4.5-6.5	---
	50-80	20-35	10.0-19.0	7.4-7.8	5-20
Rolfe----------	0-22	22-27	20.0-25.0	5.1-7.3	---
	22-49	38-45	20.0-30.0	6.1-7.3	---
	49-80	24-35	20.0-25.0	6.1-8.4	0-25

Water Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	High water table and ponding: Kind of water table	High water table and ponding: Months	High water table and ponding: Ponding duration	High water table and ponding: Maximum ponding depth
					Ft				Ft
4D:									
Renova----------	B	None-------	---	---	>6.0	---	---	---	---
4E:									
Renova----------	B	None-------	---	---	>6.0	---	---	---	---
17:									
Minneopa--------	B	Rare-------	---	---	3.0-5.0	Apparent---	Apr-May	---	---
24:									
Kasson----------	C	None-------	---	---	2.0-3.0	Perched----	Nov-May	---	---
39A:									
Wadena----------	B	None-------	---	---	>6.0	---	---	---	---
41A:									
Estherville-----	B	None-------	---	---	>6.0	---	---	---	---
41B:									
Estherville-----	B	None-------	---	---	>6.0	---	---	---	---
44:									
Ankeny----------	B	None-------	---	---	>6.0	---	---	---	---
74B:									
Dickinson-------	B	None-------	---	---	>6.0	---	---	---	---
81B:									
Boone-----------	A	None-------	---	---	>6.0	---	---	---	---
81D:									
Boone-----------	A	None-------	---	---	>6.0	---	---	---	---
81E:									
Boone-----------	A	None-------	---	---	>6.0	---	---	---	---
98:									
Colo------------	B/D	Occasional	Long------	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
99D2:									
Racine----------	B	None-------	---	---	>6.0	---	---	---	---
100A:									
Copaston--------	D	None-------	---	---	>6.0	---	---	---	---
102B:									
Clarion---------	B	None-------	---	---	3.5-6.0	Apparent---	Nov-Jul	---	---
104B:									
Hayden----------	B	None-------	---	---	>6.0	---	---	---	---
104C2:									
Hayden----------	B	None-------	---	---	>6.0	---	---	---	---
104D2:									
Hayden----------	B	None-------	---	---	>6.0	---	---	---	---

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	High water table and ponding: Kind of water table	High water table and ponding: Months	High water table and ponding: Ponding duration	High water table and ponding: Maximum ponding depth
					Ft				Ft
104E:									
Hayden	B	None	---	---	>6.0	---	---	---	---
106C2:									
Lester	B	None	---	---	>6.0	---	---	---	---
106D2:									
Lester	B	None	---	---	>6.0	---	---	---	---
106E:									
Lester	B	None	---	---	>6.0	---	---	---	---
109:									
Cordova	C/D	None	---	---	0.5-1.5	Apparent	Nov-Jun	---	---
113:									
Webster	B/D	None	---	---	0.5-1.5	Apparent	Nov-Jul	---	---
114:									
Glencoe	B/D	None	---	---	0.0-0.5	Apparent	Oct-Jul	Very long	1.0
130:									
Nicollet	B	None	---	---	2.0-3.5	Apparent	Mar-Jun	---	---
134:									
Okoboji	B/D	None	---	---	0.0-1.0	Apparent	Nov-Jul	Very long	1.0
138B:									
Lerdal	C	None	---	---	1.5-2.5	Perched	Apr-May	---	---
138C:									
Lerdal	C	None	---	---	1.5-2.5	Perched	Apr-May	---	---
176:									
Garwin	B/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	---	---
208:									
Kato	B/D	None	---	---	1.0-2.5	Apparent	Mar-Jun	---	---
213B:									
Klinger	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	---	---
219:									
Rolfe	C	None	---	---	0.0-1.0	Apparent	Nov-Jul	Very long	1.0
238B:									
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
238C2:									
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
238D2:									
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
238E:									
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
238F:									
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
239:									
Le Sueur	B	None	---	---	2.5-4.0	Apparent	Nov-May	---	---

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	High water table and ponding: Kind of water table	High water table and ponding: Months	High water table and ponding: Ponding duration	High water table and ponding: Maximum ponding depth
					Ft				Ft
253:									
Maxcreek	B/D	None	---	---	1.0-3.0	Apparent	Nov-Jun	---	---
256:									
Mazaska	C/D	None	---	---	0.0-1.0	Perched	Nov-Jun	---	---
285A:									
Port Byron	B	None	---	---	>6.0	---	---	---	---
285B:									
Port Byron	B	None	---	---	>6.0	---	---	---	---
301B:									
Lindstrom	B	None	---	---	>6.0	---	---	---	---
301C:									
Lindstrom	B	None	---	---	>6.0	---	---	---	---
307:									
Sargeant	D	None	---	---	0.5-1.5	Perched	Mar-Jun	---	---
323:									
Shields	C	None	---	---	0.5-1.5	Perched	Apr-Jun	---	---
376B:									
Moland	B	None	---	---	>6.0	---	---	---	---
377:									
Merton	B	None	---	---	2.0-5.0	Apparent	Nov-Jun	---	---
378:									
Maxfield	B/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	---	---
382B:									
Blooming	B	None	---	---	>6.0	---	---	---	---
382C2:									
Blooming	B	None	---	---	>6.0	---	---	---	---
392:									
Biscay	B/D	None	---	---	0.5-1.5	Apparent	Nov-Jun	---	---
408:									
Faxon	B/D	None	---	---	0.0-1.0	Apparent	Nov-May	---	---
411A:									
Waukegan	B	None	---	---	>6.0	---	---	---	---
411B:									
Waukegan	B	None	---	---	>6.0	---	---	---	---
414:									
Hamel	C	None	---	---	0.5-1.5	Apparent	Nov-Jun	---	---
463A:									
Minneiska	B	Occasional	Brief	Mar-Jul	2.5-4.0	Apparent	Mar-Jun	---	---
484D:									
Eyota	A	None	---	---	>6.0	---	---	---	---
523:									
Houghton	A/D	None	---	---	0.0-1.0	Apparent	Sep-Jun	Very long	1.0

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	High water table and ponding: Kind of water table	High water table and ponding: Months	High water table and ponding: Ponding duration	High water table and ponding: Maximum ponding depth
					Ft				Ft
525:									
Muskego	A/D	None	---	---	0.0-1.0	Apparent	Nov-Aug	Long	1.0
528B:									
Klossner	A/D	None	---	---	0.0-1.0	Apparent	Oct-Jul	---	---
529A:									
Ripon	B	None	---	---	>6.0	---	---	---	---
529B:									
Ripon	B	None	---	---	>6.0	---	---	---	---
548:									
Medo	A/D	None	---	---	0.0-0.5	Apparent	Nov-May	Very long	1.0
572:									
Lowlein	B	None	---	---	2.5-4.0	Perched	Mar-Jun	---	---
611D:									
Hawick	A	None	---	---	>6.0	---	---	---	---
757:									
Nerwoods	B	None	---	---	1.5-2.5	Perched	Oct-Jun	---	---
761:									
Epsom	B/D	Frequent	Brief	Nov-Jun	0.0-0.5	Perched	Nov-Jun	Very long	1.0
764:									
Klossner	A/D	Frequent	Brief	Apr-Nov	0.0-1.0	Apparent	Oct-Jul	Very long	1.0
783C2:									
Lester	B	None	---	---	>6.0	---	---	---	---
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
783D2:									
Lester	B	None	---	---	>6.0	---	---	---	---
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
783E:									
Lester	B	None	---	---	>6.0	---	---	---	---
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
783F:									
Lester	B	None	---	---	>6.0	---	---	---	---
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
849B:									
Urban land.									
Estherville	B	None	---	---	>6.0	---	---	---	---
860C:									
Urban land.									
Hayden	B	None	---	---	>6.0	---	---	---	---

Water Features--Continued

Map symbol and soil name	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	High water table and ponding: Kind of water table	High water table and ponding: Months	High water table and ponding: Ponding duration	High water table and ponding: Maximum ponding depth
					Ft				Ft
875B:									
Hawick	A	None	---	---	>6.0	---	---	---	---
Estherville	B	None	---	---	>6.0	---	---	---	---
875C:									
Hawick	A	None	---	---	>6.0	---	---	---	---
Estherville	B	None	---	---	>6.0	---	---	---	---
945C2:									
Lester	B	None	---	---	>6.0	---	---	---	---
Storden	B	None	---	---	>6.0	---	---	---	---
945D2:									
Lester	B	None	---	---	>6.0	---	---	---	---
Storden	B	None	---	---	>6.0	---	---	---	---
963C2:									
Timula	B	None	---	---	>6.0	---	---	---	---
Bold	B	None	---	---	>6.0	---	---	---	---
963D2:									
Timula	B	None	---	---	>6.0	---	---	---	---
Bold	B	None	---	---	>6.0	---	---	---	---
1013:									
Pits.									
1016:									
Udorthents	B	None	---	---	>6.0	---	---	---	---
1030:									
Pits.									
Udipsamments	A	None	---	---	>6.0	---	---	---	---
1058:									
Houghton	D	None	---	---	0.0-0.5	Apparent	Sep-Jun	Very long	2.0
Muskego	D	None	---	---	0.0-1.0	Apparent	Jan-Dec	Long	3.0
1080:									
Klossner	D	None	---	---	0.0-0.0	Apparent	Jan-Dec	Very long	3.0
Okoboji	D	None	---	---	0.0-1.0	Apparent	Jan-Dec	Very long	3.0
Glencoe	D	None	---	---	0.0-0.0	Apparent	Jan-Dec	Very long	3.0
1116F:									
Brodale	C	None	---	---	>6.0	---	---	---	---
Eyota	A	None	---	---	>6.0	---	---	---	---
1286:									
Prinsburg	B/D	None	---	---	0.5-1.5	Apparent	Nov-Jun	---	---

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	High water table and ponding: Kind of water table	High water table and ponding: Months	High water table and ponding: Ponding duration	High water table and ponding: Maximum ponding depth
					Ft				Ft
1360:									
Rushriver	B/D	Frequent	Brief	Feb-Jun	0.5-1.5	Apparent	Nov-Aug	---	---
1361:									
Le Sueur	B	None	---	---	2.5-4.0	Apparent	Nov-May	---	---
1362B:									
Angus	B	None	---	---	3.5-6.0	Apparent	Mar-Jun	---	---
1363:									
Dundas	B/D	None	---	---	1.5-2.5	Apparent	Nov-Jun	---	---
1366:									
Talcot	B/D	None	---	---	1.0-2.5	Apparent	Apr-Jul	---	---
1367:									
Derrynane	C	None	---	---	0.5-1.5	Apparent	Nov-Jun	---	---
1387A:									
Collinwood	C	None	---	---	1.5-2.5	Perched	Apr-Jun	---	---
1388B:									
Terril	B	None	---	---	3.5-6.0	---	---	---	---
1408B:									
Angus	B	None	---	---	3.5-6.0	Apparent	Mar-Jun	---	---
Kilkenny	B	None	---	---	2.5-3.5	Perched	Oct-Jun	---	---
1409A:									
Kenyon	B	None	---	---	2.5-3.5	Perched	Apr-Jun	---	---
1409B:									
Kenyon	B	None	---	---	2.5-3.5	Perched	Apr-Jun	---	---
1410B:									
Racine	B	None	---	---	3.5-6.0	Perched	Apr-Jun	---	---
1410C:									
Racine	B	None	---	---	3.5-6.0	Perched	Apr-Jun	---	---
1411B:									
Urban land.									
Hayden	B	None	---	---	>6.0	---	---	---	---
Estherville	B	None	---	---	>6.0	---	---	---	---
1413B:									
Littleton	B	None	---	---	1.5-2.5	Apparent	Apr-Jun	---	---
1416C:									
Renova	B	None	---	---	3.5-6.0	Perched	Apr-Jun	---	---
1437B:									
Renova	B	None	---	---	3.5-6.0	Perched	Apr-Jun	---	---
1501:									
Klossner	A/D	None	---	---	0.0-0.5	Apparent	Oct-Jul	Very long	1.0
1831:									
Colo	B/D	Frequent	Long	Feb-Nov	0.0-1.0	Apparent	Nov-Jul	---	---

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	High water table and ponding: Kind of water table	High water table and ponding: Months	High water table and ponding: Ponding duration	High water table and ponding: Maximum ponding depth
					Ft				Ft
1962:									
Mazaska	C/D	None	---	---	0.0-1.0	Perched	Nov-Jun	---	---
Rolfe	C	None	---	---	0.0-1.0	Apparent	Nov-Jul	Very long	1.0

Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
4D, 4E:							
Renova	>60	---	---	---	Moderate	Low	Moderate.
17:							
Minneopa	>60	---	---	---	Moderate	Low	Low.
24:							
Kasson	>60	---	---	---	High	High	Moderate.
39A:							
Wadena	>60	---	---	---	Low	Low	Low.
41A, 41B:							
Estherville	>60	---	---	---	Low	Low	Low.
44:							
Ankeny	>60	---	---	---	Moderate	Low	Low.
74B:							
Dickinson	>60	---	---	---	Moderate	Low	Moderate.
81B, 81D, 81E:							
Boone	20-40	Soft	---	---	Low	Low	Moderate.
98:							
Colo	>60	---	---	---	High	High	Moderate.
99D2:							
Racine	>60	---	---	---	Moderate	Low	Moderate.
100A:							
Copaston	12-20	Hard	---	---	Moderate	Low	Low.
102B:							
Clarion	>60	---	---	---	Moderate	Low	Low.
104B, 104C2, 104D2, 104E:							
Hayden	>60	---	---	---	Moderate	Low	Moderate.
106C2, 106D2, 106E:							
Lester	>60	---	---	---	Moderate	Low	Moderate.
109:							
Cordova	>80	---	---	---	High	High	Low.
113:							
Webster	>60	---	---	---	High	High	Low.
114:							
Glencoe	>60	---	---	---	High	High	Low.
130:							
Nicollet	>60	---	---	---	High	High	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock Depth	Bedrock Hardness	Subsidence Initial	Subsidence Total	Potential frost action	Risk of corrosion Uncoated steel	Risk of corrosion Concrete
	In		In	In			
134:							
Okoboji	>60	---	---	---	High	High	Low.
138B, 138C:							
Lerdal	>60	---	---	---	High	High	High.
176:							
Garwin	>60	---	---	---	High	High	Moderate.
208:							
Kato	>60	---	---	---	High	High	Moderate.
213B:							
Klinger	>60	---	---	---	High	High	Moderate.
219:							
Rolfe	>60	---	---	---	High	High	Moderate.
238B, 238C2, 238D2, 238E, 238F:							
Kilkenny	>80	---	---	---	Moderate	Moderate	Moderate.
239:							
Le Sueur	>60	---	---	---	High	High	Low.
253:							
Maxcreek	>60	---	---	---	High	High	Low.
256:							
Mazaska	>60	---	---	---	High	High	Moderate.
285A, 285B:							
Port Byron	>60	---	---	---	High	Low	Moderate.
301B, 301C:							
Lindstrom	>60	---	---	---	High	Moderate	Moderate.
307:							
Sargeant	>60	---	---	---	High	Moderate	High.
323:							
Shields	>60	---	---	---	High	High	Moderate.
376B:							
Moland	>60	---	---	---	Moderate	Low	Moderate.
377:							
Merton	>60	---	---	---	High	Low	Moderate.
378:							
Maxfield	>60	---	---	---	High	High	Moderate.
382B, 382C2:							
Blooming	>60	---	---	---	Moderate	Moderate	Moderate.
392:							
Biscay	>60	---	---	---	High	Moderate	Low.
408:							
Faxon	20-40	Hard	---	---	High	High	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock Depth	Bedrock Hardness	Subsidence Initial	Subsidence Total	Potential frost action	Risk of corrosion Uncoated steel	Risk of corrosion Concrete
	In		In	In			
411A, 411B:							
Waukegan	>60	---	---	---	Low	Low	Moderate.
414:							
Hamel	>60	---	---	---	High	High	Low.
463A:							
Minneiska	>70	---	---	---	Moderate	Low	Low.
484D:							
Eyota	>60	---	---	---	Moderate	Low	High.
523:							
Houghton	>60	---	6-18	55-60	High	High	Moderate.
525:							
Muskego	>60	---	---	35-45	High	Moderate	Moderate.
528B:							
Klossner	>60	---	2-4	25-32	High	High	Moderate.
529A, 529B:							
Ripon	20-40	Hard	---	---	High	Moderate	Moderate.
548:							
Medo	>60	---	2-4	25-32	High	High	Moderate.
572:							
Lowlein	>60	---	---	---	Moderate	Moderate	Low.
611D:							
Hawick	>60	---	---	---	Low	Low	Low.
757:							
Nerwoods	>80	---	---	---	High	High	Low.
761:							
Epsom	>80	---	---	---	High	High	Low.
764:							
Klossner	>60	---	2-4	25-32	High	High	Moderate.
783C2, 783D2, 783E, 783F:							
Lester	>60	---	---	---	Moderate	Low	Moderate.
Kilkenny	>80	---	---	---	Moderate	Moderate	Moderate.
849B:							
Urban land.							
Estherville	>60	---	---	---	Low	Low	Low.
860C:							
Urban land.							
Hayden	>60	---	---	---	Moderate	Low	Moderate.
875B, 875C:							
Hawick	>60	---	---	---	Low	Low	Low.
Estherville	>60	---	---	---	Low	Low	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock Depth	Bedrock Hardness	Subsidence Initial	Subsidence Total	Potential frost action	Risk of corrosion Uncoated steel	Risk of corrosion Concrete
	In		In	In			
945C2, 945D2:							
Lester	>60	---	---	---	Moderate	Low	Moderate.
Storden	>60	---	---	---	Moderate	Low	Low.
963C2, 963D2:							
Timula	>60	---	---	---	High	Low	Low.
Bold	>60	---	---	---	High	Low	Low.
1013:							
Pits.							
1016:							
Udorthents	>60	---	---	---	Moderate	High	Moderate.
1030:							
Pits.							
Udipsamments	>60	---	---	---	Low	Low	Low.
1058:							
Houghton	>60	---	---	40-60	High	High	Low.
Muskego	>60	---	---	30-40	High	Moderate	Moderate.
1080:							
Klossner	>60	---	2-4	25-32	High	High	Moderate.
Okoboji	>60	---	---	---	High	High	Low.
Glencoe	>60	---	---	---	High	High	Low.
1116F:							
Brodale	40-80	Hard	---	---	Low	Low	Low.
Eyota	>60	---	---	---	Moderate	Low	High.
1286:							
Prinsburg	>80	---	---	---	High	High	Low.
1360:							
Rushriver	>60	---	---	---	High	Moderate	Low.
1361:							
Le Sueur	>60	---	---	---	High	High	Low.
1362B:							
Angus	>80	---	---	---	Moderate	Low	Moderate.
1363:							
Dundas	>80	---	---	---	High	High	Moderate.
1366:							
Talcot	>60	---	---	---	High	High	Low.
1367:							
Derrynane	>60	---	---	---	High	High	Low.
1387A:							
Collinwood	>60	---	---	---	High	High	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock Depth	Bedrock Hardness	Subsidence Initial	Subsidence Total	Potential frost action	Risk of corrosion Uncoated steel	Risk of corrosion Concrete
	In		In	In			
1388B:							
Terril	>60	---	---	---	Moderate	Moderate	Low.
1408B:							
Angus	>80	---	---	---	Moderate	Low	Moderate.
Kilkenny	>80	---	---	---	Moderate	Moderate	Moderate.
1409A, 1409B:							
Kenyon	>80	---	---	---	Moderate	Moderate	Moderate.
1410B, 1410C:							
Racine	>60	---	---	---	Moderate	Low	Moderate.
1411B:							
Urban land.							
Hayden	>60	---	---	---	Moderate	Low	Moderate.
Estherville	>60	---	---	---	Low	Low	Low.
1413B:							
Littleton	>80	---	---	---	High	High	Low.
1416C, 1437B:							
Renova	>80	---	---	---	Moderate	Low	Moderate.
1501:							
Klossner	>80	---	2-4	25-32	High	High	Moderate.
1831:							
Colo	>60	---	---	---	High	High	Moderate.
1962:							
Mazaska	>60	---	---	---	High	High	Moderate.
Rolfe	>60	---	---	---	High	High	Moderate.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

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.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas 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:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope. A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material,

and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

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.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

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 depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

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.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Colluvium. Soil material or 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 establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Congeliturbate. Soil material disturbed by frost action.

Conglomerate. A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

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. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

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.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

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.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained,*

somewhat poorly drained, poorly drained, and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

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.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of 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 human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

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*.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to

facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

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.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

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. Water filling all the unblocked pores of the 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.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Head slope. A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

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. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or 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 soil material. 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.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it 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 potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

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.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial

rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. An elevated area between two drainageways that sheds water to those drainageways.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

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.

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.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

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, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. 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).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nose slope. A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent.

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. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that

mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

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 movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 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, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

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.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

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 degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

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-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

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.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have

horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). 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.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

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.

Sinkhole. A depression in the landscape where limestone has been dissolved.

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.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

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.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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, in millimeters, of separates recognized in the United States are as follows:

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 material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Strath terrace. A type of stream terrace that formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, representing the remnants of an abandoned flood plain, streambed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping. Growing crops in a systematic

arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.

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. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

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. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt 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 that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

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.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Upland. 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.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

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 a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.