



United States  
Department of  
Agriculture

In cooperation with  
Minnesota Agricultural  
Experiment Station



Natural  
Resources  
Conservation  
Service

# Soil Survey of Sherburne County, Minnesota



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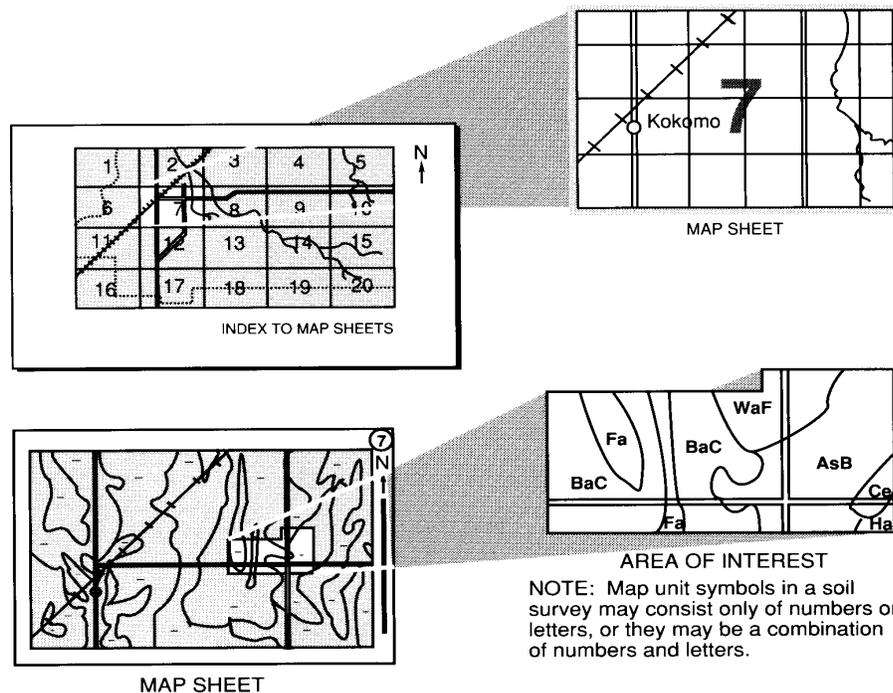
# How To Use This Soil Survey

This publication consists of a manuscript and a set of soil maps. The information provided 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 soil map unit. Also see the **Contents** for other sections of this publication that may address your specific needs.



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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 July 1993. Soil names and descriptions were approved in April 1994. The data provided in this publication are the same as the attribute data provided with the 2002 re-certified SSURGO. 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 Sherburne Soil and Water Conservation District. Financial assistance was provided by Sherburne County.

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: A big gun irrigation system in an area of Hubbard-Mosford complex, 0 to 3 percent slopes. Irrigation is needed in areas of these soils because they have a low available water capacity.**

*Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is <http://www.nrcs.usda.gov>.*

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# Foreword

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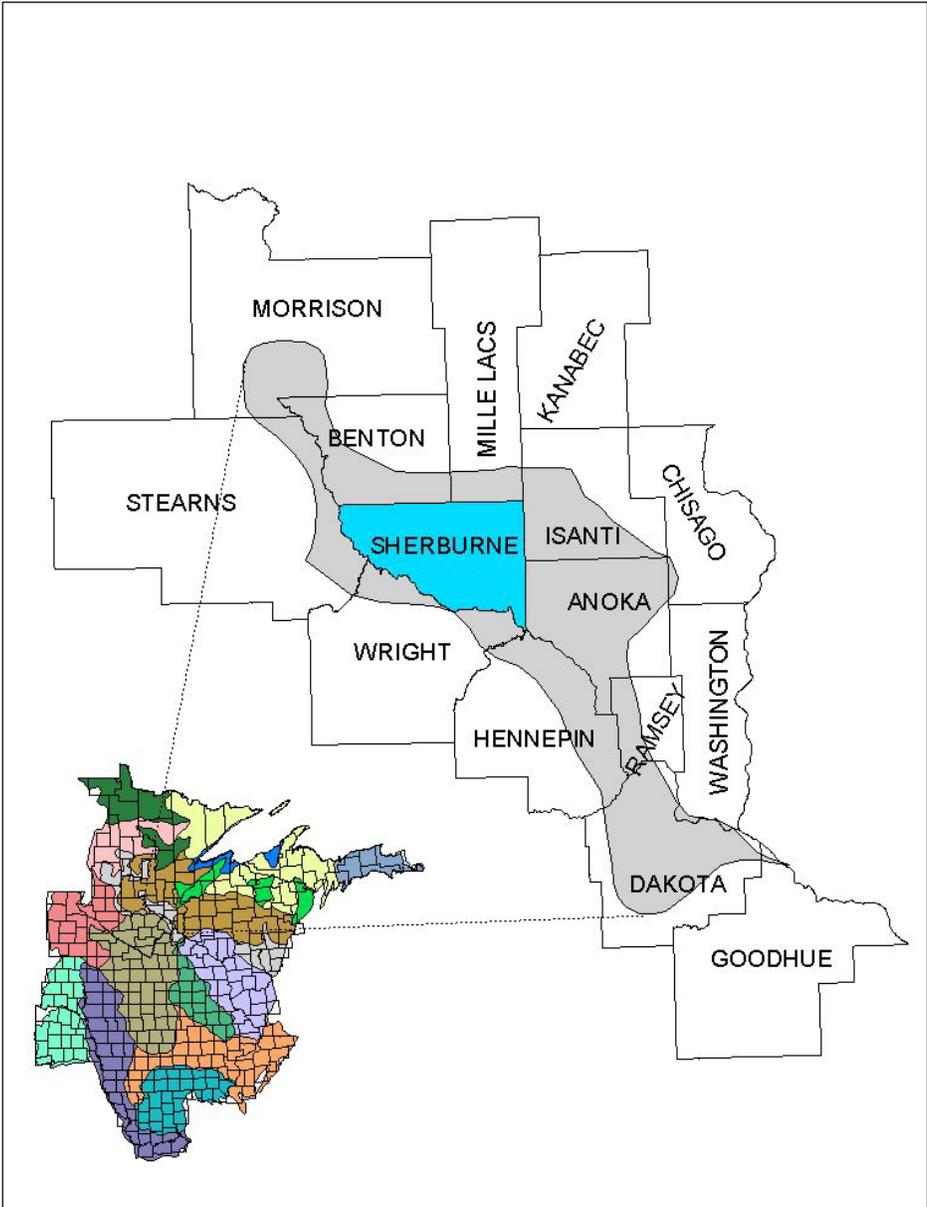
This soil survey contains information that can be used in land-planning programs in Sherburne County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact 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. If a zone in which the soil moisture status is wet occurs high in the profile, the soil may be poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. The location of each soil is shown on the soil maps, and information on specific uses is provided. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

William Hunt  
State Conservationist  
Natural Resources Conservation Service



Location of Sherburne County and MLRA 91 within Region 10

# Soil Survey of Sherburne County, Minnesota

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By Thomas Jackson, Natural Resources Conservation Service

Fieldwork (1989–93) by Thomas Jackson, Kim Steffen, Mark Perry, and Mary West,  
Natural Resources Conservation Service

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 updated information about the soils and miscellaneous areas in the survey area, which is in Region 10 and includes Major Land Resource Area 91. Region 10 is an administrative division of the Natural Resources Conservation Service. Major Land Resource Areas (MLRAs) are geographically associated land resource units that share a common land use, elevation, and topography, climate, water, soils, and vegetation (USDA, 1981). Sherburne County is a subset of MLRA 91.

The information includes a brief description of the soils and miscellaneous areas and interpretive tables showing soil properties and the subsequent effects on suitability, limitations, and management for specified uses. During the fieldwork for this survey, 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

of landscape 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 observed. The maximum depth of observation was about 80 inches (6.7 feet). Soil scientists 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. Interpretations are modified as necessary 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 zone in which the soil moisture status is wet within certain depths in most years, but they cannot predict that this zone will always be at a specific level in the soil on a specific date.

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

The descriptions, names, and delineations of the soils in this county may not fully agree with those of the soils in adjacent counties. 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 counties.

# Formation and Classification of the Soils

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

## Formation of the Soils

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil in a given area are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the living organisms on and in the soil, mainly vegetation; (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. The relative effect of each of these factors is reflected in the soil profile.

During the transformation of the parent material into soil, minerals become weathered and organic matter accumulates. Material in suspension or in solution moves downward through the soil, and new chemical compounds and new minerals form.

In Sherburne County, differences in parent material and vegetation account for most of the differences among the soils. Climate and relief are fairly uniform throughout the county, and all of the soils have been forming for about the same length of time.

All five factors of soil formation are interrelated. When one factor changes, changes in the other four factors result. The following paragraphs describe the factors of soil formation as they relate to the soils in the survey area.

### Climate

Given adequate time, climate will eventually dominate the soil-forming processes. Temperature and precipitation are the most commonly measured climatic factors that influence soil formation. Climate influences the chemical and physical reactions that are required for the development of the soil profile. Climate also influences the natural vegetation that grows in a particular region. Sherburne County has a

subhumid continental climate that has favored the growth of both grassland and forest vegetation.

The temperature varies widely from summer to winter in Sherburne County. Generally, the soils are frozen 4 or 5 months each year. Temperature influences the physical, chemical, and biological activities that affect mineral weathering and microbial activities in soils. The rate of chemical and biological processes responsible for soil formation decreases during the winter because mineral weathering or microbial activity does not take place when the soils are frozen. Alternate freezing and thawing cycles in the fall and spring create expansion and contraction pressures that rupture mineral material and increase the surface area available for mineral weathering. These cycles also play a role in the development of soil structure. Temperature influences the accumulation and decomposition of organic matter in soils. As temperature rises, the rate of organic decomposition and nutrient cycling increases. Temperature controls effective rainfall through its effect on potential evapotranspiration, which increases with increasing mean annual temperature.

Precipitation is essential to soil formation. Water is necessary for plant and animal growth and for the chemical reactions that involve mineral weathering. Water transports colloidal material and dissolved solids from one part of the profile to another. It transports the material downward or completely out of the profile through leaching, or it transports soluble salts upward through capillary action.

### Living Organisms

The soils in Sherburne County formed under prairie grasses, forbs, and forest. The largest area of grassland that existed in Sherburne County is the outwash plain along the Mississippi River, but even in this area oaks have invaded to some extent. Hubbard, Mosford, Arvilla, and Renshaw soils formed in this area. These soils are classified as Mollisols. Melanization, the darkening of soil by the addition of organic matter, is the dominant soil-forming process in Mollisols. Most of the growth in grassland plant

communities occurs in the roots rather than in the upper plant parts. Therefore, most of the organic matter added to grassland soils is incorporated directly into the soil upon the dieback of roots. As a result, Mollisols have a thick, dark surface layer.

Because of a smaller accumulation of organic matter, soils that form under forest vegetation typically have a surface layer that is thinner and lighter in color than the surface layer in soils that formed under grass. The organic matter biomass accumulation under forest vegetation is less than that in areas of grassland. Forested soils also have soil horizons that show loss of oxides and clay and then a zone or horizon of accumulation. A soil horizon in which clays and oxides have accumulated is referred to as an argillic horizon. Nebish, Milaca, Sanburn, Mora, and Zimmerman soils formed predominantly under forest vegetation.

Many of the soils in Sherburne County exhibit characteristics of soils that formed under both grassland and forest vegetation. The county is in a transition zone between areas of these two types of vegetation.

Micro-organisms are important in sizing and reworking organic and mineral material in the soil profile. This mixing increases the surface area available for weathering and decomposition of minerals and organic matter. Insects, earthworms, and rodents mix the soil and form channels that influence the movement of air and water through the soil.

Human activities, particularly the altering of vegetation and of the rates of runoff and infiltration, can affect soil formation by altering the soil-forming processes.

### **Relief**

Relief is an important factor in soil formation because it affects drainage, aeration, and erosion. Because relief influences runoff and drainage, it can affect the types of vegetation present and the chemical changes on and in the soil. Soil profile development occurs most rapidly on well drained, gentle slopes. Profile development is very slow on steep slopes, where runoff is rapid, the rate of water infiltration is slow, and geologic erosion removes the surface soil almost as quickly as it forms. Excessive runoff reduces the amount of water that is available for leaching the soil and for use by plants, and it can increase the hazard of erosion.

Topographic position on the landscape affects the drainage class of the soil. Drainage has a distinct influence on soil formation.

Differences in relief can account for the formation of different soils in similar kinds of parent material. For

example, Milaca, Mora, Ronneby, Parent, and Prebish soils all formed in noncalcareous, red glacial till. The drainage class of each soil is predictable because each is in a particular landscape position. Milaca soils are well drained and formed mainly on sloping side slopes; Mora soils are moderately well drained and formed in nearly level and gently sloping areas; the somewhat poorly drained Ronneby soils are in nearly level and slightly concave areas at the base of long slopes; the poorly drained Parent soils formed in level areas where runoff was very slow; and the very poorly drained Prebish soils are in depressions where water tends to accumulate.

### **Parent Material**

Deposits of glacial till, outwash sand and gravel, and alluvium along the Mississippi River are the most extensive sources of parent material in the survey area. All of this material was deposited during the Wisconsin stage (the last major glacial stage) of the Pleistocene epoch. Less extensive sources are recent alluvium and organic material.

Two kinds of glacial drift of slightly different age and markedly different composition have been deposited in the county. The older drift was deposited by ice of the Superior Lobe, which flowed into the area from the north with some blending of the Rainy Lobe. The till in this drift is reddish brown, is generally loamy and noncalcareous, and has a high bulk density. It is commonly referred to as "red till" on drumlins. Pebbles of basalt, gabbro, felsite, and red sandstone are common. The Superior Lobe retreated from the area about 13,500 years ago. Milaca, Mora, and Ronneby soils, which are near Santiago, formed in till deposited by the Superior Lobe.

Later, the Grantsburg Sublobe, a protrusion of the Des Moines Lobe, advanced into the area. This ice flowed generally northward, to the northern border of Sherburne County, and brought a light olive brown, loamy, calcareous drift that contained pebbles of limestone and shale. The till deposited by the Des Moines Lobe is commonly referred to as "gray till" or "buff till." In some places the Grantsburg Sublobe picked up deposits previously laid down by the Superior Lobe; consequently, complex mixtures of reddish brown and light olive brown drift were deposited in some areas. Such mixtures are part of the Elk River Moraine Complex visible on the islands of till that project through the sand plain north of Becker and northeast of Elk River. Others project through the sand on the south side of St. Cloud and in other small areas in the northwestern part of the county. A thin smear of sand generally mantles the surface on the lower slopes of these till islands.

Braham soils formed in till deposited by the Grantsburg Sublobe, and Cushing soils formed in till deposited by the Superior Lobe. Nebish soils formed mainly in till deposited by the Grantsburg Sublobe but have some mixtures of both tills.

During the retreat of the Grantsburg Sublobe about 12,500 years ago, the ice stagnated in the northern and eastern parts of the county. Meltwater left intermixed outwash gravel and sand from both the Grantsburg and Superior Lobes in a large crevasse in the ice along the eastern edge of the county. When the ice melted, this outwash deposit remained and is evident above the surrounding countryside. Pierz, Sanburn, and Stonelake soils formed in this gravelly and sandy material of the Elk River Moraine Complex.

The Anoka Sand Plain area of the Late Wisconsin outwash in east-central Minnesota was deposited as the Grantsburg Sublobe receded (Cooper, 1935). Later, the ice became stabilized along the northeastern edge of the Mississippi Valley, and meltwater produced an outwash apron sloping toward the northeast. The material deposited by the meltwater consisted of well stratified fine sand on the Anoka Sand Plain, part of which had not been deeply reworked by wind. The sand plain was once thought to be entirely of eolian origin (Leverett and Sardeson, 1932). However, sand-dune areas cover only 7 percent of the Anoka Sand Plain (Cooper, 1935). Zimmerman, Cantlin, Lino, and Isanti soils formed in these fine sand deposits.

Finally, the Grantsburg Sublobe retreated westward, uncovering the Mississippi Valley. Meltwater from the wasting Des Moines Lobe filled the valley in Sherburne County with coarse alluvium. This alluvium underlies two broad terraces that are parallel to the Mississippi River. The sand is coarse in areas near the river and becomes increasingly finer with increasing distance from the river. It is poorly stratified and generally is deeply leached of carbonates. In places it is underlain by strata of calcareous gravel. Hubbard, Mosford, Arvilla, and Sandberg soils are the major soils in this area.

As the glacier retreated from the area, large blocks of ice were left in the till and outwash. The melting of these blocks produced depressions in nearly all of the glacial deposits. Many of these depressions are now lakes or bogs. Organic soils developed in shallow depressions where water stood for part of the year and along drainageways that were frequently flooded. The organic material ranges from 12 to more than 51 inches in thickness. Markey, Seelyeville, Cathro, and Bowstring soils are the major soils in these areas.

The sand dune ridges and parabolic dunes are organized in larger parabolic dune blankets, which

migrated only limited distances to the southeast. The predominant dune-building winds were from the northwest, but south and west winds modified the dune forms (Keen and Shane, 1990). In some areas large sand dunes developed on the deposits of fine sand, probably soon after the ice melted and before vegetation became well established. The major soils in this area are the Zimmerman soils that have a thick solum.

Recent alluvium, the texture of which ranges from loam to sand, has been deposited on the flood plains along the major streams in the county. Soils on the flood plains include Elkriver, Fordum, and Winterfield soils.

### **Time**

The length of time the parent material has been in place and exposed to the soil-forming processes is an important factor in soil formation. Time is required for the parent material to be changed into a natural body that has genetically related horizons.

A mature soil is one that has well defined horizons. A young soil is one that shows little or no horizonation. Because of differences in parent material, climate, relief, and organisms, soils that have been forming for about the same length of time have not necessarily reached the same degree of profile development. If the parent material weathers slowly, profile development is slow. If the slope is steep, soil is removed almost as soon as it forms and no well defined horizons develop. In terms of geologic time, the soils in Sherburne County are quite young.

### **Classification of the Soils**

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 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. Table 1 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 sandy, mixed, frigid 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.

Table 1.--Classification of the Soils

Soil name	Family or higher taxonomic class
Arvilla-----	Sandy, mixed, frigid Calcic Hapludolls
Beltrami-----	Fine-loamy, mixed, superactive, frigid Aquic HapludalFs
Bluffton-----	Fine-loamy, mixed, superactive, frigid Typic Endoaquolls
Bowstring-----	Euic, frigid Fluvaquentic Haplosaprists
Braham-----	Loamy, mixed, superactive, frigid Oxyaquic HapludalFs
Bushville-----	Loamy, mixed, superactive, frigid Aquic Arenic HapludalFs
Cantlin-----	Mixed, frigid Typic Udipsamments
Cathro-----	Loamy, mixed, euic, frigid Terric Haplosaprists
Cushing-----	Fine-loamy, mixed, superactive, frigid Haplic GlossudalFs
Duelm-----	Sandy, mixed, frigid Oxyaquic Hapludolls
Eckvöll-----	Loamy, mixed, superactive, frigid Aquic Arenic HapludalFs
Elkriver-----	Coarse-loamy, mixed, superactive, frigid Cumulic Hapludolls
Fordum-----	Coarse-loamy, mixed, superactive, nonacid, frigid Mollic Fluvaquents
Hubbard-----	Sandy, mixed, frigid Entic Hapludolls
Isan-----	Sandy, mixed, frigid Typic Endoaquolls
Isanti-----	Sandy, mixed, frigid Typic Endoaquolls
Lino-----	Mixed, frigid Aquic Udipsamments
Mahtomedi-----	Mixed, frigid Typic Udipsamments
Markey-----	Sandy or sandy-skeletal, mixed, euic, frigid Terric Haplosaprists
Milaca-----	Coarse-loamy, mixed, superactive, frigid Typic HapludalFs
Milaca, moderately wet---	Coarse-loamy, mixed, superactive, frigid Oxyaquic HapludalFs
Mora-----	Coarse-loamy, mixed, superactive, frigid Aquic HapludalFs
Mosford-----	Sandy, mixed, frigid Typic Hapludolls
Nebish-----	Fine-loamy, mixed, superactive, frigid Typic HapludalFs
Parent-----	Coarse-loamy, mixed, superactive, frigid Typic Epiaquolls
Pierz-----	Coarse-loamy, mixed, superactive, frigid Typic Argiudolls
Prebish-----	Coarse-loamy, mixed, superactive, frigid Typic Epiaquolls
Renshaw-----	Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Calcic Hapludolls
Ricelake-----	Coarse-loamy, mixed, superactive, frigid Aquic HapludalFs
Ronneby-----	Coarse-loamy, mixed, superactive, frigid Udollic EpiqualFs
Rushlake-----	Mixed, frigid Aquic Udipsamments
Sanburn-----	Coarse-loamy, mixed, superactive, frigid Inceptic HapludalFs
Sandberg-----	Sandy, mixed, frigid Calcic Hapludolls
Seelyeville-----	Euic, frigid Typic Haplosaprists
Stonelake-----	Sandy-skeletal, mixed, frigid Typic Udorthents
Talmoon-----	Fine-loamy, mixed, superactive, frigid Mollic EndoaqualFs
Udipsamments-----	Mixed Udipsamments
Udorthents-----	Mixed, nonacid Udorthents
Verndale-----	Coarse-loamy, mixed, superactive, frigid Typic Argiudolls
Waukon-----	Fine-loamy, mixed, superactive, frigid Mollic HapludalFs
Winterfield-----	Mixed, frigid Aquic Udipsamments
Zimmerman-----	Mixed, frigid Lamellic Udipsamments



# Soil Map Unit Descriptions

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In this section, arranged in numerical order, are the soil map unit descriptions for the soil series mapped in Sherburne County.

Characteristics of the soil and the material in which it formed are identified for each soil series. A brief description of the soil profile is provided. For more information about a soil series, the official series description can be viewed or downloaded from the following Website: <http://www.statlab.iastate.edu/cgi-bin/osdname.cgi>. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (Soil Survey Division Staff, 1993) (<http://www.statlab.iastate.edu/soils/ssm>). Many of the technical terms used in the descriptions are defined in "Keys to Soil Taxonomy" (Soil Survey Staff, 1998) (<http://www.statlab.iastate.edu/soils/keytax>).

The map units on the soil maps in this survey represent the soils or miscellaneous areas in the survey area. These soils or miscellaneous areas are listed as individual components in the map unit descriptions. 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 provided in the tables (see Contents).

A map unit delineation on the soil maps represents an area on the landscape. It is identified by differences in the properties and taxonomic classification of components and by the percentage of each component in the map unit.

Components that are dissimilar, or contrasting, are identified in the map unit description. Dissimilar components are those that have properties and behavioral characteristics divergent enough from those of the major components to affect use or to require different management. 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.

Components that are similar to the major components (noncontrasting) are not identified in the map unit description. Similar components are those that have properties and behavioral characteristics

similar enough to those of the major components that they do not affect use or require different management.

The presence of multiple components 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 is used for each map unit on the soil maps. This symbol precedes the map unit name in the map unit descriptions. Each description includes general information about the unit. The map unit descriptions include representative values in feet and the months in which wet soil moisture status is highest and lowest in the soil profile and ponding is shallowest and deepest on the soil surface. The descriptions also include the classes of flooding and the months in which flooding is least and most likely to occur. Tables 20, 21, and 22 provide a complete display of this data for every month of the year. The available water capacity given in each map unit description is calculated for all horizons in the soil profile. The organic matter content displayed in each map unit description is calculated for all horizons in the soil profile, except those that represent the surface duff layer on forested soils. Table 18 provides a complete display of available water capacity and organic matter content by horizon.

The principal hazards and limitations to be considered in planning for specific uses are described in other sections 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*. The name of a soil phase commonly indicates a feature that affects use or management. For example, Hubbard loamy sand, 0 to 2 percent slopes, is a phase of the Hubbard series.

A map unit is named for the component or components that make up a dominant percentage of the map unit. Many map units consist of one dominant component. These map units are consociations. Zimmerman fine sand, 3 to 6 percent slopes, is an example.

Some map units are made up of two or more dominant components. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more components in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. Attempting to delineate the individual components of a complex would result in excessive clutter that could make the map illegible. The pattern and proportion of the components in a complex are somewhat similar in all areas. Stonelake-Nebish complex, 2 to 6 percent slopes, is an example.

An *undifferentiated group* is made up of two or more components 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 components in a mapped area are not uniform. An area can be made up of only one of the dominant components, or it can be made up of all of them. Seelyeville and Bowstring soils, 0 to 1 percent slopes, frequently flooded, 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. Pits, quarry, is an example.

Table 2 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.

## **7A—Hubbard loamy sand, 0 to 2 percent slopes**

### ***Component Description***

#### **Hubbard and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Outwash plains and stream terraces

*Position on the landform:* Flats

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Loamy sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.0 inches

*Content of organic matter in the upper 10 inches:* 3.0 percent

*Typical profile:*

Ap,AB—0 to 20 inches; loamy sand

Bw—20 to 32 inches; loamy sand

BC,C—32 to 80 inches; sand

### ***Additional Components***

#### **Soils that have a gravelly substratum**

*Extent:* 2 percent of the unit

#### **Duelm and similar soils**

*Extent:* 1 percent of the unit

#### **Isan and similar soils**

*Extent:* 1 percent of the unit

#### **Soils that have a substratum of till or bedrock**

*Extent:* 1 percent of the unit

## **7B—Hubbard loamy sand, 2 to 6 percent slopes**

### ***Component Description***

#### **Hubbard and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Hills on outwash plains and hills on stream terraces

*Position on the landform:* Summits, shoulders, and backslopes

*Slope range:* 2 to 6 percent

*Texture of the surface layer:* Loamy sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.9 inches

*Content of organic matter in the upper 10 inches:* 3.0 percent

*Typical profile:*

Ap,A—0 to 18 inches; loamy sand

Bw—18 to 23 inches; loamy sand

BC,C—23 to 80 inches; sand

### **Additional Components**

#### **Soils that have a gravelly substratum**

*Extent:* 2 percent of the unit

#### **Duelm and similar soils**

*Extent:* 1 percent of the unit

#### **Isan and similar soils**

*Extent:* 1 percent of the unit

#### **Soils that have a till substratum**

*Extent:* 1 percent of the unit

### **7C—Hubbard loamy sand, 6 to 12 percent slopes**

#### **Component Description**

#### **Hubbard and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Hills on outwash plains and hills on stream terraces

*Position on the landform:* Backslopes, shoulders, and summits

*Slope range:* 6 to 12 percent

*Texture of the surface layer:* Loamy sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.6 inches

*Content of organic matter in the upper 10 inches:* 2.0 percent

*Typical profile:*

Ap,AB—0 to 12 inches; loamy sand

Bw—12 to 33 inches; coarse sand

C—33 to 80 inches; coarse sand

### **Additional Components**

#### **Isan and similar soils**

*Extent:* 2 percent of the unit

#### **Duelm and similar soils**

*Extent:* 1 percent of the unit

#### **Soils that have a substratum of fine sand**

*Extent:* 1 percent of the unit

#### **Soils that have a gravelly substratum**

*Extent:* 1 percent of the unit

### **32B—Nebish fine sandy loam, 2 to 6 percent slopes**

#### **Component Description**

#### **Nebish and similar soils**

*Extent:* 85 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Backslopes and summits

*Slope range:* 2 to 6 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Parent material:* Till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 3.6 feet (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, July, August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 9.8 inches

*Content of organic matter in the upper 10 inches:* 1.1 percent

*Typical profile:*

Ap—0 to 5 inches; fine sandy loam

Bt—5 to 43 inches; clay loam

C—43 to 80 inches; loam

### **Additional Components**

#### **Beltrami and similar soils**

*Extent:* 5 percent of the unit

**Bluffton and similar soils***Extent:* 4 percent of the unit**Talmoon and similar soils***Extent:* 4 percent of the unit**Braham and similar soils***Extent:* 1 percent of the unit**Soils that have a substratum of sand or gravel***Extent:* 1 percent of the unit**32C—Nebish fine sandy loam, 6 to 12 percent slopes*****Component Description*****Nebish and similar soils***Extent:* 85 percent of the unit*Geomorphic description:* Hills on moraines*Position on the landform:* Backslopes and shoulders*Slope range:* 6 to 12 percent*Texture of the surface layer:* Fine sandy loam*Depth to restrictive feature:* Very deep (more than 60 inches)*Drainage class:* Well drained*Parent material:* Till*Flooding:* None*Depth to wet soil moisture status:* More than 6.7 feet all year*Ponding:* None*Available water capacity to a depth of 60 inches:* 9.7 inches*Content of organic matter in the upper 10 inches:* 1.3 percent*Typical profile:*

Ap—0 to 7 inches; fine sandy loam

BE—7 to 11 inches; fine sandy loam

Bt—11 to 44 inches; clay loam

C—44 to 80 inches; loam

***Additional Components*****Beltrami and similar soils***Extent:* 5 percent of the unit**Bluffton and similar soils***Extent:* 5 percent of the unit**Talmoon and similar soils***Extent:* 3 percent of the unit**Braham and similar soils***Extent:* 1 percent of the unit**Soils that have a substratum of sand or gravel***Extent:* 1 percent of the unit**32D—Nebish fine sandy loam, 12 to 18 percent slopes*****Component Description*****Nebish and similar soils***Extent:* 85 percent of the unit*Geomorphic description:* Hills on moraines*Position on the landform:* Shoulders and backslopes*Slope range:* 12 to 18 percent*Texture of the surface layer:* Fine sandy loam*Depth to restrictive feature:* Very deep (more than 60 inches)*Drainage class:* Well drained*Parent material:* Till*Flooding:* None*Depth to wet soil moisture status:* More than 6.7 feet all year*Ponding:* None*Available water capacity to a depth of 60 inches:* 9.4 inches*Content of organic matter in the upper 10 inches:* 1.0 percent*Typical profile:*

Ap—0 to 3 inches; fine sandy loam

Bt—3 to 22 inches; clay loam

C—22 to 80 inches; loam

***Additional Components*****Bluffton and similar soils***Extent:* 7 percent of the unit**Talmoon and similar soils***Extent:* 5 percent of the unit**Beltrami and similar soils***Extent:* 1 percent of the unit**Braham and similar soils***Extent:* 1 percent of the unit**Soils that have a substratum of sand or gravel***Extent:* 1 percent of the unit

### 32E—Nebish fine sandy loam, 18 to 35 percent slopes

#### Component Description

#### Nebish and similar soils

*Extent:* 85 percent of the unit  
*Geomorphic description:* Hills on moraines  
*Position on the landform:* Shoulders and backslopes  
*Slope range:* 18 to 35 percent  
*Texture of the surface layer:* Fine sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Parent material:* Till  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 9.5 inches  
*Content of organic matter in the upper 10 inches:* 1.1 percent  
*Typical profile:*  
 A—0 to 4 inches; fine sandy loam  
 E—4 to 13 inches; fine sandy loam  
 Bt—13 to 36 inches; clay loam  
 C—36 to 80 inches; loam

#### Additional Components

#### Bluffton and similar soils

*Extent:* 8 percent of the unit

#### Beltrami and similar soils

*Extent:* 1 percent of the unit

#### Soils that have a substratum of sand or gravel

*Extent:* 1 percent of the unit

### 38B—Waukon fine sandy loam, 2 to 6 percent slopes

#### Component Description

#### Waukon and similar soils

*Extent:* 90 percent of the unit  
*Geomorphic description:* Hills on moraines  
*Position on the landform:* Backslopes and summits  
*Slope range:* 2 to 6 percent  
*Texture of the surface layer:* Fine sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Well drained

*Parent material:* Till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 3.6 feet (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, July, August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 9.9 inches

*Content of organic matter in the upper 10 inches:* 2.9 percent

*Typical profile:*

Ap—0 to 8 inches; fine sandy loam  
 E—8 to 12 inches; fine sandy loam  
 BE,Bt—12 to 43 inches; loam  
 Bk—43 to 80 inches; loam

#### Additional Components

#### Beltrami and similar soils

*Extent:* 5 percent of the unit

#### Soils that have a substratum of sandy loam

*Extent:* 3 percent of the unit

#### Talmoon and similar soils

*Extent:* 2 percent of the unit

### 75—Bluffton loam, depressional, 0 to 1 percent slopes

#### Component Description

#### Bluffton, depressional, and similar soils

*Extent:* 90 percent of the unit  
*Geomorphic description:* Moraines  
*Position on the landform:* Depressions  
*Slope range:* 0 to 1 percent  
*Texture of the surface layer:* Loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Very poorly drained  
*Parent material:* Till  
*Flooding:* None  
*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)  
*Wet soil moisture status is lowest (depth, months):* 1.5 feet (February)  
*Ponding is shallowest (depth, months):* 0.5 foot (June)  
*Ponding is deepest (depth, months):* 1.0 foot (March, April, May)  
*Available water capacity to a depth of 60 inches:* 10.6 inches

*Content of organic matter in the upper 10 inches:* 5.0 percent

*Typical profile:*

A1,A2—0 to 13 inches; loam

Bg—13 to 40 inches; loam

Cg—40 to 80 inches; loam

### ***Additional Components***

#### **Soils that have a surface layer of muck**

*Extent:* 5 percent of the unit

#### **Talmoon and similar soils**

*Extent:* 3 percent of the unit

#### **Soils that have a substratum of sand or gravel**

*Extent:* 2 percent of the unit

### **125—Beltrami fine sandy loam, 0 to 3 percent slopes**

#### ***Component Description***

##### **Beltrami and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Moraines

*Position on the landform:* Flats and slight rises

*Slope range:* 0 to 3 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained

*Parent material:* Till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 1.5 feet (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (February, August)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 10.0 inches

*Content of organic matter in the upper 10 inches:* 2.6 percent

*Typical profile:*

Ap—0 to 6 inches; fine sandy loam

Bt1—6 to 12 inches; loam

Bt2,Bt4—12 to 48 inches; clay loam

C—48 to 80 inches; loam

### ***Additional Components***

#### **Talmoon and similar soils**

*Extent:* 4 percent of the unit

#### **Bluffton and similar soils**

*Extent:* 3 percent of the unit

#### **Nebish and similar soils**

*Extent:* 2 percent of the unit

#### **Soils that have a substratum of sand or gravel**

*Extent:* 1 percent of the unit

### **152C—Milaca fine sandy loam, 6 to 12 percent slopes**

#### ***Component Description***

##### **Milaca and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Drumlins

*Position on the landform:* Shoulders and summits

*Slope range:* 6 to 12 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Parent material:* Till

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.6 inches

*Content of organic matter in the upper 10 inches:* 0.4 percent

*Typical profile:*

A—0 to 4 inches; fine sandy loam

E—4 to 12 inches; fine sandy loam

Bt—12 to 20 inches; fine sandy loam

BC—20 to 42 inches; sandy loam

Cd—42 to 80 inches; sandy loam

### ***Additional Components***

#### **Mora and similar soils**

*Extent:* 2 percent of the unit

#### **Soils that have a substratum of sand or gravel**

*Extent:* 2 percent of the unit

#### **Parent and similar soils**

*Extent:* 1 percent of the unit

**152E—Milaca fine sandy loam, 12 to 25 percent slopes**

**Component Description**

**Milaca and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Drumlins  
*Position on the landform:* Shoulders and backslopes  
*Slope range:* 12 to 25 percent  
*Texture of the surface layer:* Fine sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Parent material:* Till  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 4.6 inches  
*Content of organic matter in the upper 10 inches:* 0.4 percent  
*Typical profile:*  
 A—0 to 3 inches; fine sandy loam  
 E—3 to 12 inches; fine sandy loam  
 Bt—12 to 20 inches; fine sandy loam  
 BC—20 to 40 inches; sandy loam  
 Cd—40 to 80 inches; sandy loam

**Additional Components**

**Soils that have a substratum of sand or gravel**

*Extent:* 2 percent of the unit

**Braham and similar soils**

*Extent:* 1 percent of the unit

**Mora and similar soils**

*Extent:* 1 percent of the unit

**Parent and similar soils**

*Extent:* 1 percent of the unit

**158A—Zimmerman fine sand, 0 to 3 percent slopes**

**Component Description**

**Zimmerman and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Outwash plains  
*Position on the landform:* Flats and slight rises  
*Slope range:* 0 to 3 percent

*Texture of the surface layer:* Fine sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 4.8 inches  
*Content of organic matter in the upper 10 inches:* 0.8 percent  
*Typical profile:*  
 Ap—0 to 7 inches; fine sand  
 E,Bw,E&Bt—7 to 80 inches; fine sand

**Additional Components**

**Cantlin and similar soils**

*Extent:* 2 percent of the unit

**Lino and similar soils**

*Extent:* 2 percent of the unit

**Isanti and similar soils**

*Extent:* 1 percent of the unit

**158B—Zimmerman fine sand, 3 to 6 percent slopes**

**Component Description**

**Zimmerman and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Hills on outwash plains  
*Position on the landform:* Summits and backslopes  
*Slope range:* 3 to 6 percent  
*Texture of the surface layer:* Fine sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 4.8 inches  
*Content of organic matter in the upper 10 inches:* 0.7 percent  
*Typical profile:*  
 Ap—0 to 6 inches; fine sand  
 E,Bw,E&Bt—6 to 80 inches; fine sand

**Additional Components****Cantlin and similar soils**

*Extent:* 2 percent of the unit

**Lino and similar soils**

*Extent:* 2 percent of the unit

**Isanti and similar soils**

*Extent:* 1 percent of the unit

**158C—Zimmerman fine sand, 6 to 12 percent slopes****Component Description****Zimmerman and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Hills on outwash plains

*Position on the landform:* Backslopes and summits

*Slope range:* 6 to 12 percent

*Texture of the surface layer:* Fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.8 inches

*Content of organic matter in the upper 10 inches:* 0.7 percent

*Typical profile:*

Ap—0 to 6 inches; fine sand

E,Bw,E&Bt—6 to 80 inches; fine sand

**Additional Components****Isanti and similar soils**

*Extent:* 2 percent of the unit

**Cantlin and similar soils**

*Extent:* 1 percent of the unit

**Lino and similar soils**

*Extent:* 1 percent of the unit

**Soils that have a substratum of loam or sandy loam**

*Extent:* 1 percent of the unit

**158E—Zimmerman fine sand, 12 to 25 percent slopes****Component Description****Zimmerman and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Hills on outwash plains

*Position on the landform:* Shoulders and backslopes

*Slope range:* 12 to 25 percent

*Texture of the surface layer:* Fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.8 inches

*Content of organic matter in the upper 10 inches:* 0.5 percent

*Typical profile:*

A—0 to 3 inches; fine sand

E,Bw,E&Bt—3 to 80 inches; fine sand

**Additional Components****Lino and similar soils**

*Extent:* 3 percent of the unit

**Isanti and similar soils**

*Extent:* 2 percent of the unit

**161—Isanti fine sandy loam, depressional, 0 to 1 percent slopes****Component Description****Isanti, depressional, and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Outwash plains

*Position on the landform:* Depressions

*Slope range:* 0 to 1 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Very poorly drained

*Parent material:* Outwash

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)

*Wet soil moisture status is lowest (depth, months):* 1.5 feet (February)

*Ponding is shallowest (depth, months):* 0.5 foot (June)

*Ponding is deepest (depth, months):* 1.0 foot (March, April, May)

*Available water capacity to a depth of 60 inches:* 5.3 inches

*Content of organic matter in the upper 10 inches:* 9.0 percent

*Typical profile:*

A1,A3—0 to 16 inches; fine sandy loam

Bg—16 to 28 inches; loamy fine sand

Cg—28 to 80 inches; fine sand

### **Additional Components**

#### **Markey and similar soils**

*Extent:* 3 percent of the unit

#### **Lino and similar soils**

*Extent:* 2 percent of the unit

### **162—Lino loamy fine sand, 0 to 2 percent slopes**

#### **Component Description**

#### **Lino and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Outwash plains

*Position on the landform:* Flats and slight rises

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Loamy fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained

*Parent material:* Outwash

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 1.5 feet (April)

*Wet soil moisture status is lowest (depth, months):* 4.5 feet (September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.3 inches

*Content of organic matter in the upper 10 inches:* 1.1 percent

*Typical profile:*

Ap—0 to 8 inches; loamy fine sand

Bw—8 to 38 inches; loamy fine sand

Cg—38 to 80 inches; fine sand

### **Additional Components**

#### **Isanti and similar soils**

*Extent:* 2 percent of the unit

#### **Cantlin and similar soils**

*Extent:* 1 percent of the unit

#### **Soils that have a substratum of gravel**

*Extent:* 1 percent of the unit

#### **Zimmerman and similar soils**

*Extent:* 1 percent of the unit

### **164A—Mora loam, 0 to 3 percent slopes**

#### **Component Description**

#### **Mora and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Drumlins

*Position on the landform:* Flats and slight rises

*Slope range:* 0 to 3 percent

*Texture of the surface layer:* Loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained

*Parent material:* Till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 1.0 foot (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, July, August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 6.9 inches

*Content of organic matter in the upper 10 inches:* 1.2 percent

*Typical profile:*

Ap—0 to 6 inches; loam

E—6 to 15 inches; sandy loam

BE,Bt—15 to 36 inches; sandy loam

BC—36 to 48 inches; sandy loam

Cd—48 to 80 inches; sandy loam

### **Additional Components**

#### **Parent and similar soils**

*Extent:* 3 percent of the unit

#### **Soils that have a gravelly substratum**

*Extent:* 1 percent of the unit

**Milaca and similar soils**

*Extent:* 1 percent of the unit

**165—Parent loam, 0 to 2 percent slopes****Component Description****Parent and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Interdrumlins

*Position on the landform:* Flats and swales

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Poorly drained

*Parent material:* Till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 0.5 foot (April, May)

*Wet soil moisture status is lowest (depth, months):* 2.5 feet (February, August)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 6.5 inches

*Content of organic matter in the upper 10 inches:* 5.5 percent

*Typical profile:*

A1,A2—0 to 15 inches; loam

Bg—15 to 33 inches; loam

BC—33 to 40 inches; sandy loam

Cd—40 to 80 inches; sandy loam

**Additional Components****Prebish and similar soils**

*Extent:* 5 percent of the unit

**Ronneby and similar soils**

*Extent:* 3 percent of the unit

**Mora and similar soils**

*Extent:* 1 percent of the unit

**Soils that have a substratum of sand or gravel**

*Extent:* 1 percent of the unit

**166—Ronneby loam, 0 to 2 percent slopes****Component Description****Ronneby and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Interdrumlins

*Position on the landform:* Flats

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained

*Parent material:* Till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 0.7 foot (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 8.1 inches

*Content of organic matter in the upper 10 inches:* 3.0 percent

*Typical profile:*

A—0 to 4 inches; loam

E—4 to 12 inches; fine sandy loam

BE,Bt—12 to 45 inches; fine sandy loam

BC—45 to 56 inches; fine sandy loam

Cd—56 to 80 inches; fine sandy loam

**Additional Components****Parent and similar soils**

*Extent:* 4 percent of the unit

**Prebish and similar soils**

*Extent:* 3 percent of the unit

**Mora and similar soils**

*Extent:* 2 percent of the unit

**Soils that have a substratum of sand or gravel**

*Extent:* 1 percent of the unit

**169B—Braham loamy fine sand, 3 to 6 percent slopes****Component Description****Braham and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Backslopes and summits

*Slope range:* 3 to 6 percent

*Texture of the surface layer:* Loamy fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Moderately well drained

*Parent material:* Outwash over till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):*  
2.5 feet (April)

*Wet soil moisture status is lowest (depth, months):*  
More than 6.7 feet (January, February, June, July,  
August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 8.7  
inches

*Content of organic matter in the upper 10 inches:* 1.9  
percent

*Typical profile:*

Ap—0 to 9 inches; loamy fine sand

E—9 to 21 inches; loamy fine sand

2Bt—21 to 46 inches; clay loam

2Bk—46 to 80 inches; loam

#### ***Additional Components***

##### **Eckvoll and similar soils**

*Extent:* 5 percent of the unit

##### **Talmoon and similar soils**

*Extent:* 3 percent of the unit

##### **Nebish and similar soils**

*Extent:* 2 percent of the unit

#### **169C—Braham loamy fine sand, 6 to 12 percent slopes**

##### ***Component Description***

##### **Braham and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Shoulders and backslopes

*Slope range:* 6 to 12 percent

*Texture of the surface layer:* Loamy fine sand

*Depth to restrictive feature:* Very deep (more than 60  
inches)

*Drainage class:* Well drained

*Parent material:* Outwash over till

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet  
all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 8.1  
inches

*Content of organic matter in the upper 10 inches:* 1.7  
percent

*Typical profile:*

Ap—0 to 8 inches; loamy fine sand

E—8 to 28 inches; loamy sand

2Bt—28 to 48 inches; clay loam

2Bk—48 to 80 inches; loam

#### ***Additional Components***

##### **Eckvoll and similar soils**

*Extent:* 3 percent of the unit

##### **Nebish and similar soils**

*Extent:* 3 percent of the unit

##### **Talmoon and similar soils**

*Extent:* 3 percent of the unit

##### **Soils that have a substratum of sand or gravel**

*Extent:* 1 percent of the unit

#### **169D—Braham loamy fine sand, 12 to 18 percent slopes**

##### ***Component Description***

##### **Braham and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Shoulders and backslopes

*Slope range:* 12 to 18 percent

*Texture of the surface layer:* Loamy fine sand

*Depth to restrictive feature:* Very deep (more than 60  
inches)

*Drainage class:* Well drained

*Parent material:* Outwash over till

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet  
all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 7.8  
inches

*Content of organic matter in the upper 10 inches:* 1.7  
percent

*Typical profile:*

Ap—0 to 8 inches; loamy fine sand

E—8 to 32 inches; loamy sand

2Bt—32 to 55 inches; clay loam

2Bk—55 to 80 inches; loam

#### ***Additional Components***

##### **Eckvoll and similar soils**

*Extent:* 4 percent of the unit

##### **Talmoon and similar soils**

*Extent:* 3 percent of the unit

**Nebish and similar soils***Extent:* 2 percent of the unit**Soils that have a substratum of sand or gravel***Extent:* 1 percent of the unit**204B—Cushing fine sandy loam, 2 to 8 percent slopes*****Component Description*****Cushing and similar soils***Extent:* 90 percent of the unit*Geomorphic description:* Hills on moraines*Position on the landform:* Backslopes and summits*Slope range:* 2 to 8 percent*Texture of the surface layer:* Fine sandy loam*Depth to restrictive feature:* Very deep (more than 60 inches)*Drainage class:* Well drained*Parent material:* Till*Flooding:* None*Wet soil moisture status is highest (depth, months):* 3.6 feet (April)*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, July, August, September)*Ponding:* None*Available water capacity to a depth of 60 inches:* 9.0 inches*Content of organic matter in the upper 10 inches:* 1.1 percent*Typical profile:*

A—0 to 6 inches; fine sandy loam

E,B/E—6 to 22 inches; fine sandy loam

Bt,BC—22 to 44 inches; clay loam

C—44 to 80 inches; loam

***Additional Components*****Talmoon and similar soils***Extent:* 4 percent of the unit**Bluffton and similar soils***Extent:* 3 percent of the unit**Beltrami and similar soils***Extent:* 2 percent of the unit**Soils that have a sandy substratum***Extent:* 1 percent of the unit**204C—Cushing fine sandy loam, 8 to 15 percent slopes*****Component Description*****Cushing and similar soils***Extent:* 95 percent of the unit*Geomorphic description:* Hills on moraines*Position on the landform:* Shoulders and backslopes*Slope range:* 8 to 15 percent*Texture of the surface layer:* Fine sandy loam*Depth to restrictive feature:* Very deep (more than 60 inches)*Drainage class:* Well drained*Parent material:* Till*Flooding:* None*Depth to wet soil moisture status:* More than 6.7 feet all year*Ponding:* None*Available water capacity to a depth of 60 inches:* 9.0 inches*Content of organic matter in the upper 10 inches:* 1.2 percent*Typical profile:*

Ap—0 to 7 inches; fine sandy loam

E—7 to 21 inches; fine sandy loam

Bt—21 to 44 inches; clay loam

C—44 to 80 inches; sandy loam

***Additional Components*****Bluffton and similar soils***Extent:* 2 percent of the unit**Beltrami and similar soils***Extent:* 1 percent of the unit**Soils that have a substratum of sand or gravel***Extent:* 1 percent of the unit**Talmoon and similar soils***Extent:* 1 percent of the unit**258B—Sandberg loamy coarse sand, 1 to 6 percent slopes*****Component Description*****Sandberg and similar soils***Extent:* 95 percent of the unit*Geomorphic description:* Hills on stream terraces

*Position on the landform:* Summits, shoulders, and backslopes  
*Slope range:* 1 to 6 percent  
*Texture of the surface layer:* Loamy coarse sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 3.9 inches  
*Content of organic matter in the upper 10 inches:* 2.5 percent  
*Typical profile:*  
 Ap,A—0 to 14 inches; loamy coarse sand  
 Bw—14 to 32 inches; gravelly coarse sand  
 C—32 to 80 inches; sand

#### ***Additional Components***

##### **Soils that have a sandy substratum**

*Extent:* 3 percent of the unit

##### **Duelm and similar soils**

*Extent:* 1 percent of the unit

##### **Isan and similar soils**

*Extent:* 1 percent of the unit

#### **258C—Sandberg loamy coarse sand, 6 to 12 percent slopes**

##### ***Component Description***

##### **Sandberg and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Hills on stream terraces  
*Position on the landform:* Shoulders and backslopes  
*Slope range:* 6 to 12 percent  
*Texture of the surface layer:* Loamy coarse sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 3.6 inches

*Content of organic matter in the upper 10 inches:* 2.0 percent

##### *Typical profile:*

Ap—0 to 11 inches; loamy coarse sand  
 Bw—11 to 26 inches; coarse sand  
 C—26 to 80 inches; coarse sand

#### ***Additional Components***

##### **Soils that have a sandy substratum**

*Extent:* 2 percent of the unit

##### **Duelm and similar soils**

*Extent:* 1 percent of the unit

##### **Isan and similar soils**

*Extent:* 1 percent of the unit

##### **Soils that have a substratum of sandy loam**

*Extent:* 1 percent of the unit

#### **258E—Sandberg loamy coarse sand, 12 to 35 percent slopes**

##### ***Component Description***

##### **Sandberg and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Hills on stream terraces; escarpments  
*Position on the landform:* Shoulders and backslopes  
*Slope range:* 12 to 35 percent  
*Texture of the surface layer:* Loamy coarse sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 3.6 inches  
*Content of organic matter in the upper 10 inches:* 2.0 percent  
*Typical profile:*  
 A—0 to 11 inches; loamy coarse sand  
 Bw—11 to 27 inches; coarse sand  
 C—27 to 80 inches; gravelly coarse sand

#### ***Additional Components***

##### **Soils that have a sandy substratum**

*Extent:* 3 percent of the unit

**Duelm and similar soils***Extent:* 1 percent of the unit**Isan and similar soils***Extent:* 1 percent of the unit**260—Duelm loamy sand, 0 to 2 percent slopes*****Component Description*****Duelm and similar soils***Extent:* 95 percent of the unit*Geomorphic description:* Outwash plains and stream terraces*Position on the landform:* Flats and slight rises*Slope range:* 0 to 2 percent*Texture of the surface layer:* Loamy sand*Depth to restrictive feature:* Very deep (more than 60 inches)*Drainage class:* Moderately well drained*Parent material:* Outwash*Flooding:* None*Wet soil moisture status is highest (depth, months):* 2.5 feet (April, May)*Wet soil moisture status is lowest (depth, months):* 4.0 feet (February, August, September)*Ponding:* None*Available water capacity to a depth of 60 inches:* 4.4 inches*Content of organic matter in the upper 10 inches:* 4.0 percent*Typical profile:*

Ap,AB—0 to 16 inches; loamy sand

Bw—16 to 30 inches; coarse sand

C—30 to 80 inches; coarse sand

***Additional Components*****Isan and similar soils***Extent:* 2 percent of the unit**Soils that have a gravelly substratum or a bedrock substratum***Extent:* 1 percent of the unit**Bushville and similar soils***Extent:* 1 percent of the unit**Hubbard and similar soils***Extent:* 1 percent of the unit**261—Isan sandy loam, depressional, 0 to 1 percent slopes*****Component Description*****Isan, depressional, and similar soils***Extent:* 95 percent of the unit*Geomorphic description:* Outwash plains and stream terraces*Position on the landform:* Depressions*Slope range:* 0 to 1 percent*Texture of the surface layer:* Sandy loam*Depth to restrictive feature:* Very deep (more than 60 inches)*Drainage class:* Very poorly drained*Parent material:* Outwash*Flooding:* None*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)*Wet soil moisture status is lowest (depth, months):* 1.5 feet (February)*Ponding is shallowest (depth, months):* 0.5 foot (June)*Ponding is deepest (depth, months):* 1.0 foot (March, April, May)*Available water capacity to a depth of 60 inches:* 4.7 inches*Content of organic matter in the upper 10 inches:* 6.5 percent*Typical profile:*

A—0 to 14 inches; sandy loam

AB,Bg—14 to 34 inches; loamy sand

Cg—34 to 80 inches; coarse sand

***Additional Components*****Duelm and similar soils***Extent:* 2 percent of the unit**Soils that have a gravelly substratum***Extent:* 2 percent of the unit**Soils that have a surface layer of muck***Extent:* 1 percent of the unit**325—Prebish fine sandy loam, depressional, 0 to 1 percent slopes*****Component Description*****Prebish, depressional, and similar soils***Extent:* 95 percent of the unit*Geomorphic description:* Interdrumlins

*Position on the landform:* Depressions  
*Slope range:* 0 to 1 percent  
*Texture of the surface layer:* Fine sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Very poorly drained  
*Parent material:* Till  
*Flooding:* None  
*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)  
*Wet soil moisture status is lowest (depth, months):* 1.0 foot (February, March, August, September)  
*Ponding is shallowest (depth, months):* 0.5 foot (June)  
*Ponding is deepest (depth, months):* 1.0 foot (March, April, May)  
*Available water capacity to a depth of 60 inches:* 6.8 inches  
*Content of organic matter in the upper 10 inches:* 6.0 percent  
*Typical profile:*  
 A1,A2—0 to 15 inches; fine sandy loam  
 Bg,BC—15 to 41 inches; sandy loam  
 Cd—41 to 80 inches; fine sandy loam

#### **Additional Components**

##### **Cathro and similar soils**

*Extent:* 2 percent of the unit

##### **Parent and similar soils**

*Extent:* 2 percent of the unit

##### **Soils that have a sandy substratum**

*Extent:* 1 percent of the unit

### **341—Arvilla sandy loam, 0 to 2 percent slopes**

#### **Component Description**

##### **Arvilla and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Stream terraces  
*Position on the landform:* Flats  
*Slope range:* 0 to 2 percent  
*Texture of the surface layer:* Sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.3 inches  
*Content of organic matter in the upper 10 inches:* 2.5 percent  
*Typical profile:*  
 Ap,A—0 to 14 inches; sandy loam  
 Bw—14 to 20 inches; sandy loam  
 2Bw,2Bk,2C—20 to 80 inches; gravelly coarse sand

#### **Additional Components**

##### **Soils that have a sandy substratum**

*Extent:* 3 percent of the unit

##### **Isan and similar soils**

*Extent:* 2 percent of the unit

### **346—Talmoon loam, 0 to 2 percent slopes**

#### **Component Description**

##### **Talmoon and similar soils**

*Extent:* 90 percent of the unit  
*Geomorphic description:* Moraines  
*Position on the landform:* Flats and swales  
*Slope range:* 0 to 2 percent  
*Texture of the surface layer:* Loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Poorly drained  
*Parent material:* Till  
*Flooding:* None  
*Wet soil moisture status is highest (depth, months):* 0.5 foot (April, May)  
*Wet soil moisture status is lowest (depth, months):* 2.5 feet (February, August)  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 10.7 inches  
*Content of organic matter in the upper 10 inches:* 2.4 percent  
*Typical profile:*  
 Ap—0 to 7 inches; loam  
 Eg—7 to 12 inches; fine sandy loam  
 Btg—12 to 32 inches; clay loam  
 Bk—32 to 80 inches; loam

#### **Additional Components**

##### **Bluffton and similar soils**

*Extent:* 6 percent of the unit

##### **Beltrami and similar soils**

*Extent:* 2 percent of the unit

**Soils that have a substratum of sand or gravel**

*Extent:* 2 percent of the unit

**373—Renshaw loam, 0 to 3 percent slopes****Component Description****Renshaw and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Stream terraces

*Position on the landform:* Flats

*Slope range:* 0 to 3 percent

*Texture of the surface layer:* Loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.9 inches

*Content of organic matter in the upper 10 inches:* 2.8 percent

*Typical profile:*

Ap—0 to 9 inches; loam

Bw—9 to 15 inches; loam

2Bw,2C—15 to 80 inches; gravelly coarse sand

**Additional Components****Duelm and similar soils**

*Extent:* 2 percent of the unit

**Soils that have a sandy substratum**

*Extent:* 2 percent of the unit

**Isan and similar soils**

*Extent:* 1 percent of the unit

**454B—Mahtomedi loamy coarse sand, 1 to 6 percent slopes****Component Description****Mahtomedi and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Summits and backslopes

*Slope range:* 1 to 6 percent

*Texture of the surface layer:* Loamy coarse sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.3 inches

*Content of organic matter in the upper 10 inches:* 0.7 percent

*Typical profile:*

Ap—0 to 9 inches; loamy coarse sand

Bw—9 to 36 inches; gravelly coarse sand

BC,C—36 to 80 inches; coarse sand

**Additional Components****Sanburn and similar soils**

*Extent:* 3 percent of the unit

**Duelm and similar soils**

*Extent:* 1 percent of the unit

**Isan and similar soils**

*Extent:* 1 percent of the unit

**454C—Mahtomedi loamy coarse sand, 6 to 15 percent slopes****Component Description****Mahtomedi and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Summits and backslopes

*Slope range:* 6 to 15 percent

*Texture of the surface layer:* Loamy coarse sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.2 inches

*Content of organic matter in the upper 10 inches:* 0.4 percent

*Typical profile:*

Ap—0 to 3 inches; loamy coarse sand

Bw—3 to 17 inches; gravelly sand  
C—17 to 80 inches; sand

**Additional Components**

**Sanburn and similar soils**

*Extent:* 3 percent of the unit

**Duelm and similar soils**

*Extent:* 1 percent of the unit

**Isan and similar soils**

*Extent:* 1 percent of the unit

**540—Seelyeville muck, 0 to 1 percent slopes**

**Component Description**

**Seelyeville and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Moraines, outwash plains, and stream terraces  
*Position on the landform:* Depressions  
*Slope range:* 0 to 1 percent  
*Texture of the surface layer:* Muck  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Very poorly drained  
*Parent material:* Organic material  
*Flooding:* None  
*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)  
*Wet soil moisture status is lowest (depth, months):* 1.5 feet (February)  
*Ponding is shallowest (depth, months):* 0.5 foot (June)  
*Ponding is deepest (depth, months):* 1.0 foot (March, April, May)  
*Available water capacity to a depth of 60 inches:* 23.9 inches  
*Content of organic matter in the upper 10 inches:* 62.0 percent  
*Typical profile:*  
Oa1—0 to 10 inches; muck  
Oa2,Oa5—10 to 80 inches; muck

**Additional Components**

**Cathro and similar soils**

*Extent:* 1 percent of the unit

**Isan and similar soils**

*Extent:* 1 percent of the unit

**Isanti and similar soils**

*Extent:* 1 percent of the unit

**Markey and similar soils**

*Extent:* 1 percent of the unit

**Prebish and similar soils**

*Extent:* 1 percent of the unit

**543—Markey muck, 0 to 1 percent slopes**

**Component Description**

**Markey and similar soils**

*Extent:* 90 percent of the unit  
*Geomorphic description:* Outwash plains and stream terraces  
*Position on the landform:* Depressions  
*Slope range:* 0 to 1 percent  
*Texture of the surface layer:* Muck  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Very poorly drained  
*Parent material:* Organic material over outwash  
*Flooding:* None  
*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)  
*Wet soil moisture status is lowest (depth, months):* 1.5 feet (February)  
*Ponding is shallowest (depth, months):* 0.5 foot (June)  
*Ponding is deepest (depth, months):* 1.0 foot (March, April, May)  
*Available water capacity to a depth of 60 inches:* 15.8 inches  
*Content of organic matter in the upper 10 inches:* 70.0 percent  
*Typical profile:*  
Oa—0 to 36 inches; muck  
2A—36 to 42 inches; loamy sand  
2Cg—42 to 80 inches; sand

**Additional Components**

**Isanti and similar soils**

*Extent:* 5 percent of the unit

**Isan and similar soils**

*Extent:* 2 percent of the unit

**Seelyeville and similar soils**

*Extent:* 2 percent of the unit

**Lino and similar soils**

*Extent:* 1 percent of the unit

**544—Cathro muck, 0 to 1 percent slopes*****Component Description*****Cathro and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Moraines

*Position on the landform:* Depressions

*Slope range:* 0 to 1 percent

*Texture of the surface layer:* Muck

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Very poorly drained

*Parent material:* Organic material over till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)

*Wet soil moisture status is lowest (depth, months):* 1.5 feet (February)

*Ponding is shallowest (depth, months):* 0.5 foot (June)

*Ponding is deepest (depth, months):* 1.0 foot (March, April, May)

*Available water capacity to a depth of 60 inches:* 20.0 inches

*Content of organic matter in the upper 10 inches:* 72.5 percent

*Typical profile:*

Oa1, Oa2—0 to 30 inches; muck

2A—30 to 38 inches; loam

2Cg—38 to 80 inches; loam

***Additional Components*****Bluffton and similar soils**

*Extent:* 2 percent of the unit

**Markey and similar soils**

*Extent:* 1 percent of the unit

**Prebish and similar soils**

*Extent:* 1 percent of the unit

**Seelyeville and similar soils**

*Extent:* 1 percent of the unit

**565—Eckvoll loamy fine sand, 0 to 3 percent slopes*****Component Description*****Eckvoll and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Moraines

*Position on the landform:* Flats and slight rises

*Slope range:* 0 to 3 percent

*Texture of the surface layer:* Loamy fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Moderately well drained

*Parent material:* Outwash over till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 1.5 feet (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, June, July, August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 8.3 inches

*Content of organic matter in the upper 10 inches:* 1.9 percent

*Typical profile:*

Ap—0 to 9 inches; loamy fine sand

E—9 to 24 inches; fine sand

2Bt—24 to 45 inches; loam

2C—45 to 80 inches; loam

***Additional Components*****Beltrami and similar soils**

*Extent:* 4 percent of the unit

**Bluffton and similar soils**

*Extent:* 4 percent of the unit

**Zimmerman and similar soils**

*Extent:* 2 percent of the unit

**567—Verndale sandy loam, 0 to 2 percent slopes*****Component Description*****Verndale and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Outwash plains and stream terraces

*Position on the landform:* Flats

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.8 inches

*Content of organic matter in the upper 10 inches:* 3.0 percent

*Typical profile:*

Ap—0 to 10 inches; sandy loam

Bt—10 to 19 inches; sandy loam

2Bw—19 to 28 inches; sand

2C—28 to 80 inches; sand

#### **Additional Components**

##### **Hubbard and similar soils**

*Extent:* 2 percent of the unit

##### **Isan and similar soils**

*Extent:* 2 percent of the unit

##### **Soils that have a gravelly substratum**

*Extent:* 1 percent of the unit

#### **623A—Pierz sandy loam, 0 to 2 percent slopes**

##### **Component Description**

##### **Pierz and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Outwash plains

*Position on the landform:* Flats

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 5.7 inches

*Content of organic matter in the upper 10 inches:* 3.0 percent

*Typical profile:*

Ap,A,AB—0 to 16 inches; sandy loam

Bt—16 to 29 inches; sandy loam

2C—29 to 80 inches; gravelly sand

#### **Additional Components**

##### **Isan and similar soils**

*Extent:* 2 percent of the unit

##### **Soils that have a thin loamy mantle**

*Extent:* 2 percent of the unit

##### **Stonelake and similar soils**

*Extent:* 1 percent of the unit

#### **623B—Pierz sandy loam, 2 to 6 percent slopes**

##### **Component Description**

##### **Pierz and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Hills on outwash plains

*Position on the landform:* Summits and backslopes

*Slope range:* 2 to 6 percent

*Texture of the surface layer:* Sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.8 inches

*Content of organic matter in the upper 10 inches:* 2.8 percent

*Typical profile:*

Ap—0 to 9 inches; sandy loam

Bt—9 to 22 inches; sandy loam

2C—22 to 80 inches; very gravelly coarse sand

#### **Additional Components**

##### **Soils that have a thin loamy mantle**

*Extent:* 3 percent of the unit

**Isan and similar soils**

*Extent:* 1 percent of the unit

**Stonelake and similar soils**

*Extent:* 1 percent of the unit

**708—Rushlake coarse sand, 1 to 4 percent slopes****Component Description****Rushlake and similar soils**

*Extent:* 85 percent of the unit

*Geomorphic description:* Beaches

*Position on the landform:* Flats and slight rises

*Slope range:* 1 to 4 percent

*Texture of the surface layer:* Coarse sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Moderately well drained

*Parent material:* Outwash

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 2.0 feet (April)

*Wet soil moisture status is lowest (depth, months):* 4.0 feet (February, August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.6 inches

*Content of organic matter in the upper 10 inches:* 2.1 percent

*Typical profile:*

A—0 to 9 inches; coarse sand

C—9 to 80 inches; coarse sand

**Additional Components****Isan and similar soils**

*Extent:* 10 percent of the unit

**Hubbard and similar soils**

*Extent:* 5 percent of the unit

**730A—Sanburn fine sandy loam, 0 to 2 percent slopes****Component Description****Sanburn and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Moraines and outwash plains

*Position on the landform:* Flats

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.3 inches

*Content of organic matter in the upper 10 inches:* 1.5 percent

*Typical profile:*

Ap—0 to 6 inches; fine sandy loam

Bt—6 to 18 inches; sandy loam

2Bt,2BC,2C—18 to 80 inches; gravelly coarse sand

**Additional Components****Soils that have a thick loamy mantle**

*Extent:* 6 percent of the unit

**Isan and similar soils**

*Extent:* 2 percent of the unit

**Moderately well drained soils**

*Extent:* 1 percent of the unit

**Stonelake and similar soils**

*Extent:* 1 percent of the unit

**730B—Sanburn fine sandy loam, 2 to 6 percent slopes****Component Description****Sanburn and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Hills on outwash plains and hills on moraines

*Position on the landform:* Summits and backslopes

*Slope range:* 2 to 6 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.3 inches

*Content of organic matter in the upper 10 inches:* 1.4 percent

*Typical profile:*

Ap—0 to 5 inches; fine sandy loam

Bt—5 to 19 inches; sandy loam

2BC,2C—19 to 80 inches; gravelly coarse sand

### **Additional Components**

#### **Soils that have a thin loamy mantle**

*Extent:* 6 percent of the unit

#### **Cushing and similar soils**

*Extent:* 1 percent of the unit

#### **Isan and similar soils**

*Extent:* 1 percent of the unit

#### **Moderately well drained soils**

*Extent:* 1 percent of the unit

#### **Stonelake and similar soils**

*Extent:* 1 percent of the unit

### **732B—Bushville fine sand, 2 to 6 percent slopes**

#### **Component Description**

##### **Bushville and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Drumlins

*Position on the landform:* Backslopes and summits

*Slope range:* 2 to 6 percent

*Texture of the surface layer:* Fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained

*Parent material:* Outwash over till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 1.0 foot (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, July, August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.9 inches

*Content of organic matter in the upper 10 inches:* 0.7 percent

*Typical profile:*

Ap—0 to 8 inches; fine sand

E1,E2,E3—8 to 28 inches; fine sand

2Bt—28 to 33 inches; fine sandy loam

2BC—33 to 43 inches; fine sandy loam

2Cd—43 to 80 inches; sandy loam

### **Additional Components**

#### **Soils that have a thick sandy mantle**

*Extent:* 2 percent of the unit

#### **Mora and similar soils**

*Extent:* 1 percent of the unit

#### **Parent and similar soils**

*Extent:* 1 percent of the unit

#### **Ronneby and similar soils**

*Extent:* 1 percent of the unit

### **768—Mosford sandy loam, 0 to 2 percent slopes**

#### **Component Description**

##### **Mosford and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Stream terraces and outwash plains

*Position on the landform:* Flats

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.8 inches

*Content of organic matter in the upper 10 inches:* 3.0 percent

*Typical profile:*

Ap,A—0 to 12 inches; sandy loam

Bw—12 to 16 inches; coarse sandy loam

2Bw—16 to 21 inches; coarse sand

2C—21 to 80 inches; sand

**Additional Components****Duelm and similar soils**

*Extent:* 1 percent of the unit

**Soils that have a gravelly substratum**

*Extent:* 1 percent of the unit

**Hubbard and similar soils**

*Extent:* 1 percent of the unit

**Isan and similar soils**

*Extent:* 1 percent of the unit

**Sandberg and similar soils**

*Extent:* 1 percent of the unit

**771—Elkriver fine sandy loam, 0 to 2 percent slopes, rarely flooded****Component Description****Elkriver, rarely flooded, and similar soils**

*Extent:* 95 percent of the unit

*Geomorphic description:* Flood plains

*Position on the landform:* Flats and slight rises

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Moderately well drained

*Parent material:* Alluvium

*Flooding does not occur (months):* January, February, July, August, September, October, November, December

*Flooding is most likely (frequency, months):* Rare (March, April, May, June)

*Wet soil moisture status is highest (depth, months):* 3.0 feet (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 8.2 inches

*Content of organic matter in the upper 10 inches:* 1.7 percent

*Typical profile:*

Ap—0 to 10 inches; fine sandy loam

A1,A3—10 to 35 inches; fine sandy loam

Bw—35 to 39 inches; fine sandy loam

2C—39 to 80 inches; sand

**Additional Components****Hubbard and similar soils**

*Extent:* 3 percent of the unit

**Fordum and similar soils**

*Extent:* 1 percent of the unit

**Occasionally flooded soils**

*Extent:* 1 percent of the unit

**799—Seelyeville and Bowstring soils, 0 to 1 percent slopes, frequently flooded****Component Description****Seelyeville, frequently flooded, and similar soils**

*Extent:* 45 percent of the unit

*Geomorphic description:* Flood plains

*Position on the landform:* Flats

*Slope range:* 0 to 1 percent

*Texture of the surface layer:* Muck

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Very poorly drained

*Parent material:* Organic material

*Flooding does not occur (months):* January, February, September, October, November, December

*Flooding is most likely (frequency, months):* Frequent (March, April, May, June)

*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)

*Wet soil moisture status is lowest (depth, months):* 1.8 feet (February)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 23.9 inches

*Content of organic matter in the upper 10 inches:* 62.0 percent

*Typical profile:*

Oa1—0 to 12 inches; muck

Oa2,Oa3—12 to 80 inches; muck

**Bowstring, frequently flooded, and similar soils**

*Extent:* 45 percent of the unit

*Geomorphic description:* Flood plains

*Position on the landform:* Flats

*Slope range:* 0 to 1 percent

*Texture of the surface layer:* Muck

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Very poorly drained

*Parent material:* Organic material and alluvium

*Flooding does not occur (months):* January, February, September, October, November, December

*Flooding is most likely (frequency, months):* Frequent (March, April, May, June)

*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)

*Wet soil moisture status is lowest (depth, months):* 1.8 feet (February)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 21.3 inches

*Content of organic matter in the upper 10 inches:* 65.0 percent

*Typical profile:*

Oa1, Oa2—0 to 38 inches; muck

Cg—38 to 47 inches; stratified fine sand to fine sandy loam

O'a—47 to 80 inches; muck

### **Additional Components**

#### **Fordum and similar soils**

*Extent:* 5 percent of the unit

#### **Soils that have a substratum of sand or gravel**

*Extent:* 4 percent of the unit

#### **Winterfield and similar soils**

*Extent:* 1 percent of the unit

### **1013—Pits, quarry**

#### **Component Description**

##### **Pits**

*Extent:* 90 percent of the unit

*Geomorphic description:* Stream terraces

*Position on the landform:* Flats

*Texture of the surface layer:* Unweathered bedrock

*Depth to restrictive feature:* Bedrock (lithic)—0 to 4 inches

*Parent material:* Bedrock, granite

*General description:* This map unit consists of open pits from which granite has been mined. These areas are active or abandoned. Some pits have water in them because they were mined to a depth below the regional aquifer.

### **Additional Components**

#### **Isan and similar soils**

*Extent:* 3 percent of the unit

#### **Soils that have sand over a bedrock substratum**

*Extent:* 3 percent of the unit

#### **Duelm and similar soils**

*Extent:* 2 percent of the unit

#### **Hubbard and similar soils**

*Extent:* 2 percent of the unit

### **1015—Udipsamments, cut and fill land**

#### **Component Description**

##### **Udipsamments**

*Extent:* 90 percent of the unit

*Geomorphic description:* Outwash plains and stream terraces

*Slope range:* 0 to 6 percent

*Parent material:* Variable sandy material

*Flooding:* None

*General description:* Udipsamments are nearly level areas that had minimal grading or were borrow areas. The cut and fill material is dominantly the sandy parent material. Because of the variability of this map unit, interpretations for specific uses are not available. Onsite investigation is needed.

### **Additional Components**

#### **Moderately well drained soils**

*Extent:* 4 percent of the unit

#### **Soils that have a gravelly substratum**

*Extent:* 3 percent of the unit

#### **Isan and similar soils**

*Extent:* 3 percent of the unit

### **1016—Udorthents, loamy, cut and fill land**

#### **Component Description**

##### **Udorthents**

*Extent:* 90 percent of the unit

*Geomorphic description:* Moraines

*Slope range:* 0 to 12 percent

*Parent material:* Variable loamy material

*Flooding:* None

*General description:* Udorthents consist primarily of areas that have been cut and/or filled for development. The cut and/or fill material is dominantly loamy soil material. As much as 30

percent of this map unit is covered by impervious surfaces. Most of the areas have been disturbed by construction activity. Because of the variability of this map unit, interpretations for specific uses are not available. Onsite investigation is needed.

### ***Additional Components***

#### **Sandy sediments**

*Extent:* 5 percent of the unit

#### **Soils that have a gravelly substratum**

*Extent:* 3 percent of the unit

#### **Poorly drained soils**

*Extent:* 2 percent of the unit

### **1028—Udorthents-Pits, gravel, complex**

#### ***Component Description***

##### **Udorthents**

*Extent:* 45 percent of the unit

*Geomorphic description:* Moraines, outwash plains, stream terraces

*Parent material:* Outwash

*General description:* Udorthents are areas of soil that support plant growth. They consist of areas of former pits that have been reclaimed or abandoned. Because of the variability of this component, interpretations for specific uses are not available. Onsite investigation is needed.

##### **Pits, gravel**

*Extent:* 40 percent of the unit

*Geomorphic description:* Moraines, outwash plains, and stream terraces

*Parent material:* Sandy and gravelly outwash

*General description:* Gravel pits are areas that have been mined for gravel or sand. Areas are being actively mined or are abandoned. Because of the variability of this component, interpretations for specific uses are not available. Onsite investigation is needed.

### ***Additional Components***

#### **Stonelake and similar soils**

*Extent:* 8 percent of the unit

#### **Hubbard and similar soils**

*Extent:* 3 percent of the unit

#### **Sanburn and similar soils**

*Extent:* 3 percent of the unit

### **Soils that have a loamy substratum**

*Extent:* 1 percent of the unit

### **1109—Isanti loamy fine sand, 0 to 2 percent slopes**

#### ***Component Description***

##### **Isanti and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Outwash plains

*Position on the landform:* Flats

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Loamy fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Poorly drained

*Parent material:* Outwash

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 0.5 foot (April, May)

*Wet soil moisture status is lowest (depth, months):* 2.0 feet (August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.5 inches

*Content of organic matter in the upper 10 inches:* 9.0 percent

*Typical profile:*

Ap,AB—0 to 16 inches; loamy fine sand

Bg—16 to 23 inches; loamy fine sand

BCg,Cg—23 to 80 inches; fine sand

### ***Additional Components***

#### **Lino and similar soils**

*Extent:* 7 percent of the unit

#### **Soils that have a surface layer of muck**

*Extent:* 3 percent of the unit

### **1110—Isan sandy loam, 0 to 2 percent slopes**

#### ***Component Description***

##### **Isan and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Outwash plains and stream terraces

*Position on the landform:* Flats and swales

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Poorly drained

*Parent material:* Outwash

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 0.5 foot (April, May)

*Wet soil moisture status is lowest (depth, months):* 2.0 feet (August, September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.8 inches

*Content of organic matter in the upper 10 inches:* 6.5 percent

*Typical profile:*

Ap,A—0 to 18 inches; sandy loam

AB,Bg—18 to 29 inches; loamy sand

Cg—29 to 80 inches; coarse sand

#### **Additional Components**

#### **Soils that have a surface layer of muck**

*Extent:* 6 percent of the unit

#### **Duelm and similar soils**

*Extent:* 4 percent of the unit

### **1223—Sandberg-Arvilla complex, 0 to 3 percent slopes**

#### **Component Description**

#### **Sandberg and similar soils**

*Extent:* 60 percent of the unit

*Geomorphic description:* Stream terraces

*Position on the landform:* Slight rises

*Slope range:* 1 to 3 percent

*Texture of the surface layer:* Loamy coarse sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.9 inches

*Content of organic matter in the upper 10 inches:* 2.5 percent

*Typical profile:*

Ap—0 to 11 inches; loamy coarse sand

Bw,BC—11 to 35 inches; gravelly coarse sand

C—35 to 80 inches; gravelly coarse sand

#### **Arvilla and similar soils**

*Extent:* 30 percent of the unit

*Geomorphic description:* Stream terraces

*Position on the landform:* Flats

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Coarse sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.1 inches

*Content of organic matter in the upper 10 inches:* 2.5 percent

*Typical profile:*

Ap,A—0 to 14 inches; coarse sandy loam

Bw—14 to 17 inches; coarse sandy loam

2Bw,2C—17 to 80 inches; gravelly coarse sand

#### **Additional Components**

#### **Soils that have a sandy substratum**

*Extent:* 5 percent of the unit

#### **Soils that have a gravelly surface layer**

*Extent:* 3 percent of the unit

#### **Duelm and similar soils**

*Extent:* 1 percent of the unit

#### **Isan and similar soils**

*Extent:* 1 percent of the unit

### **1224—Hubbard-Verndale complex, 0 to 3 percent slopes**

#### **Component Description**

#### **Hubbard and similar soils**

*Extent:* 60 percent of the unit

*Geomorphic description:* Stream terraces and outwash plains

*Position on the landform:* Slight rises

*Slope range:* 0 to 3 percent

*Texture of the surface layer:* Loamy coarse sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 3.5 inches  
*Content of organic matter in the upper 10 inches:* 3.0 percent  
*Typical profile:*  
 Ap—0 to 11 inches; loamy coarse sand  
 Bw—11 to 27 inches; loamy sand  
 BC,C—27 to 80 inches; coarse sand

#### **Verndale and similar soils**

*Extent:* 35 percent of the unit  
*Geomorphic description:* Stream terraces and outwash plains  
*Position on the landform:* Flats  
*Slope range:* 0 to 2 percent  
*Texture of the surface layer:* Coarse sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 5.1 inches  
*Content of organic matter in the upper 10 inches:* 3.0 percent  
*Typical profile:*  
 Ap—0 to 10 inches; coarse sandy loam  
 Bt—10 to 16 inches; coarse sandy loam  
 2Bw—16 to 45 inches; coarse sand  
 2C—45 to 80 inches; sand

#### **Additional Components**

##### **Soils that have a gravelly substratum**

*Extent:* 3 percent of the unit

##### **Duelm and similar soils**

*Extent:* 1 percent of the unit

##### **Isan and similar soils**

*Extent:* 1 percent of the unit

## **1231—Hubbard-Mosford complex, 0 to 3 percent slopes**

### **Component Description**

#### **Hubbard and similar soils**

*Extent:* 60 percent of the unit  
*Geomorphic description:* Outwash plains and stream terraces  
*Position on the landform:* Slight rises  
*Slope range:* 0 to 3 percent  
*Texture of the surface layer:* Loamy sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 3.6 inches  
*Content of organic matter in the upper 10 inches:* 3.0 percent  
*Typical profile:*  
 Ap,A—0 to 13 inches; loamy sand  
 Bw—13 to 19 inches; loamy sand  
 BC,C—19 to 80 inches; sand

#### **Mosford and similar soils**

*Extent:* 35 percent of the unit  
*Geomorphic description:* Outwash plains and stream terraces  
*Position on the landform:* Flats  
*Slope range:* 0 to 2 percent  
*Texture of the surface layer:* Sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Somewhat excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 5.1 inches  
*Content of organic matter in the upper 10 inches:* 3.0 percent  
*Typical profile:*  
 Ap,A—0 to 13 inches; sandy loam  
 Bw—13 to 16 inches; coarse sandy loam

2Bw—16 to 35 inches; coarse sand

2C—35 to 80 inches; sand

### ***Additional Components***

#### **Soils that have a gravelly substratum**

*Extent:* 3 percent of the unit

#### **Duelm and similar soils**

*Extent:* 1 percent of the unit

#### **Isan and similar soils**

*Extent:* 1 percent of the unit

### **1253B—Stonelake-Sanburn complex, 1 to 6 percent slopes**

#### ***Component Description***

##### **Stonelake and similar soils**

*Extent:* 60 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Shoulders and summits

*Slope range:* 1 to 6 percent

*Texture of the surface layer:* Gravelly loamy sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 2.9 inches

*Content of organic matter in the upper 10 inches:* 1.1 percent

*Typical profile:*

Ap—0 to 4 inches; gravelly loamy sand

Bw—4 to 11 inches; gravelly coarse sand

Bt—11 to 24 inches; very gravelly coarse sand

BC,C—24 to 80 inches; gravelly sand

### ***Additional Components***

#### **Sanburn and similar soils**

*Extent:* 30 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Footslopes and backslopes

*Slope range:* 1 to 6 percent

*Texture of the surface layer:* Sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.4 inches

*Content of organic matter in the upper 10 inches:* 1.4 percent

*Typical profile:*

Ap—0 to 5 inches; sandy loam

Bt—5 to 20 inches; gravelly sandy loam

2BC,2C—20 to 80 inches; gravelly coarse sand

### ***Additional Components***

#### **Soils that have a sandy substratum**

*Extent:* 5 percent of the unit

#### **Isan and similar soils**

*Extent:* 2 percent of the unit

#### **Markey and similar soils**

*Extent:* 2 percent of the unit

#### **Moderately well drained soils**

*Extent:* 1 percent of the unit

### **1253C—Stonelake-Sanburn complex, 6 to 15 percent slopes**

#### ***Component Description***

##### **Stonelake and similar soils**

*Extent:* 65 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Summits and shoulders

*Slope range:* 6 to 15 percent

*Texture of the surface layer:* Gravelly loamy coarse sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.0 inches

*Content of organic matter in the upper 10 inches:* 1.4 percent

*Typical profile:*

Ap—0 to 5 inches; gravelly loamy coarse sand

Bt—5 to 16 inches; very gravelly loamy coarse sand

BC,C—16 to 80 inches; gravelly coarse sand

#### **Sanburn and similar soils**

*Extent:* 25 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Footslopes and backslopes

*Slope range:* 6 to 15 percent

*Texture of the surface layer:* Sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.3 inches

*Content of organic matter in the upper 10 inches:* 1.8 percent

*Typical profile:*

Ap—0 to 8 inches; sandy loam

Bt—8 to 17 inches; sandy loam

2C—17 to 80 inches; coarse sand

#### **Additional Components**

##### **Soils that have a sandy substratum**

*Extent:* 5 percent of the unit

##### **Markey and similar soils**

*Extent:* 2 percent of the unit

##### **Braham and similar soils**

*Extent:* 1 percent of the unit

##### **Isan and similar soils**

*Extent:* 1 percent of the unit

##### **Nebish and similar soils**

*Extent:* 1 percent of the unit

### **1253E—Stonelake-Sanburn complex, 15 to 40 percent slopes**

#### **Component Description**

##### **Stonelake and similar soils**

*Extent:* 65 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Summits and shoulders

*Slope range:* 15 to 40 percent

*Texture of the surface layer:* Loamy coarse sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 2.7 inches

*Content of organic matter in the upper 10 inches:* 0.7 percent

*Typical profile:*

A—0 to 2 inches; loamy coarse sand

E—2 to 8 inches; very gravelly loamy coarse sand

Bt—8 to 16 inches; very gravelly coarse sand

C—16 to 80 inches; gravelly coarse sand

#### **Sanburn and similar soils**

*Extent:* 25 percent of the unit

*Geomorphic description:* Hills on moraines

*Position on the landform:* Footslopes and backslopes

*Slope range:* 15 to 30 percent

*Texture of the surface layer:* Sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding:* None

*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 3.0 inches

*Content of organic matter in the upper 10 inches:* 1.4 percent

*Typical profile:*

A—0 to 5 inches; sandy loam

Bt—5 to 14 inches; sandy loam

2C—14 to 80 inches; coarse sand

#### **Additional Components**

##### **Markey and similar soils**

*Extent:* 3 percent of the unit

##### **Soils that have a sandy substratum**

*Extent:* 3 percent of the unit

##### **Isan and similar soils**

*Extent:* 2 percent of the unit

**Braham and similar soils***Extent:* 1 percent of the unit**Pierz and similar soils***Extent:* 1 percent of the unit**1254—Ricelake fine sandy loam, 0 to 3 percent slopes*****Component Description*****Ricelake and similar soils***Extent:* 90 percent of the unit*Geomorphic description:* Outwash plains*Position on the landform:* Flats and slight rises*Slope range:* 0 to 3 percent*Texture of the surface layer:* Fine sandy loam*Depth to restrictive feature:* Very deep (more than 60 inches)*Drainage class:* Somewhat poorly drained*Parent material:* Glacial outwash over till*Flooding:* None*Wet soil moisture status is highest (depth, months):* 1.5 feet (April)*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (February, August)*Ponding:* None*Available water capacity to a depth of 60 inches:* 8.3 inches*Content of organic matter in the upper 10 inches:* 3.2 percent*Typical profile:*

A—0 to 9 inches; fine sandy loam

E—9 to 27 inches; loamy fine sand

Bt—27 to 48 inches; fine sandy loam

2Cg—48 to 80 inches; clay loam

***Additional Components*****Isanti and similar soils***Extent:* 3 percent of the unit**Soils that have a sandy substratum***Extent:* 3 percent of the unit**Beltrami and similar soils***Extent:* 2 percent of the unit**Eckvold and similar soils***Extent:* 2 percent of the unit**1255—Elkriver fine sandy loam, 0 to 2 percent slopes, occasionally flooded*****Component Description*****Elkriver, occasionally flooded, and similar soils***Extent:* 90 percent of the unit*Geomorphic description:* Flood plains*Position on the landform:* Flats*Slope range:* 0 to 2 percent*Texture of the surface layer:* Fine sandy loam*Depth to restrictive feature:* Very deep (more than 60 inches)*Drainage class:* Somewhat poorly drained*Parent material:* Alluvium*Flooding does not occur (months):* January, February, September, October, November, December*Flooding is most likely (frequency, months):*

Occasional (March, April, May, June, July, August)

*Wet soil moisture status is highest (depth, months):* 1.5 feet (April)*Wet soil moisture status is lowest (depth, months):* 4.5 feet (February)*Ponding:* None*Available water capacity to a depth of 60 inches:* 7.4 inches*Content of organic matter in the upper 10 inches:* 1.7 percent*Typical profile:*

Ap—0 to 10 inches; fine sandy loam

A1,A3—10 to 26 inches; fine sandy loam

Bw—26 to 32 inches; very fine sandy loam

2C—32 to 80 inches; sand

***Additional Components*****Fordum and similar soils***Extent:* 5 percent of the unit**Soils that have a gravelly substratum***Extent:* 2 percent of the unit**Winterfield and similar soils***Extent:* 2 percent of the unit**Soils that have a gravelly surface layer***Extent:* 1 percent of the unit

## 1256—Cantlin loamy fine sand, 0 to 3 percent slopes

### Component Description

#### Cantlin and similar soils

*Extent:* 90 percent of the unit

*Geomorphic description:* Outwash plains

*Position on the landform:* Flats and slight rises

*Slope range:* 0 to 3 percent

*Texture of the surface layer:* Loamy fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Well drained

*Parent material:* Outwash

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 3.5 feet (April, May)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (August, September, October)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.1 inches

*Content of organic matter in the upper 10 inches:* 1.1 percent

*Typical profile:*

Ap—0 to 8 inches; loamy fine sand

Bw—8 to 22 inches; loamy fine sand

BC,C—22 to 80 inches; fine sand

### Additional Components

#### Lino and similar soils

*Extent:* 4 percent of the unit

#### Isanti and similar soils

*Extent:* 2 percent of the unit

#### Soils that have a substratum of sand or gravel

*Extent:* 2 percent of the unit

#### Zimmerman and similar soils

*Extent:* 2 percent of the unit

## 1257—Elkriver-Mosford complex, 0 to 6 percent slopes, rarely flooded

### Component Description

#### Elkriver, rarely flooded, and similar soils

*Extent:* 55 percent of the unit

*Geomorphic description:* Flood plains

*Position on the landform:* Flats

*Slope range:* 0 to 3 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Moderately well drained

*Parent material:* Alluvium

*Flooding does not occur (months):* January, February, July, August, September, October, November, December

*Flooding is most likely (frequency, months):* Rare (March, April, May, June)

*Wet soil moisture status is highest (depth, months):* 3.0 feet (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 7.5 inches

*Content of organic matter in the upper 10 inches:* 1.7 percent

*Typical profile:*

Ap—0 to 11 inches; fine sandy loam

AB—11 to 20 inches; fine sandy loam

Bw—20 to 34 inches; fine sandy loam

2C—34 to 80 inches; fine sand

#### Mosford, rarely flooded, and similar soils

*Extent:* 35 percent of the unit

*Geomorphic description:* Flood plains

*Position on the landform:* Slight rises

*Slope range:* 0 to 6 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat excessively drained

*Parent material:* Outwash

*Flooding does not occur (months):* January, February, July, August, September, October, November, December

*Flooding is most likely (frequency, months):* Rare (March, April, May, June)

*Wet soil moisture status is highest (depth, months):* 3.0 feet (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.9 inches

*Content of organic matter in the upper 10 inches:* 3.0 percent

*Typical profile:*

Ap—0 to 11 inches; fine sandy loam

Bw—11 to 16 inches; fine sandy loam

2Bw—16 to 25 inches; fine sand  
2C—25 to 80 inches; sand

***Additional Components***

**Fordum and similar soils**

*Extent:* 4 percent of the unit

**Soils that have a sandy surface layer**

*Extent:* 4 percent of the unit

**Winterfield and similar soils**

*Extent:* 2 percent of the unit

**1258B—Zimmerman fine sand, thick solum, 1 to 6 percent slopes**

***Component Description***

**Zimmerman, thick solum, and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Hills on outwash plains  
*Position on the landform:* Backslopes and summits  
*Slope range:* 1 to 6 percent  
*Texture of the surface layer:* Fine sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 4.8 inches  
*Content of organic matter in the upper 10 inches:* 0.6 percent  
*Typical profile:*  
A—0 to 2 inches; fine sand  
Bw,E—2 to 62 inches; fine sand  
E' & Bt—62 to 80 inches; fine sand

***Additional Components***

**Cantlin and similar soils**

*Extent:* 2 percent of the unit

**Lino and similar soils**

*Extent:* 2 percent of the unit

**Isanti and similar soils**

*Extent:* 1 percent of the unit

**1258C—Zimmerman fine sand, thick solum, 6 to 12 percent slopes**

***Component Description***

**Zimmerman, thick solum, and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Hills on outwash plains  
*Position on the landform:* Backslopes and summits  
*Slope range:* 6 to 12 percent  
*Texture of the surface layer:* Fine sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 4.8 inches  
*Content of organic matter in the upper 10 inches:* 0.7 percent  
*Typical profile:*  
A—0 to 3 inches; fine sand  
Bw,E—3 to 70 inches; fine sand  
E' & Bt—70 to 80 inches; fine sand

***Additional Components***

**Isanti and similar soils**

*Extent:* 2 percent of the unit

**Lino and similar soils**

*Extent:* 2 percent of the unit

**Cantlin and similar soils**

*Extent:* 1 percent of the unit

**1258E—Zimmerman fine sand, thick solum, 12 to 35 percent slopes**

***Component Description***

**Zimmerman, thick solum, and similar soils**

*Extent:* 95 percent of the unit  
*Geomorphic description:* Hills on outwash plains  
*Position on the landform:* Shoulders and backslopes  
*Slope range:* 12 to 35 percent  
*Texture of the surface layer:* Fine sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 4.8 inches  
*Content of organic matter in the upper 10 inches:* 0.6 percent  
*Typical profile:*  
 A—0 to 2 inches; fine sand  
 Bw,E—2 to 62 inches; fine sand  
 E' & Bt—62 to 80 inches; fine sand

### **Additional Components**

#### **Isanti and similar soils**

*Extent:* 3 percent of the unit

#### **Cantlin and similar soils**

*Extent:* 1 percent of the unit

#### **Lino and similar soils**

*Extent:* 1 percent of the unit

### **1260B—Stonelake-Nebish complex, 2 to 6 percent slopes**

#### **Component Description**

#### **Stonelake and similar soils**

*Extent:* 55 percent of the unit  
*Geomorphic description:* Hills on moraines  
*Position on the landform:* Summits and shoulders  
*Slope range:* 2 to 6 percent  
*Texture of the surface layer:* Loamy coarse sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 3.4 inches  
*Content of organic matter in the upper 10 inches:* 1.1 percent  
*Typical profile:*  
 Ap—0 to 8 inches; loamy coarse sand  
 Bt—8 to 30 inches; very gravelly loamy coarse sand  
 BC,C—30 to 80 inches; gravelly sand

#### **Nebish and similar soils**

*Extent:* 30 percent of the unit  
*Geomorphic description:* Hills on moraines  
*Position on the landform:* Backslopes and summits  
*Slope range:* 2 to 6 percent  
*Texture of the surface layer:* Fine sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Parent material:* Till  
*Flooding:* None  
*Wet soil moisture status is highest (depth, months):* 3.6 feet (April)  
*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, July, August, September)  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 9.7 inches  
*Content of organic matter in the upper 10 inches:* 1.2 percent  
*Typical profile:*  
 Ap—0 to 6 inches; fine sandy loam  
 E—6 to 9 inches; fine sandy loam  
 Bt—9 to 43 inches; clay loam  
 Bk—43 to 80 inches; loam

### **Additional Components**

#### **Beltrami and similar soils**

*Extent:* 4 percent of the unit

#### **Talmoon and similar soils**

*Extent:* 4 percent of the unit

#### **Braham and similar soils**

*Extent:* 3 percent of the unit

#### **Soils that have a sandy substratum**

*Extent:* 3 percent of the unit

#### **Soils that have a substratum of sandy loam**

*Extent:* 1 percent of the unit

### **1260C—Stonelake-Nebish complex, 6 to 12 percent slopes**

#### **Component Description**

#### **Stonelake and similar soils**

*Extent:* 55 percent of the unit  
*Geomorphic description:* Hills on moraines  
*Position on the landform:* Summits and shoulders

*Slope range:* 6 to 12 percent  
*Texture of the surface layer:* Loamy sand  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 3.3 inches  
*Content of organic matter in the upper 10 inches:* 1.0 percent  
*Typical profile:*  
 Ap—0 to 7 inches; loamy sand  
 E—7 to 20 inches; loamy coarse sand  
 Bt—20 to 42 inches; very gravelly coarse sand  
 C—42 to 80 inches; very gravelly coarse sand

**Nebish and similar soils**

*Extent:* 30 percent of the unit  
*Geomorphic description:* Hills on moraines  
*Position on the landform:* Backslopes and summits  
*Slope range:* 6 to 12 percent  
*Texture of the surface layer:* Fine sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Parent material:* Till  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 9.4 inches  
*Content of organic matter in the upper 10 inches:* 1.0 percent  
*Typical profile:*  
 Ap—0 to 3 inches; fine sandy loam  
 E—3 to 10 inches; fine sandy loam  
 Bt—10 to 29 inches; clay loam  
 Bk—29 to 80 inches; loam

**Additional Components**

**Beltrami and similar soils**

*Extent:* 4 percent of the unit

**Talmoon and similar soils**

*Extent:* 4 percent of the unit

**Braham and similar soils**

*Extent:* 3 percent of the unit

**Soils that have a sandy substratum**

*Extent:* 3 percent of the unit

**Soils that have a substratum of sandy loam**

*Extent:* 1 percent of the unit

**1260E—Stonelake-Nebish complex, 12 to 25 percent slopes**

**Component Description**

**Stonelake and similar soils**

*Extent:* 60 percent of the unit  
*Geomorphic description:* Hills on moraines  
*Position on the landform:* Shoulders and summits  
*Slope range:* 12 to 25 percent  
*Texture of the surface layer:* Gravelly coarse sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Excessively drained  
*Parent material:* Outwash  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year  
*Ponding:* None  
*Available water capacity to a depth of 60 inches:* 2.9 inches  
*Content of organic matter in the upper 10 inches:* 1.4 percent  
*Typical profile:*  
 A—0 to 5 inches; gravelly coarse sandy loam  
 Bw—5 to 11 inches; very gravelly coarse sand  
 Bt—11 to 20 inches; very gravelly coarse sand  
 BC,C—20 to 80 inches; very gravelly coarse sand

**Nebish and similar soils**

*Extent:* 25 percent of the unit  
*Geomorphic description:* Hills on moraines  
*Position on the landform:* Backslopes and summits  
*Slope range:* 12 to 25 percent  
*Texture of the surface layer:* Fine sandy loam  
*Depth to restrictive feature:* Very deep (more than 60 inches)  
*Drainage class:* Well drained  
*Parent material:* Till  
*Flooding:* None  
*Depth to wet soil moisture status:* More than 6.7 feet all year

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 9.4 inches

*Content of organic matter in the upper 10 inches:* 1.4 percent

*Typical profile:*

A—0 to 5 inches; fine sandy loam  
 EB—5 to 9 inches; fine sandy loam  
 Bt—9 to 27 inches; clay loam  
 Bk—27 to 80 inches; loam

### ***Additional Components***

#### **Beltrami and similar soils**

*Extent:* 4 percent of the unit

#### **Talmoon and similar soils**

*Extent:* 4 percent of the unit

#### **Braham and similar soils**

*Extent:* 3 percent of the unit

#### **Soils that have a sandy substratum**

*Extent:* 3 percent of the unit

#### **Soils that have a substratum of sandy loam**

*Extent:* 1 percent of the unit

### **1270B—Milaca fine sandy loam, moderately wet, 3 to 6 percent slopes**

#### ***Component Description***

##### **Milaca, moderately wet, and similar soils**

*Extent:* 90 percent of the unit

*Geomorphic description:* Drumlins

*Position on the landform:* Summits and backslopes

*Slope range:* 3 to 6 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Moderately well drained

*Parent material:* Till

*Flooding:* None

*Wet soil moisture status is highest (depth, months):* 2.5 feet (April)

*Wet soil moisture status is lowest (depth, months):* More than 6.7 feet (January, February, July, August, September, October)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 5.8 inches

*Content of organic matter in the upper 10 inches:* 0.6 percent

*Typical profile:*

A—0 to 6 inches; fine sandy loam  
 E, BE—6 to 19 inches; fine sandy loam  
 Bt—19 to 28 inches; fine sandy loam  
 BC—28 to 45 inches; fine sandy loam  
 Cd—45 to 80 inches; sandy loam

### ***Additional Components***

#### **Ronneby and similar soils**

*Extent:* 6 percent of the unit

#### **Parent and similar soils**

*Extent:* 2 percent of the unit

#### **Prebish and similar soils**

*Extent:* 2 percent of the unit

### **1288—Seelyeville-Markey complex, ponded, 0 to 1 percent slopes**

#### ***Component Description***

##### **Seelyeville, ponded, and similar soils**

*Extent:* 60 percent of the unit

*Geomorphic description:* Outwash plains and stream terraces

*Position on the landform:* Depressions

*Slope range:* 0 to 1 percent

*Texture of the surface layer:* Muck

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Very poorly drained

*Parent material:* Organic material

*Flooding:* None

*Wet soil moisture status:* At the surface all year

*Ponding is shallowest (depth, months):* 0.5 foot (August)

*Ponding is deepest (depth, months):* 3.0 feet (March, April, May)

*Available water capacity to a depth of 60 inches:* 23.9 inches

*Content of organic matter in the upper 10 inches:* 62.0 percent

*Typical profile:*

Oa1—0 to 15 inches; muck  
 Oa2, Oa3—15 to 80 inches; muck

#### **Markey, ponded, and similar soils**

*Extent:* 30 percent of the unit

*Geomorphic description:* Outwash plains and stream terraces

*Position on the landform:* Depressions

*Slope range:* 0 to 1 percent

*Texture of the surface layer:* Muck

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Very poorly drained

*Parent material:* Organic material over outwash

*Flooding:* None

*Wet soil moisture status:* At the surface all year

*Ponding is shallowest (depth, months):* 0.5 foot (August)

*Ponding is deepest (depth, months):* 3.0 feet (March, April, May)

*Available water capacity to a depth of 60 inches:* 12.8 inches

*Content of organic matter in the upper 10 inches:* 70.0 percent

*Typical profile:*

Oa—0 to 27 inches; muck

A—27 to 32 inches; loamy sand

Cg—32 to 80 inches; sand

### **Additional Components**

#### **Prebish and similar soils**

*Extent:* 6 percent of the unit

#### **Isan and similar soils**

*Extent:* 2 percent of the unit

#### **Isanti and similar soils**

*Extent:* 2 percent of the unit

### **1356—Water, miscellaneous**

#### **Component Description**

- This map unit consists of constructed areas of water. It includes sewage lagoons, storm-water sediment basins with a permanent pool of water, and aquaculture ponds.

### **1946—Fordum-Winterfield complex, 0 to 2 percent slopes, frequently flooded**

#### **Component Description**

#### **Fordum, frequently flooded, and similar soils**

*Extent:* 65 percent of the unit

*Geomorphic description:* Flood plains

*Position on the landform:* Concave drainageways

*Slope range:* 0 to 1 percent

*Texture of the surface layer:* Fine sandy loam

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Very poorly drained

*Parent material:* Alluvium

*Flooding does not occur (months):* January, February, September, October, November, December

*Flooding is most likely (frequency, months):* Frequent (March, April, May, June)

*Wet soil moisture status is highest (depth, months):* At the surface (April, May, June)

*Wet soil moisture status is lowest (depth, months):* 1.8 feet (February)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 6.6 inches

*Content of organic matter in the upper 10 inches:* 6.6 percent

*Typical profile:*

A—0 to 7 inches; fine sandy loam

Cg—7 to 28 inches; sandy loam

2Cg—28 to 80 inches; sand

#### **Winterfield, frequently flooded, and similar soils**

*Extent:* 20 percent of the unit

*Geomorphic description:* Flood plains

*Position on the landform:* Slight rises

*Slope range:* 0 to 2 percent

*Texture of the surface layer:* Loamy fine sand

*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained

*Parent material:* Alluvium

*Flooding does not occur (months):* January, February, September, October, November, December

*Flooding is most likely (frequency, months):* Frequent (March, April)

*Wet soil moisture status is highest (depth, months):* 1.5 feet (April)

*Wet soil moisture status is lowest (depth, months):* 4.5 feet (September)

*Ponding:* None

*Available water capacity to a depth of 60 inches:* 4.7 inches

*Content of organic matter in the upper 10 inches:* 1.7 percent

*Typical profile:*

A—0 to 8 inches; loamy fine sand

C1,C2—8 to 20 inches; sand

C3,C5—20 to 80 inches; sand

***Additional Components*****Soils that have a gravelly substratum**

*Extent:* 4 percent of the unit

**Bowstring and similar soils**

*Extent:* 3 percent of the unit

**Soils that have a loamy substratum**

*Extent:* 3 percent of the unit

**Seelyeville and similar soils**

*Extent:* 3 percent of the unit

**Markey and similar soils**

*Extent:* 2 percent of the unit

**W—Water*****Component Description***

- This map unit consists of naturally occurring basins of surface water.

Table 2.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
7A	Hubbard loamy sand, 0 to 2 percent slopes-----	6,280	2.2
7B	Hubbard loamy sand, 2 to 6 percent slopes-----	15,596	5.4
7C	Hubbard loamy sand, 6 to 12 percent slopes-----	3,692	1.3
32B	Nebish fine sandy loam, 2 to 6 percent slopes-----	3,206	1.1
32C	Nebish fine sandy loam, 6 to 12 percent slopes-----	1,445	0.5
32D	Nebish fine sandy loam, 12 to 18 percent slopes-----	231	*
32E	Nebish fine sandy loam, 18 to 35 percent slopes-----	113	*
38B	Waukon fine sandy loam, 2 to 6 percent slopes-----	88	*
75	Bluffton loam, depressionnal, 0 to 1 percent slopes-----	192	*
125	Beltrami fine sandy loam, 0 to 3 percent slopes-----	1,015	0.4
152C	Milaca fine sandy loam, 6 to 12 percent slopes-----	89	*
152E	Milaca fine sandy loam, 12 to 25 percent slopes-----	46	*
158A	Zimmerman fine sand, 0 to 3 percent slopes-----	20,963	7.3
158B	Zimmerman fine sand, 3 to 6 percent slopes-----	31,048	10.8
158C	Zimmerman fine sand, 6 to 12 percent slopes-----	6,366	2.2
158E	Zimmerman fine sand, 12 to 25 percent slopes-----	1,482	0.5
161	Isanti fine sandy loam, depressionnal, 0 to 1 percent slopes-----	1,295	0.4
162	Lino loamy fine sand, 0 to 2 percent slopes-----	9,142	3.2
164A	Mora loam, 0 to 3 percent slopes-----	1,481	0.5
165	Parent loam, 0 to 2 percent slopes-----	808	0.3
166	Ronneby loam, 0 to 2 percent slopes-----	1,203	0.4
169B	Braham loamy fine sand, 3 to 6 percent slopes-----	1,847	0.6
169C	Braham loamy fine sand, 6 to 12 percent slopes-----	692	0.2
169D	Braham loamy fine sand, 12 to 18 percent slopes-----	171	*
204B	Cushing fine sandy loam, 2 to 8 percent slopes-----	505	0.2
204C	Cushing fine sandy loam, 8 to 15 percent slopes-----	198	*
258B	Sandberg loamy coarse sand, 1 to 6 percent slopes-----	4,821	1.7
258C	Sandberg loamy coarse sand, 6 to 12 percent slopes-----	1,480	0.5
258E	Sandberg loamy coarse sand, 12 to 35 percent slopes-----	2,388	0.8
260	Duelm loamy sand, 0 to 2 percent slopes-----	3,396	1.2
261	Isan sandy loam, depressionnal, 0 to 1 percent slopes-----	418	0.1
325	Prebish fine sandy loam, depressionnal, 0 to 1 percent slopes-----	104	*
341	Arvilla sandy loam, 0 to 2 percent slopes-----	995	0.3
346	Talmoon loam, 0 to 2 percent slopes-----	2,253	0.8
373	Renshaw loam, 0 to 3 percent slopes-----	255	*
454B	Mahtomedi loamy coarse sand, 1 to 6 percent slopes-----	2,135	0.7
454C	Mahtomedi loamy coarse sand, 6 to 15 percent slopes-----	820	0.3
540	Seelyeville muck, 0 to 1 percent slopes-----	19,247	6.7
543	Markey muck, 0 to 1 percent slopes-----	7,172	2.5
544	Cathro muck, 0 to 1 percent slopes-----	745	0.3
565	Eckvoll loamy fine sand, 0 to 3 percent slopes-----	1,626	0.6
567	Verndale sandy loam, 0 to 2 percent slopes-----	1,133	0.4
623A	Pierz sandy loam, 0 to 2 percent slopes-----	1,207	0.4
623B	Pierz sandy loam, 2 to 6 percent slopes-----	928	0.3
708	Rushlake coarse sand, 1 to 4 percent slopes-----	210	*
730A	Sanburn fine sandy loam, 0 to 2 percent slopes-----	457	0.2
730B	Sanburn fine sandy loam, 2 to 6 percent slopes-----	2,737	0.9
732B	Bushville fine sand, 2 to 6 percent slopes-----	547	0.2
768	Mosford sandy loam, 0 to 2 percent slopes-----	1,091	0.4
771	Elkriver fine sandy loam, 0 to 2 percent slopes, rarely flooded-----	1,259	0.4
799	Seelyeville and Bowstring soils, 0 to 1 percent slopes, frequently flooded-----	6,267	2.2
1013	Pits, quarry-----	76	*
1015	Udipsamments, cut and fill land-----	1,054	0.4
1016	Udorthents, loamy, cut and fill land-----	177	*
1028	Udorthents-Pits, gravel, complex-----	1,517	0.5
1109	Isanti loamy fine sand, 0 to 2 percent slopes-----	9,285	3.2
1110	Isan sandy loam, 0 to 2 percent slopes-----	3,483	1.2
1223	Sandberg-Arvilla complex, 0 to 3 percent slopes-----	4,787	1.7
1224	Hubbard-Verndale complex, 0 to 3 percent slopes-----	2,319	0.8
1231	Hubbard-Mosford complex, 0 to 3 percent slopes-----	37,693	13.1
1253B	Stonelake-Sanburn complex, 1 to 6 percent slopes-----	3,451	1.2

See footnote at end of table.

Table 2.--Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
1253C	Stonelake-Sanburn complex, 6 to 15 percent slopes-----	3,298	1.1
1253E	Stonelake-Sanburn complex, 15 to 40 percent slopes-----	1,758	0.6
1254	Ricelake fine sandy loam, 0 to 3 percent slopes-----	1,365	0.5
1255	Elkriver fine sandy loam, 0 to 2 percent slopes, occasionally flooded---	1,216	0.4
1256	Cantlin loamy fine sand, 0 to 3 percent slopes-----	7,338	2.5
1257	Elkriver-Mosford complex, 0 to 6 percent slopes, rarely flooded-----	873	0.3
1258B	Zimmerman fine sand, thick solum, 1 to 6 percent slopes-----	2,965	1.0
1258C	Zimmerman fine sand, thick solum, 6 to 12 percent slopes-----	2,525	0.9
1258E	Zimmerman fine sand, thick solum, 12 to 35 percent slopes-----	1,051	0.4
1260B	Stonelake-Nebish complex, 2 to 6 percent slopes-----	1,835	0.6
1260C	Stonelake-Nebish complex, 6 to 12 percent slopes-----	1,332	0.5
1260E	Stonelake-Nebish complex, 12 to 25 percent slopes-----	870	0.3
1270B	Milaca fine sandy loam, moderately wet, 3 to 6 percent slopes-----	554	0.2
1288	Seelyeville-Markey complex, ponded, 0 to 1 percent slopes-----	9,910	3.4
1356	Water, miscellaneous-----	429	0.1
1946	Fordum-Winterfield complex, 0 to 2 percent slopes, frequently flooded---	5,324	1.8
W	Water-----	9,130	3.2
	Total-----	288,500	100.0

\* Less than 0.1 percent.

# Use and Management of the Soils

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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, highways and other transportation systems, and parks and other recreational facilities; and as wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

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

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

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

## Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and

indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

## Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited*, *somewhat limited*, and *very limited*. The suitability ratings are expressed as *well suited*, *moderately suited*, *poorly suited*, and *unsuited* or as *good*, *fair*, *poor*, and *very poor*.

## Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

## Agronomy

General management needed for crops and for hay and pasture is suggested in this section. Climate information for the survey area is provided, the system of land capability classification used by the Natural Resources Conservation Service is explained, the estimated yields of the main crops and hay and pasture plants are listed, and prime farmland is defined. 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.

## Climate

Table 3 gives data on temperature and precipitation for the survey area as recorded at Santiago, Minnesota, in the period 1961 to 1990. Table 4 shows probable dates of the first freeze in fall and the last freeze in spring. Table 5 provides data on length of the growing season.

In winter, the average temperature is 13 degrees F and the average daily minimum temperature is 2 degrees. The lowest temperature on record, which occurred on December 19, 1983, is -41 degrees. In summer, the average temperature is 68 degrees and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred on July 15, 1988, is 105 degrees.

Growing degree days are shown in table 3. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 30.63 inches. Of this, 21.98 inches, or about 72 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 3.65 inches at Santiago on August 31, 1977. Thunderstorms occur on about 35 days each year, and most occur in June.

The average seasonal snowfall is 46.5 inches. The greatest snow depth at any one time during the period of record was 45 inches. On the average, 14 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 69 percent of the time possible in summer and 51 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 10 miles per hour, in April.

## Cropland Management Considerations

The management concerns affecting the use of the soil map units in the survey area for crops are shown in table 6. 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 water infiltration rate. 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*, *limited organic matter content*, *potential poor till 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.

On irrigated soils the main management concerns

are efficient water use, nutrient management, control of erosion, pest and weed control, and timely planting and harvesting for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Also, it can increase wetness and soil salinity.

### 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.*—Saturated hydraulic conductivity is 42 micrometers per second or more within the soil profile.

*Flooding.*—Flooding is occasional, frequent, or very 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. Water 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).*—The depth to a zone in which the soil moisture status is wet is 4 feet or less, the saturated hydraulic conductivity of any layer is more than 42 micrometers per second, 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, frequently, or very 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.

*Previously eroded.*—The word “eroded” is included in the map unit name.

*Restricted permeability.*—Saturated hydraulic conductivity is less than 0.42 micrometer per second 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 description of the surface layer, or 0.01 percent or more of the surface is covered with boulders.

*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.

*Wet soil moisture status.*—A zone in which the soil moisture status is wet 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 table 7. 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 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.

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

The estimated yields reflect the productive capacity of each soil 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**

Soils are assigned to forage suitability groups according to their suitability for the production of forage. The soils in each group are similar enough to be suited to the same species of grasses or legumes, have similar limitations and hazards, require similar management, and have similar productivity levels and other responses to management. The forage suitability groups of the soils in the survey area are listed in table 8. Detailed descriptions of forage suitability groups are available at local offices of the Natural Resources Conservation Service.

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 table 7.

## **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, 2*e*. 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 map units in the survey area is given in table 7.

## 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 zone high in the profile in which the soil moisture status is wet or soils that 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 16,160 acres, or nearly 6 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 table 9. This list does not constitute a recommendation for a particular land use. 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 soil maps. The soil qualities that affect use and management are described in the section "Soil Map Unit Descriptions."

## 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 for the soils in the survey area are shown in table 18.

### 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 gullyng, 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 for the soils in the survey area are listed in table 18.

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.

Table 10 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 table 11.

*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 land types 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.

## Recreation

The soils of the survey area are rated in tables 12a and 12b according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses.

*Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.

*Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

*Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They

indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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

The information in the tables can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, and water management.

*Camp areas* require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas.

The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a zone in which the soil moisture status is wet, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are

the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a zone in which the soil moisture status is wet, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Playgrounds* require soils that are nearly level, are free of stones, and can withstand intensive foot traffic. The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of playgrounds. For good trafficability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a zone in which the soil moisture status is wet, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Paths and trails* for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a zone in which the soil moisture status is wet, ponding, flooding, slope, and texture of the surface layer.

*Off-road motorcycle trails* require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a zone in which the soil moisture status is wet, ponding, flooding, and texture of the surface layer.

*Golf fairways* are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a zone in which the soil moisture status is wet; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to

a zone in which the soil moisture status is wet, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer. The suitability of the soil for traps, tees, roughs, and greens is not considered in the ratings.

## 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.

In table 13, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

*Grain and seed crops* are domestic grains and seed-producing herbaceous plants 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, indiagrass, 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.

*Coniferous plants* are cone-bearing trees, shrubs, or 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.

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

*Habitat for openland wildlife* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce

grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include ring-necked pheasant, 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, raccoon, and white-tailed deer.

*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.

## 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, construction materials, and water management. The ratings are based on observed performance of the soils and on the data in the tables described under the heading "Soil Properties."

*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 between the surface and a depth of 5 to 7 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 particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7

feet of the surface, soil wetness, depth to a zone in which the soil moisture status is wet, ponding, 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, linear extensibility, 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; 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

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Tables 14a and 14b show the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the tables are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development.

*Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.

*Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by

special planning, design, or installation. Fair performance and moderate maintenance can be expected.

*Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*Dwellings* are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a zone in which the soil moisture status is wet, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a zone in which the soil moisture status is wet, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

*Small commercial buildings* are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a zone in which the soil moisture status is wet, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect

the ease and amount of excavation include flooding, depth to a zone in which the soil moisture status is wet, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

*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 soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a zone in which the soil moisture status is wet, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a zone in which the soil moisture status is wet, and ponding.

*Shallow excavations* are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to a zone in which the soil moisture status is wet, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to a zone in which the soil moisture status is wet, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

*Lawns and landscaping* require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a zone in which the soil moisture status is wet; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a zone in which the soil moisture status is wet, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

## Construction Materials

Tables 15a and 15b give information about the soils as potential sources of gravel, sand, topsoil, reclamation material, and roadfill. Normal compaction, minor processing, and other standard construction practices are assumed.

*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 table 15a, only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

The soils are rated *good*, *fair*, or *poor* as potential sources of sand and gravel. A rating of good or fair means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The soils are rated *good*, *fair*, or *poor* as potential sources of topsoil, reclamation material, and roadfill. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

*Reclamation material* is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These

properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

*Roadfill* is soil material that is excavated in one place and used in road embankments in another place. In table 15b, 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 whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a zone in which the soil moisture status is wet, 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 AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

*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. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a zone in which the soil moisture status is wet, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a zone in which the soil moisture status is wet, rock fragments, depth to bedrock or a cemented pan, and toxic material.

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

## Water Management

Table 16 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 ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses.

*Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.

*Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

*Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*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. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

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

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A seasonal zone in which the soil moisture status is wet 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 zone in which the soil moisture status is wet. 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 zone in which the soil moisture status is wet, 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.

Table 3.--Temperature and Precipitation  
(Recorded in the period 1961-90 at Santiago, Minnesota)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
°F	°F	°F	°F	°F	Units	In	In	In		In	
January----	20.5	-2.2	9.1	46	-34	0	1.07	0.35	1.73	2	11.3
February---	27.2	3.4	15.3	51	-30	1	.94	.31	1.46	2	8.4
March-----	39.5	18.1	28.8	68	-16	25	1.62	.72	2.39	3	9.7
April-----	57.3	32.4	44.8	85	10	193	2.51	1.28	3.74	5	1.5
May-----	70.7	43.7	57.2	91	24	514	3.37	2.06	4.54	7	.0
June-----	79.4	52.7	66.0	96	35	742	4.39	2.15	6.34	7	.0
July-----	84.4	57.7	71.0	98	41	931	3.85	2.03	5.45	5	.0
August-----	81.1	55.0	68.0	97	37	862	4.50	2.82	6.02	6	.0
September--	71.1	45.7	58.4	91	24	552	3.36	1.49	4.96	6	.0
October----	59.5	35.0	47.3	83	13	250	2.46	.73	3.86	4	.0
November---	40.4	21.3	30.8	66	-9	29	1.53	.52	2.45	3	6.5
December---	24.9	5.2	15.1	49	-27	1	1.03	.31	1.61	3	9.1
Yearly:											
Average---	54.7	30.7	42.7	---	---	---	---	---	---	---	---
Extreme---	105	-41	---	99	-35	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,100	30.63	23.94	36.90	53	46.5

\* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Table 4.--Freeze Dates in Spring and Fall  
(Recorded in the period 1961-90 at Santiago, Minnesota)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
<b>Last freezing temperature in spring:</b>			
1 year in 10 later than--	May 6	May 19	June 4
2 years in 10 later than--	May 1	May 13	May 28
5 years in 10 later than--	Apr. 20	May 3	May 16
<b>First freezing temperature in fall:</b>			
1 year in 10 earlier than--	Sept. 25	Sept. 16	Sept. 10
2 years in 10 earlier than--	Oct. 1	Sept. 21	Sept. 14
5 years in 10 earlier than--	Oct. 13	Sept. 30	Sept. 20

Table 5.--Growing Season  
(Recorded in the period 1961-90 at Santiago, 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	137	122	101
8 years in 10	145	130	110
5 years in 10	161	143	126
2 years in 10	177	157	142
1 year in 10	186	165	150

Table 6.--Cropland Management Considerations

(See text for a description of the considerations listed in this table.)

Map symbol and component name	Pct. of map unit	Cropland management considerations
7A: Hubbard-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
7B: Hubbard-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
7C: Hubbard-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
32B: Nebish-----	85	Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
32C: Nebish-----	85	Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion
32D: Nebish-----	85	Slope Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion
32E: Nebish-----	85	Slope Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion
38B: Waukon-----	90	Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
75: Bluffton, depressional-----	90	Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
125: Beltrami-----	90	Potential for ground-water contamination Wet soil moisture status Wind erosion
152C: Milaca-----	95	Dense layer Limited available water capacity Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion
152E: Milaca-----	95	Slope Dense layer Limited available water capacity Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion
158A: Zimmerman-----	95	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
158B: Zimmerman-----	95	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
158C: Zimmerman-----	95	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
158E: Zimmerman-----	95	Slope Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
161: Isanti, depressional-----	95	Excessive permeability Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
162: Lino-----	95	Acid soil Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wet soil moisture status Wind erosion
164A: Mora-----	95	Dense layer Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status
165: Parent-----	90	Dense layer Potential for ground-water contamination Wet soil moisture status
166: Ronneby-----	90	Dense layer Potential for ground-water contamination Wet soil moisture status
169B: Braham-----	90	Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Wind erosion
169C: Braham-----	90	Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
169D: Braham-----	90	Slope Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
204B: Cushing-----	90	Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
204C: Cushing-----	95	Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion
258B: Sandberg-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
258C: Sandberg-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
258E: Sandberg-----	95	Slope Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
260: Duelm-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
261: Isan, depressional-----	95	Excessive permeability Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
325: Prebish, depressional-----	95	Dense layer Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
341: Arvilla-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
346: Talmoon-----	90	Potential for ground-water contamination Wet soil moisture status
373: Renshaw-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination
454B: Mahtomedi-----	95	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
454C: Mahtomedi-----	95	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
540: Seelyeville-----	95	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
543: Markey-----	90	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
544: Cathro-----	95	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
565: Eckvöll-----	90	Excessive permeability Potential for ground-water contamination Wet soil moisture status Wind erosion
567: Verndale-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
623A: Pierz-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
623B: Pierz-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
708: Rushlake-----	85	Excessive permeability Limited available water capacity Potential for ground-water contamination Wet soil moisture status Wind erosion
730A: Sanburn-----	90	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
730B: Sanburn-----	90	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
732B: Bushville-----	95	Dense layer Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
768: Mosford-----	95	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
771: Elkriver, rarely flooded----	95	Excessive permeability Potential for ground-water contamination Wind erosion
799: Seelyeville, frequently flooded-----	45	Flooding High organic matter content Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
Bowstring, frequently flooded	45	Flooding High organic matter content Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
1013: Pits.		

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
1015: Udipsamments.		
1016: Udorthents.		
1028: Udorthents.		
Pits, gravel.		
1109: Isanti-----	90	Excessive permeability Limited available water capacity Potential for ground-water contamination Wet soil moisture status Wind erosion
1110: Isan-----	90	Excessive permeability Limited available water capacity Potential for ground-water contamination Wet soil moisture status Wind erosion
1223: Sandberg-----	60	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
Arvilla-----	30	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
1224: Hubbard-----	60	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
Verndale-----	35	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
1231: Hubbard-----	60	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
Mosford-----	35	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
1253B: Stonelake-----	60	Excessive permeability Limited available water capacity Potential for ground-water contamination

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
1253B: Sanburn-----	30	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1253C: Stonelake-----	65	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion
Sanburn-----	25	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1253E: Stonelake-----	65	Slope Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Sanburn-----	25	Slope Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1254: Ricelake-----	90	Excessive permeability Potential for ground-water contamination Wet soil moisture status Wind erosion
1255: Elkriver, occasionally flooded-----	90	Flooding Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status Wind erosion
1256: Cantlin-----	90	Acid soil Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
1257: Elkriver, rarely flooded-----	55	Excessive permeability Potential for ground-water contamination Wind erosion
Mosford, rarely flooded-----	35	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1258B: Zimmerman, thick solum-----	95	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
1258C: Zimmerman, thick solum-----	95	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1258E: Zimmerman, thick solum-----	95	Slope Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1260B: Stonelake-----	55	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
Nebish-----	30	Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1260C: Stonelake-----	55	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Nebish-----	30	Limited organic matter content Potential for surface-water contamination Water erosion Wind erosion

Table 6.--Cropland Management Considerations--Continued

Map symbol and component name	Pct. of map unit	Cropland management considerations
1260E: Stonelake-----	60	Slope Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion
Nebish-----	25	Slope Potential for surface-water contamination Water erosion Wind erosion
1270B: Milaca, moderately wet-----	90	Dense layer Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1288: Seelyeville, ponded-----	60	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status
Markey, ponded-----	30	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status
1356: Water, miscellaneous.		
1946: Fordum, frequently flooded---	65	Flooding Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status
Winterfield, frequently flooded-----	20	Flooding Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Wet soil moisture status
W: Water.		

Table 7.--Land Capability and Yields per Acre of Crops

(Yields in the "N" columns are for nonirrigated areas; those in the "I" columns are for irrigated areas. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil.)

Map symbol and component name	Pct. of map unit	Land capability		Alfalfa hay		Corn		Irish potatoes		Rye		Soybeans	
		N	I	N	I	N	I	N	I	N	I	N	I
				Tons	Tons	Bu	Bu	Cwt	Cwt	Bu	Bu	Bu	Bu
7A: Hubbard-----	95	4s	4s	3.0	8.0	70	172	---	400	30	---	23	50
7B: Hubbard-----	95	4s	4s	3.0	8.0	70	172	---	400	30	---	23	50
7C: Hubbard-----	95	6s	6s	2.5	7.0	60	168	---	380	25	---	20	45
32B: Nebish-----	85	2e	---	4.6	---	145	---	---	---	---	---	39	---
32C: Nebish-----	85	3e	---	4.0	---	130	---	---	---	---	---	38	---
32D: Nebish-----	85	4e	---	3.3	---	105	---	---	---	---	---	30	---
32E: Nebish-----	85	7e	---	---	---	---	---	---	---	---	---	---	---
38B: Waukon-----	90	2e	---	4.6	---	150	---	---	---	---	---	42	---
75: Bluffton, depressional-----	90	6w	---	---	---	---	---	---	---	---	---	---	---
125: Beltrami-----	90	1	---	4.6	---	150	---	---	---	---	---	42	---
152C: Milaca-----	95	3e	---	4.0	---	120	---	---	---	---	---	32	---
152E: Milaca-----	95	6e	---	---	---	---	---	---	---	---	---	---	---
158A: Zimmerman-----	95	4s	4s	3.0	8.0	65	165	---	400	30	---	25	48

Table 7.--Land Capability and Yields per Acre of Crops--Continued

Map symbol and component name	Pct. of map unit	Land capability		Alfalfa hay		Corn		Irish potatoes		Rye		Soybeans	
		N	I	N	I	N	I	N	I	N	I	N	I
				Tons	Tons	Bu	Bu	Cwt	Cwt	Bu	Bu	Bu	Bu
158B: Zimmerman-----	95	4s	4s	3.0	8.0	65	165	---	400	30	---	25	48
158C: Zimmerman-----	95	6s	6s	2.5	7.0	55	160	---	---	25	---	20	45
158E: Zimmerman-----	95	6s	---	---	---	---	---	---	---	---	---	---	---
161: Isanti, depressional-----	95	6w	---	---	---	---	---	---	---	---	---	---	---
162: Lino-----	95	3s	---	---	---	85	---	---	---	---	---	24	---
164A: Mora-----	95	2s	---	4.2	---	135	---	---	---	---	---	39	---
165: Parent-----	90	2w	---	---	---	115	---	---	---	---	---	30	---
166: Ronneby-----	90	2w	---	---	---	125	---	---	---	---	---	36	---
169B: Braham-----	90	3s	---	3.5	---	100	---	---	---	---	---	30	---
169C: Braham-----	90	4e	---	3.0	---	80	---	---	---	---	---	28	---
169D: Braham-----	90	6e	---	2.5	---	---	---	---	---	---	---	---	---
204B: Cushing-----	90	2e	---	4.6	---	145	---	---	---	---	---	39	---
204C: Cushing-----	95	3e	---	4.0	---	130	---	---	---	---	---	38	---
258B: Sandberg-----	95	4s	4s	3.0	---	60	168	---	400	28	---	23	48
258C: Sandberg-----	95	6s	6s	2.5	---	55	168	---	380	22	---	16	45

Table 7.--Land Capability and Yields per Acre of Crops--Continued

Map symbol and component name	Pct. of map unit	Land capability		Alfalfa hay		Corn		Irish potatoes		Rye		Soybeans	
		N	I	N	I	N	I	N	I	N	I	N	I
				Tons	Tons	Bu	Bu	Cwt	Cwt	Bu	Bu	Bu	Bu
258E: Sandberg-----	95	7e	---	---	---	---	---	---	---	---	---	---	---
260: Duelm-----	95	4s	---	---	---	65	---	---	---	35	---	24	---
261: Isan, depressional	95	6w	---	---	---	---	---	---	---	---	---	---	---
325: Prebish, depressional-----	95	6w	---	---	---	---	---	---	---	---	---	---	---
341: Arvilla-----	95	3s	3s	3.2	8.0	75	175	---	400	40	---	23	50
346: Talmoon-----	90	2w	---	---	---	145	---	---	---	---	---	38	---
373: Renshaw-----	95	3s	3s	3.2	8.0	80	175	---	400	40	---	25	50
454B: Mahtomedi-----	95	4s	---	2.5	---	65	---	---	---	25	---	22	---
454C: Mahtomedi-----	95	6s	---	2.0	---	60	---	---	---	20	---	18	---
540: Seelyeville-----	95	6w	---	---	---	---	---	---	---	---	---	---	---
543: Markey-----	90	6w	---	---	---	---	---	---	---	---	---	---	---
544: Cathro-----	95	6w	---	---	---	---	---	---	---	---	---	---	---
565: Eckvoll-----	90	3s	---	3.3	---	90	---	---	---	38	---	30	---
567: Verndale-----	95	3s	---	3.2	8.0	85	175	---	400	40	---	30	50
623A: Pierz-----	95	2s	2s	3.5	8.0	100	175	---	---	40	---	33	50

Table 7.--Land Capability and Yields per Acre of Crops--Continued

Map symbol and component name	Pct. of map unit	Land capability		Alfalfa hay		Corn		Irish potatoes		Rye		Soybeans	
		N	I	N	I	N	I	N	I	N	I	N	I
				Tons	Tons	Bu	Bu	Cwt	Cwt	Bu	Bu	Bu	Bu
623B: Pierz-----	95	2e	2e	3.2	8.0	90	175	---	---	38	---	31	50
708: Rushlake-----	85	4s	---	---	---	---	---	---	---	---	---	---	---
730A: Sanburn-----	90	3s	3s	3.2	---	85	170	---	---	32	---	26	45
730B: Sanburn-----	90	3e	3e	3.0	---	85	165	---	---	30	---	24	45
732B: Bushville-----	95	3s	---	3.3	---	85	---	---	---	---	---	30	---
768: Mosford-----	95	3s	3s	3.3	8.0	80	180	---	400	40	---	30	50
771: Elkriver, rarely flooded-----	95	2s	---	4.0	---	120	---	---	---	---	---	37	---
799----- Seelyeville, frequently flooded	45	6w	---	---	---	---	---	---	---	---	---	---	---
Bowstring, frequently flooded	45	6w	---	---	---	---	---	---	---	---	---	---	---
1013: Pits.													
1015: Udipsamments.													
1016: Udorthents.													
1028: Udorthents.  Pits, gravel.													
1109: Isanti-----	90	3w	---	---	---	65	---	---	---	---	---	22	---

Table 7.--Land Capability and Yields per Acre of Crops--Continued

Map symbol and component name	Pct. of map unit	Land capability		Alfalfa hay		Corn		Irish potatoes		Rye		Soybeans	
		N	I	N	I	N	I	N	I	N	I	N	I
				Tons	Tons	Bu	Bu	Cwt	Cwt	Bu	Bu	Bu	Bu
1110: Isan-----	90	3w	---	---	---	60	---	---	---	---	---	20	---
1223----- Sandberg-----	60	4s	4s	3.0	---	60	172	---	400	32	---	23	50
Arvilla-----	30	3s	3s										
1224----- Hubbard-----	60	4s	4s	3.2	8.0	70	172	---	400	33	---	25	50
Verndale-----	35	3s	3s										
1231----- Hubbard-----	60	4s	4s	3.2	8.0	75	172	---	400	33	---	25	50
Mosford-----	35	3s	3s										
1253B----- Stonelake-----	60	4s	---	2.8	---	65	---	---	---	25	---	22	---
Sanburn-----	30	3e	---										
1253C----- Stonelake-----	65	6s	---	2.8	---	60	---	---	---	23	---	20	---
Sanburn-----	25	4e	---										
1253E----- Stonelake-----	65	7s	---	---	---	---	---	---	---	---	---	---	---
Sanburn-----	25	6e	---										
1254: Ricelake-----	90	2w	---	4.0	---	120	---	---	---	---	---	35	---
1255: Elkriver, occasionally flooded-----	90	2w	---	3.8	---	115	---	---	---	---	---	35	---
1256: Cantlin-----	90	4s	---	---	---	70	---	---	---	33	---	24	---

Table 7.--Land Capability and Yields per Acre of Crops--Continued

Map symbol and component name	Pct. of map unit	Land capability		Alfalfa hay		Corn		Irish potatoes		Rye		Soybeans	
		N	I	N	I	N	I	N	I	N	I	N	I
				Tons	Tons	Bu	Bu	Cwt	Cwt	Bu	Bu	Bu	Bu
1257----- Elkriver, rarely flooded-----	55	2s	---	3.7	---	105	---	---	---	---	---	34	---
Mosford, rarely flooded-----	35	3e	---										
1258B: Zimmerman, thick solum-----	95	4s	---	3.0	---	65	---	---	---	30	---	25	---
1258C: Zimmerman, thick solum-----	95	6s	---	2.8	---	---	---	---	---	---	---	---	---
1258E: Zimmerman, thick solum-----	95	6s	---	---	---	---	---	---	---	---	---	---	---
1260B----- Stonelake-----	55	4s	---	3.0	---	85	---	---	---	---	---	24	---
Nebish-----	30	2e	---										
1260C----- Stonelake-----	55	6s	---	2.8	---	80	---	---	---	---	---	22	---
Nebish-----	30	3e	---										
1260E----- Stonelake-----	60	7s	---	---	---	---	---	---	---	---	---	---	---
Nebish-----	25	6e	---										
1270B Milaca, moderately wet-----	90	2e	---	4.2	---	135	---	---	---	---	---	33	---
1288----- Seelyeville, ponded	60	8w	---	---	---	---	---	---	---	---	---	---	---
Markey, ponded-----	30	8w	---										
1356: Water, miscellaneous.													

Table 7.--Land Capability and Yields per Acre of Crops--Continued

Map symbol and component name	Pct. of map unit	Land capability		Alfalfa hay		Corn		Irish potatoes		Rye		Soybeans	
		N	I	N	I	N	I	N	I	N	I	N	I
				Tons	Tons	Bu	Bu	Cwt	Cwt	Bu	Bu	Bu	Bu
1946----- Fordum, frequently flooded-----	65	6w	---	---	---	---	---	---	---	---	---	---	---
Winterfield, frequently flooded-----	20	4w	---										
W: Water.													

Table 8.--Forage Suitability Groups

(Only the soils assigned to forage suitability groups are listed.)

Map symbol	Map unit name	MLRA	Group no.
7A	Hubbard loamy sand, 0 to 2 percent slopes----	091X	22
7B	Hubbard loamy sand, 2 to 6 percent slopes----	091X	22
7C	Hubbard loamy sand, 6 to 12 percent slopes---	091X	22
32B	Nebish fine sandy loam, 2 to 6 percent slopes	091X	06
32C	Nebish fine sandy loam, 6 to 12 percent slopes-----	091X	06
32D	Nebish fine sandy loam, 12 to 18 percent slopes-----	091X	23
32E	Nebish fine sandy loam, 18 to 35 percent slopes-----	091X	17
38B	Waukon fine sandy loam, 2 to 6 percent slopes	091X	02
75	Bluffton loam, depressionnal, 0 to 1 percent slopes-----	091X	24
125	Beltrami fine sandy loam, 0 to 3 percent slopes-----	091X	02
152C	Milaca fine sandy loam, 6 to 12 percent slopes-----	090X	08
152E	Milaca fine sandy loam, 12 to 25 percent slopes-----	090X	18
158A	Zimmerman fine sand, 0 to 3 percent slopes---	091X	22
158B	Zimmerman fine sand, 3 to 6 percent slopes---	091X	22
158C	Zimmerman fine sand, 6 to 12 percent slopes--	091X	22
158E	Zimmerman fine sand, 12 to 25 percent slopes	091X	18
161	Isanti fine sandy loam, depressionnal, 0 to 1 percent slopes-----	091X	24
162	Lino loamy fine sand, 0 to 2 percent slopes--	091X	07
164A	Mora loam, 0 to 3 percent slopes-----	090X	06
165	Parent loam, 0 to 2 percent slopes-----	090X	05
166	Ronneby loam, 0 to 2 percent slopes-----	090X	05
169B	Braham loamy fine sand, 3 to 6 percent slopes	091X	06
169C	Braham loamy fine sand, 6 to 12 percent slopes-----	091X	06
169D	Braham loamy fine sand, 12 to 18 percent slopes-----	091X	23
204B	Cushing fine sandy loam, 2 to 8 percent slopes-----	091X	06

Table 8.--Forage Suitability Groups--Continued

Map symbol	Map unit name	MLRA	Group no.
204C	Cushing fine sandy loam, 8 to 15 percent slopes-----	091X	06
258B	Sandberg loamy coarse sand, 1 to 6 percent slopes-----	091X	22
258C	Sandberg loamy coarse sand, 6 to 12 percent slopes-----	091X	22
258E	Sandberg loamy coarse sand, 12 to 35 percent slopes-----	091X	18
260	Duelm loamy sand, 0 to 2 percent slopes-----	091X	08
261	Isan sandy loam, depressional, 0 to 1 percent slopes-----	091X	24
325	Prebish fine sandy loam, depressional, 0 to 1 percent slopes-----	090X	24
341	Arvilla sandy loam, 0 to 2 percent slopes-----	091X	22
346	Talmoon loam, 0 to 2 percent slopes-----	091X	05
373	Renshaw loam, 0 to 3 percent slopes-----	091X	22
454B	Mahtomedi loamy coarse sand, 1 to 6 percent slopes-----	091X	22
454C	Mahtomedi loamy coarse sand, 6 to 15 percent slopes-----	091X	22
540	Seelyville muck, 0 to 1 percent slopes-----	091X	24
543	Markey muck, 0 to 1 percent slopes-----	091X	24
544	Cathro muck, 0 to 1 percent slopes-----	091X	24
565	Eckvoll loamy fine sand, 0 to 3 percent slopes-----	091X	02
567	Verndale sandy loam, 0 to 2 percent slopes---	091X	22
623A	Pierz sandy loam, 0 to 2 percent slopes-----	091X	08
623B	Pierz sandy loam, 2 to 6 percent slopes-----	091X	08
708	Rushlake coarse sand, 1 to 4 percent slopes--	091X	03
730A	Sanburn fine sandy loam, 0 to 2 percent slopes-----	091X	22
730B	Sanburn fine sandy loam, 2 to 6 percent slopes-----	091X	22
732B	Bushville fine sand, 2 to 6 percent slopes---	091X	08
768	Mosford sandy loam, 0 to 2 percent slopes-----	091X	22
771	Elkriver fine sandy loam, 0 to 2 percent slopes, rarely flooded-----	091X	06
799	Seelyville and Bowstring soils, 0 to 1 percent slopes, frequently flooded-----	091X	24

Table 8.--Forage Suitability Groups--Continued

Map symbol	Map unit name	MLRA	Group no.
1109	Isanti loamy fine sand, 0 to 2 percent slopes	091X	07
1110	Isan sandy loam, 0 to 2 percent slopes-----	091X	07
1223	Sandberg-Arvilla complex, 0 to 3 percent slopes-----	091X	22
1224	Hubbard-Verndale complex, 0 to 3 percent slopes-----	091X	22
1231	Hubbard-Mosford complex, 0 to 3 percent slopes-----	091X	22
1253B	Stonelake-Sanburn complex, 1 to 6 percent slopes-----	091X	22
1253C	Stonelake-Sanburn complex, 6 to 15 percent slopes-----	091X	22
1253E	Stonelake-Sanburn complex, 15 to 40 percent slopes-----	091X	24
1254	Ricelake fine sandy loam, 0 to 3 percent slopes-----	091X	05
1255	Elkriver fine sandy loam, 0 to 2 percent slopes, occasionally flooded-----	091X	05
1256	Cantlin loamy fine sand, 0 to 3 percent slopes-----	091X	08
1257	Elkriver-Mosford complex, 0 to 6 percent slopes, rarely flooded: Elkriver-----	091X	06
	Mosford-----	091X	22
1258B	Zimmerman fine sand, thick solum, 1 to 6 percent slopes-----	091X	22
1258C	Zimmerman fine sand, thick solum, 6 to 12 percent slopes-----	091X	22
1258E	Zimmerman fine sand, thick solum, 12 to 35 percent slopes-----	091X	18
1260B	Stonelake-Nebish complex, 2 to 6 percent slopes: Stonelake-----	091X	22
	Nebish-----	091X	06
1260C	Stonelake-Nebish complex, 6 to 12 percent slopes: Stonelake-----	091X	22
	Nebish-----	091X	06
1260E	Stonelake-Nebish complex, 12 to 25 percent slopes: Stonelake-----	091X	22
	Nebish-----	091X	17

Table 8.--Forage Suitability Groups--Continued

Map symbol	Map unit name	MLRA	Group no.
1270B	Milaca fine sandy loam, moderately wet, 3 to 6 percent slopes-----	090X	08
1288	Seelyeville-Markey complex, ponded, 0 to 1 percent slopes-----	091X	24
1946	Fordum-Winterfield complex, 0 to 2 percent slopes, frequently flooded:		
	Fordum-----	091X	16
	Winterfield-----	091X	07

Table 9.--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
32B	Nebish fine sandy loam, 2 to 6 percent slopes
38B	Waukon fine sandy loam, 2 to 6 percent slopes
125	Beltrami fine sandy loam, 0 to 3 percent slopes
164A	Mora loam, 0 to 3 percent slopes
165	Parent loam, 0 to 2 percent slopes (where drained)
166	Ronneby loam, 0 to 2 percent slopes (where drained)
204B	Cushing fine sandy loam, 2 to 8 percent slopes
346	Talmoon loam, 0 to 2 percent slopes (where drained)
623A	Pierz sandy loam, 0 to 2 percent slopes
771	Elkriver fine sandy loam, 0 to 2 percent slopes, rarely flooded
1254	Ricelake fine sandy loam, 0 to 3 percent slopes
1255	Elkriver fine sandy loam, 0 to 2 percent slopes, occasionally flooded
1270B	Milaca fine sandy loam, moderately wet, 3 to 6 percent slopes

Table 10.--Windbreaks and Environmental Plantings

(Only the soils suitable for windbreaks and environmental plantings are listed. Absence of an entry indicates that trees generally do not grow to the given height.)

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
7A: Hubbard-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
7B: Hubbard-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
7C: Hubbard-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
32B: Nebish-----	85	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
32C: Nebish-----	85	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood
32D: Nebish-----	85	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood
32E: Nebish-----	85	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood
38B: Waukon-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood
125: Beltrami-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
152C: Milaca-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, bur oak, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, northern red oak, common hackberry	Eastern white pine, Siberian elm, green ash, red pine, silver maple	Eastern cottonwood, Siouxland cottonwood
152E: Milaca-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, bur oak, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, northern red oak, common hackberry	Eastern white pine, Siberian elm, green ash, red pine, silver maple	Eastern cottonwood, Siouxland cottonwood
158A: Zimmerman-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
158B: Zimmerman-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
158C: Zimmerman-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
158E: Zimmerman-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
162: Lino-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
164A: Mora-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
165: Parent-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, common chokecherry, eastern redcedar	Amur maple, Black Hills spruce, Manchurian crabapple, blue spruce, white spruce, common hackberry	Eastern white pine, green ash, red pine, Siberian elm	silver maple, eastern cottonwood, Siouxland cottonwood
166: Ronneby-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, bur oak, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, northern red oak, common hackberry	Eastern white pine, Siberian elm, green ash, red pine, silver maple	Eastern cottonwood, Siouxland cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
169B: Braham-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
169C: Braham-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
169D: Braham-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
204B: Cushing-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood
204C: Cushing-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
258B: Sandberg-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
258C: Sandberg-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
258E: Sandberg-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
260: Duelm-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
341: Arvilla-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, Manchurian crabapple, bur oak, common chokecherry, eastern redcedar, northern red oak	Black Hills spruce, blue spruce, eastern white pine, red pine, Siberian elm	Green ash, silver maple, Siouxland cottonwood	Eastern cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
346: Talmoon-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, common chokecherry, eastern redcedar	Amur maple, Black Hills spruce, Manchurian crabapple, blue spruce, white spruce, common hackberry	Eastern white pine, green ash, red pine, Siberian elm	silver maple, eastern cottonwood, Siouxland cottonwood
373: Renshaw-----	95	Nanking cherry, western sandcherry	Amur maple, Harbin pear, Manchurian crabapple, Siberian peashrub, bur oak, common chokecherry, eastern redcedar, northern red oak	Black Hills spruce, blue spruce, eastern white pine, red pine, Siberian elm	Green ash, silver maple, Siouxland cottonwood	Eastern cottonwood
454B: Mahtomedi-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
454C: Mahtomedi-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
565: Eckvoll-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
567: Verndale-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, Manchurian crabapple, bur oak, common chokecherry, eastern redcedar, northern red oak	Black Hills spruce, blue spruce, eastern white pine, red pine, Siberian elm	Green ash, silver maple, Siouxland cottonwood	Eastern cottonwood
623A: Pierz-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
623B: Pierz-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
708: Rushlake-----	85	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
730A: Sanburn-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
730B: Sanburn-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
732B: Bushville-----	95	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
768: Mosford-----	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
771: Elkriver, rarely flooded	95	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
1109: Isanti-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, common chokecherry, eastern redcedar	Amur maple, Black Hills spruce, Manchurian crabapple, blue spruce, white spruce, common hackberry	Eastern white pine, green ash, red pine, Siberian elm	silver maple, eastern cottonwood, Siouxland cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
1110: Isan-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, common chokecherry, eastern redcedar	Amur maple, Black Hills spruce, Manchurian crabapple, blue spruce, white spruce, common hackberry	Eastern white pine, green ash, red pine, Siberian elm	silver maple, eastern cottonwood, Siouxland cottonwood
1223: Sandberg-----	60	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
Arvilla-----	30	Nanking cherry, western sandcherry	Amur maple, Harbin pear, Manchurian crabapple, Siberian peashrub, bur oak, common chokecherry, eastern redcedar, northern red oak	Black Hills spruce, blue spruce, eastern white pine, red pine, Siberian elm	Green ash, silver maple, Siouxland cottonwood	Eastern cottonwood
1224: Hubbard-----	60	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
Verndale-----	35	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, Manchurian crabapple, bur oak, common chokecherry, eastern redcedar, northern red oak	Black Hills spruce, blue spruce, eastern white pine, red pine, Siberian elm	Green ash, silver maple, Siouxland cottonwood	Eastern cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
1231: Hubbard-----	60	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
Mosford-----	35	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
1253B: Stonelake-----	60	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
Sanburn-----	30	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
1253C: Stonelake-----	65	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
1253C: Sanburn-----	25	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
1253E: Stonelake-----	65	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
Sanburn-----	25	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry, eastern redcedar	Black Hills spruce, Manchurian crabapple, blue spruce, bur oak, white spruce, common hackberry, northern red oak, red pine	Green ash, eastern white pine, Siberian elm	silver maple, Siouxland cottonwood, eastern cottonwood
1254: Ricelake-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
1255: Elkriver, occasionally flooded-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
1256: Cantlin-----	90	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
1257: Elkriver, rarely flooded	55	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood
Mosford, rarely flooded	35	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
1258B: Zimmerman, thick solum--	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
1258C: Zimmerman, thick solum--	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
1258E: Zimmerman, thick solum--	95	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
1260B: Stonelake-----	55	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
Nebish-----	30	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood
1260C: Stonelake-----	55	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
Nebish-----	30	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood

Table 10.--Windbreaks and Environmental Plantings--Continued

Map symbol and component name	Pct. of map unit	Trees having predicted 20-year average height, in feet, of--				
		<8	8-15	16-25	26-35	>35
1260E: Stonelake-----	60	Nanking cherry, western sandcherry	Siberian peashrub, common chokecherry, Amur maple, Harbin pear, Manchurian crabapple, blue spruce, bur oak, eastern redcedar, northern red oak	Black Hills spruce, green ash, red pine	Eastern white pine, silver maple, Siouxland cottonwood, eastern cottonwood	Siberian elm
Nebish-----	25	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, bur oak, northern red oak, common hackberry	Green ash, eastern white pine, red pine, Siberian elm, silver maple	Eastern cottonwood, Siouxland cottonwood
1270B: Milaca, moderately wet--	90	Nanking cherry, western sandcherry	Siberian peashrub, Amur maple, Harbin pear, bur oak, common chokecherry	Black Hills spruce, Manchurian crabapple, blue spruce, eastern redcedar, white spruce, northern red oak, common hackberry	Eastern white pine, Siberian elm, green ash, red pine, silver maple	Eastern cottonwood, Siouxland cottonwood
1946: Fordum, frequently flooded-----	65	---	---	---	---	---
Winterfield, frequently flooded----	20	Nanking cherry, western sandcherry	Siberian peashrub, Harbin pear, blue spruce, common chokecherry	Amur maple, Black Hills spruce, Manchurian crabapple, eastern redcedar, bur oak, common hackberry, white spruce	Northern red oak, red pine, eastern white pine, green ash	Siberian elm, silver maple, eastern cottonwood, Siouxland cottonwood

Table 11.--Windbreak Suitability Groups

(Suitable shrubs and trees with their mature heights are listed in table 10. Absence of an entry indicates that a windbreak suitability group is not assigned.)

Map symbol and component name	Windbreak suitability group
7A: Hubbard-----	7
7B: Hubbard-----	7
7C: Hubbard-----	7
32B: Nebish-----	3
32C: Nebish-----	3
32D: Nebish-----	3
32E: Nebish-----	3
38B: Waukon-----	3
75: Bluffton, depressiona	10
125: Beltrami-----	1
152C: Milaca-----	4
152E: Milaca-----	4
158A: Zimmerman-----	7
158B: Zimmerman-----	7
158C: Zimmerman-----	7
158E: Zimmerman-----	7
161: Isanti, depressiona--	10
162: Lino-----	1
164A: Mora-----	1
165: Parent-----	2

Table 11.--Windbreak Suitability Groups--Continued

Map symbol and component name	Windbreak suitability group
166: Ronneby-----	4
169B: Braham-----	5
169C: Braham-----	5
169D: Braham-----	5
204B: Cushing-----	3
204C: Cushing-----	3
258B: Sandberg-----	7
258C: Sandberg-----	7
258E: Sandberg-----	7
260: Duelm-----	1
261: Isan, depressiona----	10
325: Prebish, depressiona	10
341: Arvilla-----	6G
346: Talmoon-----	2
373: Renshaw-----	6G
454B: Mahtomedi-----	7
454C: Mahtomedi-----	7
540: Seelyeville-----	10
543: Markey-----	10
544: Cathro-----	10
565: Eckvoll-----	1

Table 11.--Windbreak Suitability Groups--Continued

Map symbol and component name	Windbreak suitability group
567: Verndale-----	6G
623A: Pierz-----	5
623B: Pierz-----	5
708: Rushlake-----	1
730A: Sanburn-----	5
730B: Sanburn-----	5
732B: Bushville-----	1
768: Mosford-----	7
771: Elkriver, rarely flooded-----	1
799: Seelyeville, frequently flooded---	10
Bowstring, frequently flooded-----	10
1013: Pits.	
1015: Udipsamments.	
1016: Udorthents.	
1028: Udorthents.  Pits, gravel.	
1109: Isanti-----	2
1110: Isan-----	2
1223: Sandberg-----	7
Arvilla-----	6G
1224: Hubbard-----	7
Verndale-----	6G

Table 11.--Windbreak Suitability Groups--Continued

Map symbol and component name	Windbreak suitability group
1231: Hubbard-----	7
Mosford-----	7
1253B: Stonelake-----	7
Sanburn-----	5
1253C: Stonelake-----	7
Sanburn-----	5
1253E: Stonelake-----	7
Sanburn-----	5
1254: Ricelake-----	1
1255: Elkriver, occasionally flooded-----	1
1256: Cantlin-----	1
1257: Elkriver, rarely flooded-----	1
Mosford, rarely flooded-----	7
1258B: Zimmerman, thick solum	7
1258C: Zimmerman, thick solum	7
1258E: Zimmerman, thick solum	7
1260B: Stonelake-----	7
Nebish-----	3
1260C: Stonelake-----	7
Nebish-----	3
1260E: Stonelake-----	7
Nebish-----	3
1270B: Milaca, moderately wet	4

Table 11.--Windbreak Suitability Groups--Continued

Map symbol and component name	Windbreak suitability group
1288: Seelyeville, ponded---	10
Markey, ponded-----	10
1356: Water, miscellaneous.	
1946: Fordum, frequently flooded-----	10
Winterfield, frequently flooded	1
W: Water.	

Table 12a.--Recreation

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
7A: Hubbard-----	95	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy	0.81
7B: Hubbard-----	95	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy Slope	0.81 0.13
7C: Hubbard-----	95	Somewhat limited Too sandy Slope	0.81 0.04	Somewhat limited Too sandy Slope	0.81 0.04	Very limited Slope Too sandy	1.00 0.81
32B: Nebish-----	85	Not limited		Not limited		Somewhat limited Slope	0.13
32C: Nebish-----	85	Somewhat limited Slope	0.04	Somewhat limited Slope	0.04	Very limited Slope	1.00
32D: Nebish-----	85	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
32E: Nebish-----	85	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
38B: Waukon-----	90	Not limited		Not limited		Somewhat limited Slope	0.13
75: Bluffton, depressional-----	90	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
125: Beltrami-----	90	Very limited Depth to saturated zone	0.99	Somewhat limited Depth to saturated zone	0.78	Somewhat limited Depth to saturated zone Slope	0.99 0.01
152C: Milaca-----	95	Somewhat limited Restricted permeability Slope	0.94 0.04	Somewhat limited Restricted permeability Slope	0.94 0.04	Very limited Slope Restricted permeability	1.00 0.94

Table 12a.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
152E: Milaca-----	95	Very limited Slope Restricted permeability	1.00  0.94	Very limited Slope Restricted permeability	1.00  0.94	Very limited Slope Restricted permeability	1.00  0.94
158A: Zimmerman-----	95	Very limited Too sandy	1.00	Very limited Too sandy	1.00	Very limited Too sandy	1.00
158B: Zimmerman-----	95	Very limited Too sandy	1.00	Very limited Too sandy	1.00	Very limited Too sandy Slope	1.00 0.13
158C: Zimmerman-----	95	Very limited Too sandy Slope	1.00 0.04	Very limited Too sandy Slope	1.00 0.04	Very limited Too sandy Slope	1.00 1.00
158E: Zimmerman-----	95	Very limited Too sandy Slope	1.00 1.00	Very limited Too sandy Slope	1.00 1.00	Very limited Slope Too sandy	1.00 1.00
161: Isanti, depressiona	95	Very limited Ponding Depth to saturated zone	1.00  1.00	Very limited Ponding Depth to saturated zone	1.00  1.00	Very limited Ponding Depth to saturated zone	1.00  1.00
162: Lino-----	95	Somewhat limited Depth to saturated zone Too sandy	0.98  0.96	Somewhat limited Too sandy Depth to saturated zone	0.96  0.75	Somewhat limited Depth to saturated zone Too sandy Slope	0.98  0.96 0.01
164A: Mora-----	95	Very limited Depth to saturated zone Restricted permeability	1.00  0.94	Very limited Depth to saturated zone Restricted permeability	1.00  0.94	Very limited Depth to saturated zone Restricted permeability Gravel content Slope	1.00  0.94 0.01 0.01
165: Parent-----	90	Very limited Depth to saturated zone Restricted permeability	1.00  0.94	Very limited Depth to saturated zone Restricted permeability	1.00  0.94	Very limited Depth to saturated zone Restricted permeability Gravel content	1.00  0.94 0.20
166: Ronneby-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone Gravel content	1.00 0.04

Table 12a.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
169B: Braham-----	90	Somewhat limited Too sandy	0.37	Somewhat limited Too sandy	0.37	Somewhat limited Slope Too sandy	0.50 0.37
169C: Braham-----	90	Somewhat limited Too sandy Slope	0.37 0.04	Somewhat limited Too sandy Slope	0.37 0.04	Very limited Slope Too sandy	1.00 0.37
169D: Braham-----	90	Very limited Slope Too sandy	1.00 0.37	Very limited Slope Too sandy	1.00 0.37	Very limited Slope Too sandy	1.00 0.37
204B: Cushing-----	90	Not limited		Not limited		Somewhat limited Slope Gravel content	0.87 0.04
204C: Cushing-----	95	Somewhat limited Slope	0.37	Somewhat limited Slope	0.37	Very limited Slope Gravel content	1.00 0.04
258B: Sandberg-----	95	Somewhat limited Too sandy	0.77	Somewhat limited Too sandy	0.77	Somewhat limited Gravel content Too sandy Slope	0.78 0.77 0.13
258C: Sandberg-----	95	Somewhat limited Too sandy Slope	0.77 0.04	Somewhat limited Too sandy Slope	0.77 0.04	Very limited Slope Gravel content Too sandy	1.00 0.78 0.77
258E: Sandberg-----	95	Very limited Slope Too sandy	1.00 0.77	Very limited Slope Too sandy	1.00 0.77	Very limited Slope Gravel content Too sandy	1.00 0.78 0.77
260: Duelm-----	95	Somewhat limited Too sandy	0.87	Somewhat limited Too sandy	0.87	Somewhat limited Too sandy	0.87
261: Isan, depressional--	95	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
325: Prebish, depressional-----	95	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone Gravel content	1.00 1.00 0.20

Table 12a.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
341: Arvilla-----	95	Not limited		Not limited		Not limited	
346: Talmoon-----	90	Very limited Depth to saturated zone Restricted permeability	1.00  0.15	Very limited Depth to saturated zone Restricted permeability	1.00  0.15	Very limited Depth to saturated zone Restricted permeability	1.00  0.15
373: Renshaw-----	95	Not limited		Not limited		Not limited	
454B: Mahtomedi-----	95	Somewhat limited Too sandy	0.61	Somewhat limited Too sandy	0.61	Somewhat limited Too sandy Gravel content Slope	0.61 0.48 0.13
454C: Mahtomedi-----	95	Somewhat limited Too sandy Slope	0.61 0.16	Somewhat limited Too sandy Slope	0.61 0.16	Very limited Slope Too sandy Gravel content	1.00 0.61 0.48
540: Seelyeville-----	95	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00
543: Markey-----	90	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00
544: Cathro-----	95	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00
565: Eckvoll-----	90	Somewhat limited Depth to saturated zone Too sandy	0.98 0.89	Somewhat limited Too sandy Depth to saturated zone	0.89 0.75	Somewhat limited Depth to saturated zone Too sandy Slope	0.98 0.89 0.01
567: Verndale-----	95	Not limited		Not limited		Not limited	

Table 12a.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
623A: Pierz-----	95	Not limited		Not limited		Somewhat limited Gravel content	0.04
623B: Pierz-----	95	Not limited		Not limited		Somewhat limited Slope Gravel content	0.13 0.04
708: Rushlake-----	85	Very limited Too sandy Depth to saturated zone	1.00  0.39	Very limited Too sandy Depth to saturated zone	1.00  0.19	Very limited Too sandy Depth to saturated zone Gravel content Slope	1.00  0.39 0.06 0.01
730A: Sanburn-----	90	Not limited		Not limited		Not limited	
730B: Sanburn-----	90	Not limited		Not limited		Somewhat limited Slope	0.13
732B: Bushville-----	95	Very limited Too sandy Depth to saturated zone Restricted permeability	1.00  1.00 0.94	Very limited Too sandy Depth to saturated zone Restricted permeability	1.00  1.00 0.94	Very limited Too sandy Depth to saturated zone Restricted permeability Slope	1.00  1.00 0.94 0.13
768: Mosford-----	95	Not limited		Not limited		Not limited	
771: Elkriver, rarely flooded-----	95	Very limited Flooding	1.00	Not limited		Not limited	
799: Seelyeville, frequently flooded	45	Very limited Flooding Content of organic matter Depth to saturated zone	1.00  1.00 1.00	Very limited Content of organic matter Depth to saturated zone Flooding	1.00  1.00 0.40	Very limited Content of organic matter Flooding Depth to saturated zone	1.00  1.00 1.00
Bowstring, frequently flooded	45	Very limited Flooding Content of organic matter Depth to saturated zone	1.00  1.00 1.00	Very limited Content of organic matter Depth to saturated zone Flooding	1.00  1.00 0.40	Very limited Content of organic matter Flooding Depth to saturated zone	1.00  1.00 1.00
1013: Pits-----	90	Not rated		Not rated		Not rated	

Table 12a.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1015: Udipsamments-----	90	Not rated		Not rated		Not rated	
1016: Udorthents-----	90	Not rated		Not rated		Not rated	
1028: Udorthents-----	45	Not rated		Not rated		Not rated	
Pits, gravel-----	40	Not rated		Not rated		Not rated	
1109: Isanti-----	90	Very limited Depth to saturated zone Too sandy	1.00 0.96	Very limited Depth to saturated zone Too sandy	1.00 0.96	Very limited Depth to saturated zone Too sandy	1.00 0.96
1110: Isan-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
1223: Sandberg-----	60	Somewhat limited Too sandy	0.77	Somewhat limited Too sandy	0.77	Somewhat limited Gravel content Too sandy	0.78 0.77
Arvilla-----	30	Not limited		Not limited		Not limited	
1224: Hubbard-----	60	Somewhat limited Too sandy	0.70	Somewhat limited Too sandy	0.70	Somewhat limited Too sandy	0.70
Verndale-----	35	Not limited		Not limited		Not limited	
1231: Hubbard-----	60	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy Slope	0.81 0.01
Mosford-----	35	Not limited		Not limited		Not limited	
1253B: Stonelake-----	60	Somewhat limited Too sandy Gravel content	0.89 0.36	Somewhat limited Too sandy Gravel content	0.89 0.36	Very limited Gravel content Too sandy Slope Content of large stones	1.00 0.89 0.13 0.01
Sanburn-----	30	Not limited		Not limited		Somewhat limited Slope	0.13

Table 12a.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1253C: Stonelake-----	65	Somewhat limited Too sandy Gravel content Slope	 0.79 0.36 0.16	Somewhat limited Too sandy Gravel content Slope	 0.79 0.36 0.16	Very limited Gravel content Slope Too sandy Content of large stones	 1.00 1.00 0.79 0.01
Sanburn-----	25	Somewhat limited Slope	 0.16	Somewhat limited Slope	 0.16	Very limited Slope	 1.00
1253E: Stonelake-----	65	Very limited Slope Too sandy	 1.00 0.79	Very limited Slope Too sandy	 1.00 0.79	Very limited Slope Too sandy Gravel content	 1.00 0.79 0.22
Sanburn-----	25	Very limited Slope	 1.00	Very limited Slope	 1.00	Very limited Slope	 1.00
1254: Ricelake-----	90	Very limited Depth to saturated zone	 0.99	Somewhat limited Depth to saturated zone	 0.78	Somewhat limited Depth to saturated zone Slope	 0.99 0.01
1255: Elkriver, occasionally flooded-----	90	Very limited Flooding Depth to saturated zone	 1.00 0.98	Somewhat limited Depth to saturated zone	 0.75	Somewhat limited Depth to saturated zone Flooding	 0.98 0.60
1256: Cantlin-----	90	Somewhat limited Too sandy	 0.96	Somewhat limited Too sandy	 0.96	Somewhat limited Too sandy	 0.96
1257: Elkriver, rarely flooded-----	55	Very limited Flooding	 1.00	Not limited		Somewhat limited Slope	 0.01
Mosford, rarely flooded-----	35	Very limited Flooding	 1.00	Not limited		Somewhat limited Slope	 0.13
1258B: Zimmerman, thick solum-----	95	Very limited Too sandy	 1.00	Very limited Too sandy	 1.00	Very limited Too sandy Slope	 1.00 0.13
1258C: Zimmerman, thick solum-----	95	Very limited Too sandy Slope	 1.00 0.04	Very limited Too sandy Slope	 1.00 0.04	Very limited Too sandy Slope	 1.00 1.00

Table 12a.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1258E: Zimmerman, thick solum-----	95	Very limited Too sandy Slope	1.00 1.00	Very limited Too sandy Slope	1.00 1.00	Very limited Slope Too sandy	1.00 1.00
1260B: Stonelake-----	55	Somewhat limited Too sandy	0.50	Somewhat limited Too sandy	0.50	Somewhat limited Too sandy Slope Gravel content	0.50 0.13 0.04
Nebish-----	30	Not limited		Not limited		Somewhat limited Slope	0.13
1260C: Stonelake-----	55	Somewhat limited Too sandy Slope	0.57 0.04	Somewhat limited Too sandy Slope	0.57 0.04	Very limited Slope Too sandy Gravel content	1.00 0.57 0.04
Nebish-----	30	Somewhat limited Slope	0.04	Somewhat limited Slope	0.04	Very limited Slope	1.00
1260E: Stonelake-----	60	Very limited Slope Gravel content	1.00 0.36	Very limited Slope Gravel content	1.00 0.36	Very limited Gravel content Slope Content of large stones	1.00 1.00 0.01
Nebish-----	25	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
1270B: Milaca, moderately wet-----	90	Somewhat limited Restricted permeability	0.94	Somewhat limited Restricted permeability	0.94	Somewhat limited Restricted permeability Slope	0.94 0.50
1288: Seelyeville, ponded	60	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00
Markey, ponded-----	30	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00
1356: Water, miscellaneous	100	Not rated		Not rated		Not rated	

Table 12a.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1946: Fordum, frequently flooded-----	65	Very limited Flooding Depth to saturated zone	1.00  1.00	Very limited Depth to saturated zone Flooding	1.00  0.40	Very limited Flooding Depth to saturated zone Gravel content	1.00  1.00 0.05
Winterfield, frequently flooded	20	Very limited Flooding Depth to saturated zone Too sandy	1.00  0.98 0.96	Somewhat limited Too sandy Depth to saturated zone Flooding	0.96  0.75 0.40	Very limited Flooding Depth to saturated zone Too sandy	1.00  0.98 0.96
W: Water-----	100	Not rated		Not rated		Not rated	

Table 12b.--Recreation

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and component name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
7A: Hubbard-----	95	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy	0.81	Somewhat limited Droughty	0.50
7B: Hubbard-----	95	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy	0.81	Somewhat limited Droughty	0.59
7C: Hubbard-----	95	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy	0.81	Somewhat limited Droughty Slope	0.83 0.04
32B: Nebish-----	85	Not limited		Not limited		Not limited	
32C: Nebish-----	85	Not limited		Not limited		Somewhat limited Slope	0.04
32D: Nebish-----	85	Somewhat limited Slope	0.01	Not limited		Very limited Slope	1.00
32E: Nebish-----	85	Very limited Slope	1.00	Somewhat limited Slope	0.01	Very limited Slope	1.00
38B: Waukon-----	90	Not limited		Not limited		Not limited	
75: Bluffton, depressional-----	90	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
125: Beltrami-----	90	Somewhat limited Depth to saturated zone	0.50	Somewhat limited Depth to saturated zone	0.50	Somewhat limited Depth to saturated zone	0.78
152C: Milaca-----	95	Not limited		Not limited		Somewhat limited Slope	0.04
152E: Milaca-----	95	Somewhat limited Slope	0.50	Not limited		Very limited Slope	1.00
158A: Zimmerman-----	95	Very limited Too sandy	1.00	Very limited Too sandy	1.00	Somewhat limited Droughty	0.34

Table 12b.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
158B: Zimmerman-----	95	Very limited Too sandy	1.00	Very limited Too sandy	1.00	Somewhat limited Droughty	0.34
158C: Zimmerman-----	95	Very limited Too sandy	1.00	Very limited Too sandy	1.00	Somewhat limited Droughty Slope	0.34 0.04
158E: Zimmerman-----	95	Very limited Too sandy Slope	1.00 0.50	Very limited Too sandy	1.00	Very limited Slope Droughty	1.00 0.34
161: Isanti, depressional	95	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
162: Lino-----	95	Somewhat limited Too sandy Depth to saturated zone	0.96 0.44	Somewhat limited Too sandy Depth to saturated zone	0.96 0.44	Somewhat limited Depth to saturated zone Droughty	0.75 0.42
164A: Mora-----	95	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
165: Parent-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
166: Ronneby-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
169B: Braham-----	90	Somewhat limited Too sandy	0.37	Somewhat limited Too sandy	0.37	Not limited	
169C: Braham-----	90	Somewhat limited Too sandy	0.37	Somewhat limited Too sandy	0.37	Somewhat limited Slope	0.04
169D: Braham-----	90	Somewhat limited Too sandy Slope	0.37 0.01	Somewhat limited Too sandy	0.37	Very limited Slope	1.00
204B: Cushing-----	90	Not limited		Not limited		Not limited	
204C: Cushing-----	95	Not limited		Not limited		Somewhat limited Slope	0.37

Table 12b.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
258B: Sandberg-----	95	Somewhat limited Too sandy	0.77	Somewhat limited Too sandy	0.77	Somewhat limited Too sandy Droughty	0.50 0.38
258C: Sandberg-----	95	Somewhat limited Too sandy	0.77	Somewhat limited Too sandy	0.77	Somewhat limited Droughty Too sandy Slope	0.66 0.50 0.04
258E: Sandberg-----	95	Somewhat limited Too sandy Slope	0.77 0.50	Somewhat limited Too sandy	0.77	Very limited Slope Droughty Too sandy	1.00 0.63 0.50
260: Duelm-----	95	Somewhat limited Too sandy	0.87	Somewhat limited Too sandy	0.87	Somewhat limited Droughty	0.21
261: Isan, depressional--	95	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone Droughty	1.00 1.00 0.04
325: Prebish, depressional-----	95	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
341: Arvilla-----	95	Not limited		Not limited		Somewhat limited Droughty	0.10
346: Talmoon-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
373: Renshaw-----	95	Not limited		Not limited		Somewhat limited Droughty	0.01
454B: Mahtomedi-----	95	Somewhat limited Too sandy	0.61	Somewhat limited Too sandy	0.61	Somewhat limited Droughty Too sandy	0.61 0.50
454C: Mahtomedi-----	95	Somewhat limited Too sandy	0.61	Somewhat limited Too sandy	0.61	Somewhat limited Droughty Too sandy Slope	0.70 0.50 0.16

Table 12b.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
540: Seelyeville-----	95	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00
543: Markey-----	90	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00
544: Cathro-----	95	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00
565: Eckvoll-----	90	Somewhat limited Too sandy Depth to saturated zone	0.89 0.44	Somewhat limited Too sandy Depth to saturated zone	0.89 0.44	Somewhat limited Depth to saturated zone	0.75
567: Verndale-----	95	Not limited		Not limited		Not limited	
623A: Pierz-----	95	Not limited		Not limited		Not limited	
623B: Pierz-----	95	Not limited		Not limited		Not limited	
708: Rushlake-----	85	Very limited Too sandy	1.00	Very limited Too sandy	1.00	Very limited Too sandy Droughty Depth to saturated zone	1.00 0.92 0.19
730A: Sanburn-----	90	Not limited		Not limited		Somewhat limited Droughty	0.74
730B: Sanburn-----	90	Not limited		Not limited		Somewhat limited Droughty	0.73
732B: Bushville-----	95	Very limited Too sandy Depth to saturated zone	1.00 1.00	Very limited Too sandy Depth to saturated zone	1.00 1.00	Very limited Depth to saturated zone Droughty	1.00 1.00 0.19

Table 12b.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
768: Mosford-----	95	Not limited		Not limited		Somewhat limited Droughty	0.02
771: Elkriver, rarely flooded-----	95	Not limited		Not limited		Not limited	
799: Seelyeville, frequently flooded	45	Very limited Content of organic matter Depth to saturated zone Flooding	1.00  1.00 0.40	Very limited Content of organic matter Depth to saturated zone Flooding	1.00  1.00 0.40	Very limited Flooding Content of organic matter Depth to saturated zone	1.00  1.00 1.00
Bowstring, frequently flooded	45	Very limited Content of organic matter Depth to saturated zone Flooding	1.00  1.00 0.40	Very limited Content of organic matter Depth to saturated zone Flooding	1.00  1.00 0.40	Very limited Flooding Content of organic matter Depth to saturated zone	1.00  1.00 1.00
1013: Pits-----	90	Not rated		Not rated		Not rated	
1015: Udipsamments-----	90	Not rated		Not rated		Not rated	
1016: Udorthents-----	90	Not rated		Not rated		Not rated	
1028: Udorthents-----	45	Not rated		Not rated		Not rated	
Pits, gravel-----	40	Not rated		Not rated		Not rated	
1109: Isanti-----	90	Very limited Depth to saturated zone Too sandy	1.00  0.96	Very limited Depth to saturated zone Too sandy	1.00  0.96	Very limited Depth to saturated zone Droughty	1.00  0.27
1110: Isan-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone Droughty	1.00 0.03
1223: Sandberg-----	60	Somewhat limited Too sandy	0.77	Somewhat limited Too sandy	0.77	Somewhat limited Too sandy Droughty	0.50 0.41
Arvilla-----	30	Not limited		Not limited		Somewhat limited Droughty	0.27

Table 12b.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1224:							
Hubbard-----	60	Somewhat limited Too sandy	0.70	Somewhat limited Too sandy	0.70	Somewhat limited Droughty Too sandy	0.85 0.50
Verndale-----	35	Not limited		Not limited		Not limited	
1231:							
Hubbard-----	60	Somewhat limited Too sandy	0.81	Somewhat limited Too sandy	0.81	Somewhat limited Droughty	0.79
Mosford-----	35	Not limited		Not limited		Not limited	
1253B:							
Stonelake-----	60	Somewhat limited Too sandy	0.89	Somewhat limited Too sandy	0.89	Somewhat limited Droughty Gravel content Content of large stones	0.99 0.36 0.01
Sanburn-----	30	Not limited		Not limited		Somewhat limited Droughty	0.66
1253C:							
Stonelake-----	65	Somewhat limited Too sandy	0.79	Somewhat limited Too sandy	0.79	Somewhat limited Droughty Too sandy Gravel content Slope Content of large stones	0.98 0.50 0.36 0.16 0.01
Sanburn-----	25	Not limited		Not limited		Somewhat limited Droughty Slope	0.75 0.16
1253E:							
Stonelake-----	65	Very limited Slope Too sandy	1.00 0.79	Somewhat limited Too sandy Slope	0.79 0.01	Very limited Slope Droughty Too sandy	1.00 1.00 0.50
Sanburn-----	25	Very limited Slope	1.00	Somewhat limited Slope	0.01	Very limited Slope Droughty	1.00 0.92
1254:							
Ricelake-----	90	Somewhat limited Depth to saturated zone	0.50	Somewhat limited Depth to saturated zone	0.50	Somewhat limited Depth to saturated zone	0.78
1255:							
Elkriver, occasionally flooded-----	90	Somewhat limited Depth to saturated zone	0.44	Somewhat limited Depth to saturated zone	0.44	Somewhat limited Depth to saturated zone Flooding	0.75 0.60

Table 12b.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1256: Cantlin-----	90	Somewhat limited Too sandy	0.96	Somewhat limited Too sandy	0.96	Somewhat limited Droughty	0.57
1257: Elkriver, rarely flooded-----	55	Not limited		Not limited		Not limited	
Mosford, rarely flooded-----	35	Not limited		Not limited		Somewhat limited Droughty	0.01
1258B: Zimmerman, thick solum-----	95	Very limited Too sandy	1.00	Very limited Too sandy	1.00	Somewhat limited Droughty	0.34
1258C: Zimmerman, thick solum-----	95	Very limited Too sandy	1.00	Very limited Too sandy	1.00	Somewhat limited Droughty Slope	0.34 0.04
1258E: Zimmerman, thick solum-----	95	Very limited Too sandy Slope	1.00 0.18	Very limited Too sandy	1.00	Very limited Slope Droughty	1.00 0.34
1260B: Stonelake-----	55	Somewhat limited Too sandy	0.50	Somewhat limited Too sandy	0.50	Somewhat limited Droughty Too sandy	0.82 0.50
Nebish-----	30	Not limited		Not limited		Not limited	
1260C: Stonelake-----	55	Somewhat limited Too sandy	0.57	Somewhat limited Too sandy	0.57	Somewhat limited Droughty Slope	0.88 0.04
Nebish-----	30	Not limited		Not limited		Somewhat limited Slope	0.04
1260E: Stonelake-----	60	Somewhat limited Slope	0.18	Not limited		Very limited Slope Droughty Gravel content Content of large stones	1.00 0.99 0.36 0.01
Nebish-----	25	Somewhat limited Slope	0.18	Not limited		Very limited Slope	1.00
1270B: Milaca, moderately wet-----	90	Not limited		Not limited		Not limited	

Table 12b.--Recreation--Continued

Map symbol and component name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1288: Seelyeville, ponded	60	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00
Markey, ponded-----	30	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00
1356: Water, miscellaneous	100	Not rated		Not rated		Not rated	
1946: Fordum, frequently flooded-----	65	Very limited Depth to saturated zone Flooding	1.00 0.40	Very limited Depth to saturated zone Flooding	1.00 0.40	Very limited Flooding Depth to saturated zone	1.00 1.00
Winterfield, frequently flooded	20	Somewhat limited Too sandy Depth to saturated zone Flooding	0.96 0.44 0.40	Somewhat limited Too sandy Depth to saturated zone Flooding	0.96 0.44 0.40	Very limited Flooding Depth to saturated zone Droughty	1.00 0.75 0.22
W: Water-----	100	Not rated		Not rated		Not rated	

Table 13.--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 component name	Pct. of map unit	Potential for habitat elements							Potential as habitat for--		
		Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
7A: Hubbard-----	95	Fair	Good	Fair	Fair	Fair	Very poor	Very poor	Good	Fair	Very poor
7B: Hubbard-----	95	Fair	Good	Fair	Fair	Fair	Very poor	Very poor	Good	Fair	Very poor
7C: Hubbard-----	95	Poor	Good	Fair	Fair	Fair	Very poor	Very poor	Good	Fair	Very poor
32B: Nebish-----	85	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
32C: Nebish-----	85	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
32D: Nebish-----	85	Poor	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
32E: Nebish-----	85	Poor	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
38B: Waukon-----	90	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
75: Bluffton, depressiona--	90	Very poor	Good	Good	Poor	Poor	Good	Good	Poor	Poor	Good
125: Beltrami-----	90	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
152C: Milaca-----	95	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
152E: Milaca-----	95	Poor	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
158A: Zimmerman-----	95	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
158B: Zimmerman-----	95	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
158C: Zimmerman-----	95	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor

Table 13.--Wildlife Habitat--Continued

Map symbol and component name	Pct. of map unit	Potential for habitat elements							Potential as habitat for--		
		Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
158E: Zimmerman-----	95	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
161: Isanti, depressional----	95	Very poor	Good	Good	Poor	Poor	Good	Good	Good	Poor	Good
162: Lino-----	95	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
164A: Mora-----	95	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
165: Parent-----	90	Fair	Good	Good	Good	Fair	Good	Good	Good	Good	Good
166: Ronneby-----	90	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair
169B: Braham-----	90	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
169C: Braham-----	90	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
169D: Braham-----	90	Very poor	Fair	Good	Fair	Good	Very poor	Very poor	Good	Good	Very poor
204B: Cushing-----	90	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
204C: Cushing-----	95	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
258B: Sandberg-----	95	Poor	Fair	Fair	Poor	Fair	Very poor	Very poor	Good	Fair	Very poor
258C: Sandberg-----	95	Poor	Fair	Fair	Poor	Fair	Very poor	Very poor	Good	Fair	Very poor
258E: Sandberg-----	95	Very poor	Fair	Fair	Poor	Fair	Very poor	Very poor	Poor	Fair	Very poor
260: Duelm-----	95	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
261: Isan, depressional-----	95	Very poor	Good	Good	Poor	Poor	Good	Good	Fair	Poor	Good
325: Prebish, depressional---	95	Very poor	Good	Good	Poor	Poor	Good	Good	Fair	Poor	Good

Table 13.--Wildlife Habitat--Continued

Map symbol and component name	Pct. of map unit	Potential for habitat elements							Potential as habitat for--		
		Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
341: Arvilla-----	95	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
346: Talmoon-----	90	Good	Good	Good	Fair	Good	Good	Good	Good	Good	Good
373: Renshaw-----	95	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
454B: Mahtomedi-----	95	Poor	Fair	Fair	Poor	Fair	Very poor	Very poor	Fair	Fair	Very poor
454C: Mahtomedi-----	95	Poor	Fair	Fair	Poor	Fair	Very poor	Very poor	Fair	Fair	Very poor
540: Seelyeville-----	95	Very poor	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good
543: Markey-----	90	Very poor	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good
544: Cathro-----	95	Very poor	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good
565: Eckvoll-----	90	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
567: Verndale-----	95	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
623A: Pierz-----	95	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
623B: Pierz-----	95	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
708: Rushlake-----	85	Poor	Good	Good	Good	Good	Fair	Poor	Good	Good	Fair
730A: Sanburn-----	90	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
730B: Sanburn-----	90	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
732B: Bushville-----	95	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor

Table 13.--Wildlife Habitat--Continued

Map symbol and component name	Pct. of map unit	Potential for habitat elements							Potential as habitat for--		
		Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
768: Mosford-----	95	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
771: Elkriver, rarely flooded	95	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
799: Seelyeville, frequently flooded-----	45	Very poor	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good
Bowstring, frequently flooded-----	45	Very poor	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good
1013: Pits.											
1015: Udipsamments.											
1016: Udorthents.											
1028: Udorthents.  Pits, gravel.											
1109: Isanti-----	90	Poor	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good
1110: Isan-----	90	Poor	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good
1223: Sandberg-----	60	Poor	Fair	Good	Poor	Poor	Very poor	Very poor	Good	Poor	Very poor
Arvilla-----	30	Fair	Good	Good	Fair	Fair	Very poor	Very poor	Good	Fair	Very poor
1224: Hubbard-----	60	Fair	Good	Fair	Fair	Fair	Very poor	Very poor	Good	Fair	Very poor
Verndale-----	35	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1231: Hubbard-----	60	Fair	Good	Fair	Fair	Fair	Very poor	Very poor	Good	Fair	Very poor
Mosford-----	35	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1253B: Stonelake-----	60	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor

Table 13.--Wildlife Habitat--Continued

Map symbol and component name	Pct. of map unit	Potential for habitat elements							Potential as habitat for--		
		Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
1253B: Sanburn-----	30	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1253C: Stonelake-----	65	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
Sanburn-----	25	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1253E: Stonelake-----	65	Very poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
Sanburn-----	25	Very poor	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1254: Ricelake-----	90	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor
1255: Elkriver, occasionally flooded-----	90	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1256: Cantlin-----	90	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1257: Elkriver, rarely flooded	55	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
Mosford, rarely flooded	35	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1258B: Zimmerman, thick solum--	95	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
1258C: Zimmerman, thick solum--	95	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
1258E: Zimmerman, thick solum--	95	Poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor
1260B: Stonelake-----	55	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
Nebish-----	30	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor
1260C: Stonelake-----	55	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor
Nebish-----	30	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor



Table 14a.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and component name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
7A: Hubbard-----	95	Not limited		Not limited		Not limited	
7B: Hubbard-----	95	Not limited		Not limited		Not limited	
7C: Hubbard-----	95	Somewhat limited Slope	0.04	Somewhat limited Slope	0.04	Very limited Slope	1.00
32B: Nebish-----	85	Somewhat limited Shrink-swell	0.50	Somewhat limited Depth to saturated zone Shrink-swell	0.78 0.50	Somewhat limited Shrink-swell	0.50
32C: Nebish-----	85	Somewhat limited Shrink-swell Slope	0.50 0.04	Somewhat limited Shrink-swell Slope	0.50 0.04	Very limited Slope Shrink-swell	1.00 0.50
32D: Nebish-----	85	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
32E: Nebish-----	85	Very limited Slope Shrink-swell	1.00 0.50	Very limited Slope	1.00	Very limited Slope Shrink-swell	1.00 0.50
38B: Waukon-----	90	Somewhat limited Shrink-swell	0.50	Somewhat limited Depth to saturated zone Shrink-swell	0.78 0.50	Somewhat limited Shrink-swell	0.50
75: Bluffton, depressional-----	90	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
125: Beltrami-----	90	Somewhat limited Depth to saturated zone Shrink-swell	0.99 0.50	Very limited Depth to saturated zone Shrink-swell	1.00 0.50	Very limited Depth to saturated zone Shrink-swell	0.99 0.50
152C: Milaca-----	95	Somewhat limited Slope	0.04	Somewhat limited Slope	0.04	Very limited Slope	1.00

Table 14a.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
152E: Milaca-----	95	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
158A: Zimmerman-----	95	Not limited		Not limited		Not limited	
158B: Zimmerman-----	95	Not limited		Not limited		Not limited	
158C: Zimmerman-----	95	Somewhat limited Slope	0.04	Somewhat limited Slope	0.04	Very limited Slope	1.00
158E: Zimmerman-----	95	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
161: Isanti, depressional	95	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
162: Lino-----	95	Somewhat limited Depth to saturated zone	0.98	Very limited Depth to saturated zone	1.00	Somewhat limited Depth to saturated zone	0.98
164A: Mora-----	95	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
165: Parent-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
166: Ronneby-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
169B: Braham-----	90	Somewhat limited Shrink-swell	0.50	Very limited Depth to saturated zone Shrink-swell	1.00 0.50	Somewhat limited Shrink-swell Slope	0.50 0.01
169C: Braham-----	90	Somewhat limited Slope	0.04	Somewhat limited Shrink-swell Slope	0.50 0.04	Very limited Slope	1.00
169D: Braham-----	90	Very limited Slope	1.00	Very limited Slope Shrink-swell	1.00 0.50	Very limited Slope	1.00

Table 14a.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
204B: Cushing-----	90	Not limited		Somewhat limited Depth to saturated zone	0.78	Somewhat limited Slope	0.12
204C: Cushing-----	95	Somewhat limited Slope	0.37	Somewhat limited Slope	0.37	Very limited Slope	1.00
258B: Sandberg-----	95	Not limited		Not limited		Not limited	
258C: Sandberg-----	95	Somewhat limited Slope	0.04	Somewhat limited Slope	0.04	Very limited Slope	1.00
258E: Sandberg-----	95	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
260: Duelm-----	95	Not limited		Very limited Depth to saturated zone	1.00	Not limited	
261: Isan, depressional--	95	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
325: Prebish, depressional-----	95	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
341: Arvilla-----	95	Not limited		Not limited		Not limited	
346: Talmoon-----	90	Very limited Depth to saturated zone Shrink-swell	1.00 0.50	Very limited Depth to saturated zone Shrink-swell	1.00 0.50	Very limited Depth to saturated zone Shrink-swell	1.00 0.50
373: Renshaw-----	95	Not limited		Not limited		Not limited	
454B: Mahtomedi-----	95	Not limited		Not limited		Not limited	
454C: Mahtomedi-----	95	Somewhat limited Slope	0.16	Somewhat limited Slope	0.16	Very limited Slope	1.00

Table 14a.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
540: Seelyeville-----	95	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	 1.00 1.00 1.00 1.00	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	 1.00 1.00 1.00 1.00	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	 1.00 1.00 1.00 1.00
543: Markey-----	90	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	 1.00 1.00 1.00 1.00	Very limited Ponding Subsidence Depth to saturated zone	 1.00 1.00 1.00	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	 1.00 1.00 1.00 1.00
544: Cathro-----	95	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	 1.00 1.00 1.00 1.00	Very limited Ponding Subsidence Depth to saturated zone	 1.00 1.00 1.00	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	 1.00 1.00 1.00 1.00
565: Eckvoll-----	90	Somewhat limited Depth to saturated zone Shrink-swell	 0.98 0.50	Very limited Depth to saturated zone Shrink-swell	 1.00 0.50	Somewhat limited Depth to saturated zone Shrink-swell	 0.98 0.50
567: Verndale-----	95	Not limited		Not limited		Not limited	
623A: Pierz-----	95	Not limited		Not limited		Not limited	
623B: Pierz-----	95	Not limited		Not limited		Not limited	
708: Rushlake-----	85	Somewhat limited Depth to saturated zone	 0.39	Very limited Depth to saturated zone	 1.00	Somewhat limited Depth to saturated zone	 0.39
730A: Sanburn-----	90	Not limited		Not limited		Not limited	
730B: Sanburn-----	90	Not limited		Not limited		Not limited	
732B: Bushville-----	95	Very limited Depth to saturated zone	 1.00	Very limited Depth to saturated zone	 1.00	Very limited Depth to saturated zone	 1.00
768: Mosford-----	95	Not limited		Not limited		Not limited	

Table 14a.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
771: Elkriver, rarely flooded-----	95	Very limited Flooding	1.00	Very limited Flooding Depth to saturated zone	1.00 0.95	Very limited Flooding	1.00
799: Seelyeville, frequently flooded	45	Very limited Subsidence Flooding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Subsidence Flooding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Subsidence Flooding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00
Bowstring, frequently flooded	45	Very limited Subsidence Flooding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Subsidence Flooding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Subsidence Flooding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00
1013: Pits-----	90	Not rated		Not rated		Not rated	
1015: Udipsamments-----	90	Not rated		Not rated		Not rated	
1016: Udorthents-----	90	Not rated		Not rated		Not rated	
1028: Udorthents-----	45	Not rated		Not rated		Not rated	
Pits, gravel-----	40	Not rated		Not rated		Not rated	
1109: Isanti-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
1110: Isan-----	90	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00	Very limited Depth to saturated zone	1.00
1223: Sandberg-----	60	Not limited		Not limited		Not limited	
Arvilla-----	30	Not limited		Not limited		Not limited	

Table 14a.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1224:							
Hubbard-----	60	Not limited		Not limited		Not limited	
Verndale-----	35	Not limited		Not limited		Not limited	
1231:							
Hubbard-----	60	Not limited		Not limited		Not limited	
Mosford-----	35	Not limited		Not limited		Not limited	
1253B:							
Stonelake-----	60	Not limited		Not limited		Not limited	
Sanburn-----	30	Not limited		Not limited		Not limited	
1253C:							
Stonelake-----	65	Somewhat limited Slope	0.16	Somewhat limited Slope	0.16	Very limited Slope	1.00
Sanburn-----	25	Somewhat limited Slope	0.16	Somewhat limited Slope	0.16	Very limited Slope	1.00
1253E:							
Stonelake-----	65	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
Sanburn-----	25	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
1254:							
Ricelake-----	90	Somewhat limited Depth to saturated zone	0.99	Very limited Depth to saturated zone Shrink-swell	1.00 0.50	Very limited Depth to saturated zone	0.99
1255:							
Elkriver, occasionally flooded-----	90	Very limited Flooding Depth to saturated zone	1.00 0.98	Very limited Flooding Depth to saturated zone	1.00 1.00	Very limited Flooding Depth to saturated zone	1.00 0.98
1256:							
Cantlin-----	90	Not limited		Somewhat limited Depth to saturated zone	0.82	Not limited	
1257:							
Elkriver, rarely flooded-----	55	Very limited Flooding	1.00	Very limited Flooding Depth to saturated zone	1.00 0.95	Very limited Flooding	1.00
Mosford, rarely flooded-----	35	Very limited Flooding	1.00	Very limited Flooding Depth to saturated zone	1.00 0.95	Very limited Flooding	1.00

Table 14a.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1258B: Zimmerman, thick solum-----	95	Not limited		Not limited		Not limited	
1258C: Zimmerman, thick solum-----	95	Somewhat limited Slope	0.04	Somewhat limited Slope	0.04	Very limited Slope	1.00
1258E: Zimmerman, thick solum-----	95	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
1260B: Stonelake-----	55	Not limited		Not limited		Not limited	
Nebish-----	30	Somewhat limited Shrink-swell	0.50	Somewhat limited Depth to saturated zone Shrink-swell	0.78 0.50	Somewhat limited Shrink-swell	0.50
1260C: Stonelake-----	55	Somewhat limited Slope	0.04	Somewhat limited Slope	0.04	Very limited Slope	1.00
Nebish-----	30	Somewhat limited Shrink-swell Slope	0.50 0.04	Somewhat limited Slope	0.04	Very limited Slope Shrink-swell	1.00 0.50
1260E: Stonelake-----	60	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
Nebish-----	25	Very limited Slope Shrink-swell	1.00 0.50	Very limited Slope	1.00	Very limited Slope Shrink-swell	1.00 0.50
1270B: Milaca, moderately wet-----	90	Not limited		Very limited Depth to saturated zone	1.00	Somewhat limited Slope	0.01
1288: Seelyeville, ponded	60	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00
Markey, ponded-----	30	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Ponding Subsidence Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Subsidence Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00

Table 14a.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1356: Water, miscellaneous	100	Not rated		Not rated		Not rated	
1946: Fordum, frequently flooded-----	65	Very limited Flooding Depth to saturated zone	1.00 1.00	Very limited Flooding Depth to saturated zone	1.00 1.00	Very limited Flooding Depth to saturated zone	1.00 1.00
Winterfield, frequently flooded	20	Very limited Flooding Depth to saturated zone	1.00 0.98	Very limited Flooding Depth to saturated zone	1.00 1.00	Very limited Flooding Depth to saturated zone	1.00 0.98
W: Water-----	100	Not rated		Not rated		Not rated	

Table 14b.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
7A: Hubbard-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.50
7B: Hubbard-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.59
7C: Hubbard-----	95	Somewhat limited Slope	0.04	Very limited Cutbanks cave Slope	1.00 0.04	Somewhat limited Droughty Slope	0.83 0.04
32B: Nebish-----	85	Somewhat limited Shrink-swell Frost action	0.50 0.50	Somewhat limited Depth to saturated zone Cutbanks cave	0.78 0.10	Not limited	
32C: Nebish-----	85	Somewhat limited Shrink-swell Frost action Slope	0.50 0.50 0.04	Somewhat limited Cutbanks cave Slope	0.10 0.04	Somewhat limited Slope	0.04
32D: Nebish-----	85	Very limited Slope Frost action	1.00 0.50	Very limited Slope Cutbanks cave	1.00 0.10	Very limited Slope	1.00
32E: Nebish-----	85	Very limited Slope Shrink-swell Frost action	1.00 0.50 0.50	Very limited Slope Cutbanks cave	1.00 0.10	Very limited Slope	1.00
38B: Waukon-----	90	Somewhat limited Shrink-swell Frost action	0.50 0.50	Somewhat limited Depth to saturated zone Cutbanks cave	0.78 0.10	Not limited	
75: Bluffton, depressional-----	90	Very limited Ponding Frost action Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Depth to saturated zone Cutbanks cave	1.00 1.00 1.00 0.10	Very limited Ponding Depth to saturated zone	1.00 1.00

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
125: Beltrami-----	90	Very limited Frost action Depth to saturated zone Shrink-swell	1.00 0.78 0.50	Very limited Depth to saturated zone Cutbanks cave	1.00 0.10	Somewhat limited Depth to saturated zone	0.78
152C: Milaca-----	95	Somewhat limited Frost action Slope	0.50 0.04	Somewhat limited Depth to dense layer Cutbanks cave Slope	0.50 0.10 0.04	Somewhat limited Slope	0.04
152E: Milaca-----	95	Very limited Slope Frost action	1.00 0.50	Very limited Slope Depth to dense layer Cutbanks cave	1.00 0.50 0.10	Very limited Slope	1.00
158A: Zimmerman-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.34
158B: Zimmerman-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.34
158C: Zimmerman-----	95	Somewhat limited Slope	0.04	Very limited Cutbanks cave Slope	1.00 0.04	Somewhat limited Droughty Slope	0.34 0.04
158E: Zimmerman-----	95	Very limited Slope	1.00	Very limited Cutbanks cave Slope	1.00 1.00	Very limited Slope Droughty	1.00 0.34
161: Isanti, depressional	95	Very limited Ponding Depth to saturated zone Frost action	1.00 1.00 1.00 0.50	Very limited Ponding Cutbanks cave Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Depth to saturated zone	1.00 1.00
162: Lino-----	95	Somewhat limited Depth to saturated zone Frost action	0.75 0.50	Very limited Cutbanks cave Depth to saturated zone	1.00 1.00	Somewhat limited Depth to saturated zone Droughty	0.75 0.42
164A: Mora-----	95	Very limited Frost action Depth to saturated zone	1.00 1.00	Very limited Depth to saturated zone Depth to dense layer Cutbanks cave	1.00 0.50 0.10	Very limited Depth to saturated zone	1.00

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
165: Parent-----	90	Very limited Frost action Depth to saturated zone	1.00 1.00	Very limited Depth to saturated zone Depth to dense layer Cutbanks cave	1.00 0.50 0.10	Very limited Depth to saturated zone	1.00
166: Ronneby-----	90	Very limited Frost action Depth to saturated zone	1.00 1.00	Very limited Depth to saturated zone Depth to dense layer Cutbanks cave	1.00 0.50 0.10	Very limited Depth to saturated zone	1.00
169B: Braham-----	90	Somewhat limited Shrink-swell	0.50	Very limited Cutbanks cave Depth to saturated zone	1.00 1.00	Not limited	
169C: Braham-----	90	Somewhat limited Slope	0.04	Very limited Cutbanks cave Slope	1.00 0.04	Somewhat limited Slope	0.04
169D: Braham-----	90	Very limited Slope	1.00	Very limited Cutbanks cave Slope	1.00 1.00	Very limited Slope	1.00
204B: Cushing-----	90	Somewhat limited Frost action	0.50	Somewhat limited Depth to saturated zone Cutbanks cave	0.78 0.10	Not limited	
204C: Cushing-----	95	Somewhat limited Frost action Slope	0.50 0.37	Somewhat limited Slope Cutbanks cave	0.37 0.10	Somewhat limited Slope	0.37
258B: Sandberg-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Too sandy Droughty	0.50 0.38
258C: Sandberg-----	95	Somewhat limited Slope	0.04	Very limited Cutbanks cave Slope	1.00 0.04	Somewhat limited Droughty Too sandy Slope	0.66 0.50 0.04
258E: Sandberg-----	95	Very limited Slope	1.00	Very limited Cutbanks cave Slope	1.00 1.00	Very limited Slope Droughty Too sandy	1.00 0.63 0.50

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
260: Duelm-----	95	Somewhat limited Frost action	0.50	Very limited Cutbanks cave Depth to saturated zone	1.00 1.00	Somewhat limited Droughty	0.21
261: Isan, depressional--	95	Very limited Ponding Depth to saturated zone Frost action	1.00 1.00 0.50	Very limited Ponding Cutbanks cave Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Depth to saturated zone Droughty	1.00 1.00 1.00 0.04
325: Prebish, depressional-----	95	Very limited Ponding Frost action Depth to saturated zone	1.00 1.00 1.00	Very limited Ponding Depth to saturated zone Depth to dense layer Cutbanks cave	1.00 1.00 1.00 0.50 0.10	Very limited Ponding Depth to saturated zone	1.00 1.00 1.00
341: Arvilla-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.10
346: Talmoon-----	90	Very limited Frost action Depth to saturated zone Shrink-swell	1.00 1.00 0.50	Very limited Depth to saturated zone Cutbanks cave	1.00 0.10	Very limited Depth to saturated zone	1.00
373: Renshaw-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.01
454B: Mahtomedi-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty Too sandy	0.61 0.50
454C: Mahtomedi-----	95	Somewhat limited Slope	0.16	Very limited Cutbanks cave Slope	1.00 0.16	Somewhat limited Droughty Too sandy Slope	0.70 0.50 0.16
540: Seelyeville-----	95	Very limited Ponding Subsidence Frost action Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone Cutbanks cave	1.00 1.00 1.00 1.00 0.10	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
543: Markey-----	90	Very limited Ponding Subsidence Frost action Depth to saturated zone	 1.00 1.00 1.00 1.00	Very limited Ponding Cutbanks cave Depth to saturated zone Content of organic matter	 1.00 1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	 1.00 1.00 1.00
544: Cathro-----	95	Very limited Ponding Subsidence Frost action Depth to saturated zone	 1.00 1.00 1.00 1.00	Very limited Ponding Depth to saturated zone Content of organic matter Cutbanks cave	 1.00 1.00 1.00 1.00 0.10	Very limited Ponding Content of organic matter Depth to saturated zone	 1.00 1.00 1.00
565: Eckvoll-----	90	Very limited Frost action Depth to saturated zone Shrink-swell	 1.00 0.75 0.50	Very limited Cutbanks cave Depth to saturated zone	 1.00 1.00	Somewhat limited Depth to saturated zone	 0.75
567: Verndale-----	95	Not limited		Very limited Cutbanks cave	 1.00	Not limited	
623A: Pierz-----	95	Not limited		Very limited Cutbanks cave	 1.00	Not limited	
623B: Pierz-----	95	Not limited		Very limited Cutbanks cave	 1.00	Not limited	
708: Rushlake-----	85	Somewhat limited Frost action Depth to saturated zone	 0.50 0.19	Very limited Cutbanks cave Depth to saturated zone	 1.00 1.00	Very limited Too sandy Droughty Depth to saturated zone	 1.00 0.92 0.19
730A: Sanburn-----	90	Not limited		Very limited Cutbanks cave	 1.00	Somewhat limited Droughty	 0.74
730B: Sanburn-----	90	Not limited		Very limited Cutbanks cave	 1.00	Somewhat limited Droughty	 0.73
732B: Bushville-----	95	Very limited Depth to saturated zone	 1.00	Very limited Cutbanks cave Depth to saturated zone Depth to dense layer	 1.00 1.00 0.50	Very limited Depth to saturated zone Droughty	 1.00 0.19

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
768: Mosford-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.02
771: Elkriver, rarely flooded-----	95	Somewhat limited Frost action Flooding	0.50 0.40	Very limited Cutbanks cave Depth to saturated zone	1.00 0.95	Not limited	
799: Seelyville, frequently flooded	45	Very limited Subsidence Frost action Flooding Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Content of organic matter Depth to saturated zone Flooding Cutbanks cave	1.00 1.00 1.00 1.00 0.80 0.10	Very limited Flooding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00
Bowstring, frequently flooded	45	Very limited Subsidence Frost action Flooding Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Cutbanks cave Depth to saturated zone Content of organic matter Flooding	1.00 1.00 1.00 1.00 1.00 0.80	Very limited Flooding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00
1013: Pits-----	90	Not rated		Not rated		Not rated	
1015: Udipsammments-----	90	Not rated		Not rated		Not rated	
1016: Udorthents-----	90	Not rated		Not rated		Not rated	
1028: Udorthents-----	45	Not rated		Not rated		Not rated	
Pits, gravel-----	40	Not rated		Not rated		Not rated	
1109: Isanti-----	90	Very limited Depth to saturated zone Frost action	1.00 0.50	Very limited Cutbanks cave Depth to saturated zone	1.00 1.00	Very limited Depth to saturated zone Droughty	1.00 0.27
1110: Isan-----	90	Very limited Depth to saturated zone Frost action	1.00 0.50	Very limited Cutbanks cave Depth to saturated zone	1.00 1.00	Very limited Depth to saturated zone Droughty	1.00 0.03

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1223: Sandberg-----	60	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Too sandy Droughty	0.50 0.41
Arvilla-----	30	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.27
1224: Hubbard-----	60	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty Too sandy	0.85 0.50
Verndale-----	35	Not limited		Very limited Cutbanks cave	1.00	Not limited	
1231: Hubbard-----	60	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.79
Mosford-----	35	Not limited		Very limited Cutbanks cave	1.00	Not limited	
1253B: Stonelake-----	60	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty Gravel content Content of large stones	0.99 0.36 0.01
Sanburn-----	30	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.66
1253C: Stonelake-----	65	Somewhat limited Slope	0.16	Very limited Cutbanks cave Slope	1.00 0.16	Somewhat limited Droughty Too sandy Gravel content Slope Content of large stones	0.98 0.50 0.36 0.16 0.01
Sanburn-----	25	Somewhat limited Slope	0.16	Very limited Cutbanks cave Slope	1.00 0.16	Somewhat limited Droughty Slope	0.75 0.16
1253E: Stonelake-----	65	Very limited Slope	1.00	Very limited Cutbanks cave Slope	1.00 1.00	Very limited Slope Droughty Too sandy	1.00 1.00 0.50
Sanburn-----	25	Very limited Slope	1.00	Very limited Cutbanks cave Slope	1.00 1.00	Very limited Slope Droughty	1.00 0.92

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1254: Ricelake-----	90	Very limited Frost action Depth to saturated zone	1.00 0.78	Very limited Cutbanks cave Depth to saturated zone	1.00 1.00	Somewhat limited Depth to saturated zone	0.78
1255: Elkriver, occasionally flooded-----	90	Very limited Flooding Depth to saturated zone Frost action	1.00 0.75 0.50	Very limited Cutbanks cave Depth to saturated zone Flooding	1.00 1.00 0.60	Somewhat limited Depth to saturated zone Flooding	0.75 0.60
1256: Cantlin-----	90	Not limited		Very limited Cutbanks cave Depth to saturated zone	1.00 0.82	Somewhat limited Droughty	0.57
1257: Elkriver, rarely flooded-----	55	Somewhat limited Frost action Flooding	0.50 0.40	Very limited Cutbanks cave Depth to saturated zone	1.00 0.95	Not limited	
Mosford, rarely flooded-----	35	Somewhat limited Flooding	0.40	Very limited Cutbanks cave Depth to saturated zone	1.00 0.95	Somewhat limited Droughty	0.01
1258B: Zimmerman, thick solum-----	95	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty	0.34
1258C: Zimmerman, thick solum-----	95	Somewhat limited Slope	0.04	Very limited Cutbanks cave Slope	1.00 0.04	Somewhat limited Droughty Slope	0.34 0.04
1258E: Zimmerman, thick solum-----	95	Very limited Slope	1.00	Very limited Cutbanks cave Slope	1.00 1.00	Very limited Slope Droughty	1.00 0.34
1260B: Stonelake-----	55	Not limited		Very limited Cutbanks cave	1.00	Somewhat limited Droughty Too sandy	0.82 0.50
Nebish-----	30	Somewhat limited Shrink-swell Frost action	0.50 0.50	Somewhat limited Depth to saturated zone Cutbanks cave	0.78 0.10	Not limited	

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1260C: Stonelake-----	55	Somewhat limited Slope	0.04	Very limited Cutbanks cave Slope	1.00 0.04	Somewhat limited Droughty Slope	0.88 0.04
Nebish-----	30	Somewhat limited Shrink-swell Frost action Slope	0.50 0.50 0.04	Somewhat limited Cutbanks cave Slope	0.10 0.04	Somewhat limited Slope	0.04
1260E: Stonelake-----	60	Very limited Slope	1.00	Very limited Cutbanks cave Slope	1.00 1.00	Very limited Slope Droughty Gravel content Content of large stones	1.00 0.99 0.36 0.01
Nebish-----	25	Very limited Slope Shrink-swell Frost action	1.00 0.50 0.50	Very limited Slope Cutbanks cave	1.00 0.10	Very limited Slope	1.00
1270B: Milaca, moderately wet-----	90	Somewhat limited Frost action	0.50	Very limited Depth to saturated zone Depth to dense layer Cutbanks cave	1.00 0.50 0.10	Not limited	
1288: Seelyeville, ponded	60	Very limited Ponding Subsidence Frost action Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone Cutbanks cave	1.00 1.00 1.00 1.00 0.10	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00
Markey, ponded-----	30	Very limited Ponding Subsidence Frost action Depth to saturated zone	1.00 1.00 1.00 1.00	Very limited Ponding Cutbanks cave Depth to saturated zone Content of organic matter	1.00 1.00 1.00 1.00 1.00	Very limited Ponding Content of organic matter Depth to saturated zone	1.00 1.00 1.00 1.00
1356: Water, miscellaneous	100	Not rated		Not rated		Not rated	
1946: Fordum, frequently flooded-----	65	Very limited Frost action Flooding Depth to saturated zone	1.00 1.00 1.00	Very limited Cutbanks cave Depth to saturated zone Flooding	1.00 1.00 0.80	Very limited Flooding Depth to saturated zone	1.00 1.00

Table 14b.--Building Site Development--Continued

Map symbol and component name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1946: Winterfield, frequently flooded	20	Very limited Flooding Depth to saturated zone Frost action	1.00  0.75 0.50	Very limited Cutbanks cave Depth to saturated zone Flooding	1.00  1.00 0.60	Very limited Flooding Depth to saturated zone Droughty	1.00  0.75 0.22
W: Water-----	100	Not rated		Not rated		Not rated	

Table 15a.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table.)

Map symbol and component name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
7A: Hubbard-----	95	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.41
		Thickest layer	0.00		
7B: Hubbard-----	95	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.41
		Thickest layer	0.00		
7C: Hubbard-----	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.93
		Thickest layer	0.00	Bottom layer	0.96
32B: Nebish-----	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
32C: Nebish-----	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
32D: Nebish-----	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
32E: Nebish-----	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
38B: Waukon-----	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
75: Bluffton, depressional-----	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
125: Beltrami-----	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 15a.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
152C: Milaca-----	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.09
		Thickest layer	0.00	Bottom layer	0.09
152E: Milaca-----	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.09
		Thickest layer	0.00	Bottom layer	0.09
158A: Zimmerman-----	95	Poor		Good	
		Bottom layer	0.00		
		Thickest layer	0.00		
158B: Zimmerman-----	95	Poor		Good	
		Bottom layer	0.00		
		Thickest layer	0.00		
158C: Zimmerman-----	95	Poor		Good	
		Bottom layer	0.00		
		Thickest layer	0.00		
158E: Zimmerman-----	95	Poor		Good	
		Bottom layer	0.00		
		Thickest layer	0.00		
161: Isanti, depressional	95	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.07
		Thickest layer	0.00		
162: Lino-----	95	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.70
		Thickest layer	0.00		
164A: Mora-----	95	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.09
		Thickest layer	0.00	Thickest layer	0.09
165: Parent-----	90	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.09
166: Ronneby-----	90	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.08
		Thickest layer	0.00	Thickest layer	0.09
169B: Braham-----	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 15a.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
169C: Braham-----	90	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.20
169D: Braham-----	90	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.20
204B: Cushing-----	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
204C: Cushing-----	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.09
258B: Sandberg-----	95	Fair		Fair	
		Thickest layer	0.01	Thickest layer	0.91
		Bottom layer	0.08	Bottom layer	0.91
258C: Sandberg-----	95	Fair		Fair	
		Thickest layer	0.01	Thickest layer	0.91
		Bottom layer	0.08	Bottom layer	0.91
258E: Sandberg-----	95	Fair		Fair	
		Thickest layer	0.01	Thickest layer	0.91
		Bottom layer	0.08	Bottom layer	0.91
260: Duelm-----	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.49
		Thickest layer	0.00	Bottom layer	0.98
261: Isan, depressional--	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.20
		Thickest layer	0.00	Bottom layer	0.98
325: Prebish, depressional-----	95	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.08
		Thickest layer	0.00	Thickest layer	0.09
341: Arvilla-----	95	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.10
		Bottom layer	0.12	Bottom layer	0.91
346: Talmoon-----	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 15a.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
373: Renshaw-----	95	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.00
		Bottom layer	0.08	Bottom layer	0.91
454B: Mahtomedi-----	95	Fair		Fair	
		Thickest layer	0.00	Bottom layer	0.86
		Bottom layer	0.01	Thickest layer	0.86
454C: Mahtomedi-----	95	Fair		Fair	
		Thickest layer	0.00	Bottom layer	0.86
		Bottom layer	0.01	Thickest layer	0.86
540: Seelyeville-----	95	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
543: Markey-----	90	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00		
544: Cathro-----	95	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
565: Eckvoll-----	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
567: Verndale-----	95	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.09
		Thickest layer	0.00		
623A: Pierz-----	95	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.09
		Bottom layer	0.31	Bottom layer	0.86
623B: Pierz-----	95	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.09
		Bottom layer	0.31	Bottom layer	0.86
708: Rushlake-----	85	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.93
		Bottom layer	0.01	Bottom layer	0.93
730A: Sanburn-----	90	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.09
		Bottom layer	0.00	Bottom layer	0.86

Table 15a.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
730B: Sanburn-----	90	Poor Thickest layer Bottom layer	0.00 0.00	Fair Thickest layer Bottom layer	0.09 0.86
732B: Bushville-----	95	Poor Bottom layer Thickest layer	0.00 0.00	Fair Bottom layer Thickest layer	0.09 0.91
768: Mosford-----	95	Poor Bottom layer Thickest layer	0.00 0.00	Good Thickest layer	0.09
771: Elkriver, rarely flooded-----	95	Poor Bottom layer Thickest layer	0.00 0.00	Good Thickest layer	0.09
799: Seelyeville, frequently flooded	45	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
Bowstring, frequently flooded	45	Poor Bottom layer Thickest layer	0.00 0.00	Poor Bottom layer Thickest layer	0.00 0.00
1013: Pits-----	90	Not rated		Not rated	
1015: Udipsamments-----	90	Not rated		Not rated	
1016: Udorthents-----	90	Not rated		Not rated	
1028: Udorthents-----	45	Not rated		Not rated	
Pits, gravel-----	40	Not rated		Not rated	
1109: Isanti-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Good Thickest layer	0.70
1110: Isan-----	90	Poor Bottom layer Thickest layer	0.00 0.00	Fair Thickest layer Bottom layer	0.09 0.98

Table 15a.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
1223: Sandberg-----	60	Fair		Fair	
		Thickest layer	0.01	Thickest layer	0.91
		Bottom layer	0.08	Bottom layer	0.91
Arvilla-----	30	Fair		Fair	
		Thickest layer	0.00	Thickest layer	0.10
		Bottom layer	0.12	Bottom layer	0.91
1224: Hubbard-----	60	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.25
		Thickest layer	0.00	Bottom layer	0.96
Verndale-----	35	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.84
		Thickest layer	0.00		
1231: Hubbard-----	60	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.41
		Thickest layer	0.00		
Mosford-----	35	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.98
		Thickest layer	0.00		
1253B: Stonelake-----	60	Fair		Fair	
		Bottom layer	0.35	Thickest layer	0.86
		Thickest layer	0.54	Bottom layer	0.86
Sanburn-----	30	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.09
		Bottom layer	0.00	Bottom layer	0.86
1253C: Stonelake-----	65	Fair		Fair	
		Bottom layer	0.35	Thickest layer	0.18
		Thickest layer	0.54	Bottom layer	0.86
Sanburn-----	25	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.09
		Bottom layer	0.00	Bottom layer	0.86
1253E: Stonelake-----	65	Fair		Fair	
		Bottom layer	0.35	Bottom layer	0.86
		Thickest layer	0.54	Thickest layer	0.86
Sanburn-----	25	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.09
		Bottom layer	0.00	Bottom layer	0.86
1254: Ricelake-----	90	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.07

Table 15a.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
1255: Elkriver, occasionally flooded-----	90	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.09
		Thickest layer	0.00		
1256: Cantlin-----	90	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.70
		Thickest layer	0.00		
1257: Elkriver, rarely flooded-----	55	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.09
		Thickest layer	0.00		
Mosford, rarely flooded-----	35	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.09
		Thickest layer	0.00		
1258B: Zimmerman, thick solum-----	95	Poor		Good	
		Bottom layer	0.00		
		Thickest layer	0.00		
1258C: Zimmerman, thick solum-----	95	Poor		Good	
		Bottom layer	0.00		
		Thickest layer	0.00		
1258E: Zimmerman, thick solum-----	95	Poor		Good	
		Bottom layer	0.00		
		Thickest layer	0.00		
1260B: Stonelake-----	55	Fair		Fair	
		Bottom layer	0.35	Thickest layer	0.18
		Thickest layer	0.54	Bottom layer	0.86
Nebish-----	30	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1260C: Stonelake-----	55	Fair		Fair	
		Bottom layer	0.35	Thickest layer	0.86
		Thickest layer	0.54	Bottom layer	0.86
Nebish-----	30	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 15a.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
1260E: Stonelake-----	60	Fair		Fair	
		Bottom layer	0.35	Bottom layer	0.86
		Thickest layer	0.54	Thickest layer	0.86
Nebish-----	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1270B: Milaca, moderately wet-----	90	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.09
		Thickest layer	0.00	Bottom layer	0.10
1288: Seelyeville, ponded	60	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Markey, ponded-----	30	Poor		Good	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00		
1356: Water, miscellaneous	100	Not rated		Not rated	
1946: Fordum, frequently flooded-----	65	Fair		Fair	
		Bottom layer	0.16	Thickest layer	0.10
		Thickest layer	0.16	Bottom layer	0.91
Winterfield, frequently flooded	20	Poor		Good	
		Bottom layer	0.00		
		Thickest layer	0.00		
W: Water-----	100	Not rated		Not rated	

Table 15b.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
7A: Hubbard-----	95	Poor		Good		Fair	
		Wind erosion	0.00			Too sandy	0.01
		Too sandy	0.01				
		Low content of organic matter	0.12				
		Droughty	0.81				
		Too acid	0.92				
7B: Hubbard-----	95	Poor		Good		Fair	
		Wind erosion	0.00			Too sandy	0.01
		Too sandy	0.01				
		Low content of organic matter	0.12				
		Droughty	0.77				
		Too acid	0.92				
7C: Hubbard-----	95	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00			Slope	0.96
		Low content of organic matter	0.12				
		Droughty	0.60				
		Too acid	0.92				
32B: Nebish-----	85	Fair		Fair		Good	
		Low content of organic matter	0.88	Shrink-swell	0.98		
		Too acid	0.92				
32C: Nebish-----	85	Fair		Fair		Fair	
		Low content of organic matter	0.88	Shrink-swell	0.98	Slope	0.96
		Too acid	0.92				
32D: Nebish-----	85	Fair		Good		Poor	
		Low content of organic matter	0.12			Slope	0.00
		Too acid	0.92				
32E: Nebish-----	85	Fair		Poor		Poor	
		Low content of organic matter	0.12	Slope	0.00	Slope	0.00
		Too acid	0.95				

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
38B: Waukon-----	90	Fair Low content of organic matter Too acid Carbonate content	 0.12 0.95 0.97	Fair Shrink-swell	 0.99	Good	
75: Bluffton, depressional-----	90	Fair Low content of organic matter Carbonate content	 0.12 0.97	Poor Depth to saturated zone	 0.00	Poor Depth to saturated zone	 0.00
125: Beltrami-----	90	Fair Low content of organic matter Too acid	 0.88 0.95	Fair Depth to saturated zone Shrink-swell	 0.12 0.97	Fair Depth to saturated zone	 0.12
152C: Milaca-----	95	Fair Low content of organic matter Droughty Too acid	 0.12 0.81 0.92	Good		Fair Rock fragments Slope	 0.88 0.96
152E: Milaca-----	95	Fair Low content of organic matter Droughty Too acid	 0.12 0.81 0.92	Fair Slope	 0.50	Poor Slope Rock fragments	 0.00 0.88
158A: Zimmerman-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid	 0.00 0.00 0.12 0.84	Good		Poor Too sandy	 0.00
158B: Zimmerman-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid	 0.00 0.00 0.12 0.84	Good		Poor Too sandy	 0.00
158C: Zimmerman-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid	 0.00 0.00 0.12 0.84	Good		Poor Too sandy Slope	 0.00 0.96

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
158E: Zimmerman-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid	 0.00 0.00 0.12 0.84	Fair Slope	 0.50	Poor Too sandy Slope	 0.00 0.00
161: Isanti, depressional	95	Fair Low content of organic matter Too acid	 0.12 0.92	Poor Depth to saturated zone	 0.00	Poor Depth to saturated zone	 0.00
162: Lino-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid Droughty	 0.00 0.00 0.12 0.74 0.96	Fair Depth to saturated zone	 0.14	Poor Too sandy Depth to saturated zone	 0.00 0.14
164A: Mora-----	95	Fair Low content of organic matter Too acid	 0.12 0.68	Poor Depth to saturated zone	 0.00	Poor Depth to saturated zone No rock fragments	 0.00 0.99
165: Parent-----	90	Fair Low content of organic matter	 0.12	Poor Depth to saturated zone	 0.00	Poor Depth to saturated zone Rock fragments Not hard to reclaim	 0.00 0.88 0.99
166: Ronneby-----	90	Fair Too acid Low content of organic matter	 0.84 0.88	Poor Depth to saturated zone	 0.00	Poor Depth to saturated zone Rock fragments	 0.00 0.88
169B: Braham-----	90	Poor Wind erosion Low content of organic matter Too acid No water erosion limitation	 0.00 0.12 0.95 0.99	Fair Depth to saturated zone Shrink-swell	 0.89 0.96	Fair Depth to saturated zone	 0.89

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
169C: Braham-----	90	Poor Wind erosion Low content of organic matter Too sandy Too acid No water erosion limitation	0.00 0.12 0.30 0.95 0.99	Fair Shrink-swell	0.99	Fair Too sandy Slope	0.30 0.96
169D: Braham-----	90	Poor Wind erosion Low content of organic matter Too sandy Too acid No water erosion limitation	0.00 0.12 0.30 0.95 0.99	Fair Shrink-swell	0.99	Poor Slope Too sandy	0.00 0.30
204B: Cushing-----	90	Fair Low content of organic matter Too acid	0.12 0.92	Good		Fair Rock fragments	0.97
204C: Cushing-----	95	Fair Low content of organic matter Too acid	0.12 0.92	Good		Fair Slope Rock fragments	0.63 0.97
258B: Sandberg-----	95	Poor Too sandy Wind erosion Low content of organic matter Droughty Too acid	0.00 0.00 0.12 0.68 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.03 0.92
258C: Sandberg-----	95	Poor Too sandy Wind erosion Low content of organic matter Droughty Too acid	0.00 0.00 0.12 0.49 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim Slope	0.00 0.03 0.92 0.96
258E: Sandberg-----	95	Poor Too sandy Wind erosion Low content of organic matter Droughty Too acid	0.00 0.00 0.12 0.52 0.92	Fair Slope	0.50	Poor Too sandy Slope Rock fragments Hard to reclaim	0.00 0.00 0.03 0.92

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
260: Duelm-----	95	Poor Wind erosion Too sandy Low content of organic matter Droughty Too acid	0.00 0.00 0.12 0.93 0.97	Fair Depth to saturated zone	0.89	Poor Too sandy Depth to saturated zone	0.00 0.89
261: Isan, depressional--	95	Fair Low content of organic matter Too sandy Droughty	0.12 0.30 0.99	Poor Depth to saturated zone	0.00	Poor Depth to saturated zone Too sandy	0.00 0.30
325: Prebish, depressional-----	95	Fair Low content of organic matter Too acid	0.12 0.95	Poor Depth to saturated zone	0.00	Poor Depth to saturated zone Rock fragments	0.00 0.88
341: Arvilla-----	95	Poor Too sandy Low content of organic matter Droughty	0.00 0.12 0.87	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.50
346: Talmoon-----	90	Fair Low content of organic matter Too acid Carbonate content No water erosion limitation	0.12 0.92 0.97 0.99	Poor Depth to saturated zone Shrink-swell	0.00 0.89	Poor Depth to saturated zone	0.00
373: Renshaw-----	95	Poor Too sandy Low content of organic matter Too acid Droughty	0.00 0.12 0.92 0.99	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.08
454B: Mahtomedi-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid Droughty	0.00 0.00 0.12 0.92 0.99	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.92

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
454C: Mahtomedi-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid Droughty	0.00 0.00 0.12 0.92 0.98	Good		Poor Too sandy Rock fragments Slope Hard to reclaim	0.00 0.00 0.84 0.92
540: Seelyeville-----	95	Poor Wind erosion	0.00	Poor Depth to saturated zone	0.00	Poor Content of organic matter Depth to saturated zone	0.00 0.00
543: Markey-----	90	Poor Wind erosion	0.00	Poor Depth to saturated zone	0.00	Poor Content of organic matter Depth to saturated zone	0.00 0.00
544: Cathro-----	95	Poor Wind erosion Low content of organic matter	0.00 0.12	Poor Depth to saturated zone	0.00	Poor Content of organic matter Depth to saturated zone	0.00 0.00
565: Eckvoll-----	90	Poor Wind erosion Low content of organic matter Too acid No water erosion limitation	0.00 0.12 0.97 0.99	Fair Depth to saturated zone Shrink-swell	0.14 0.98	Fair Depth to saturated zone	0.14
567: Verndale-----	95	Poor Too sandy Low content of organic matter Too acid Droughty	0.00 0.12 0.68 0.98	Good		Poor Too sandy Rock fragments	0.00 0.97
623A: Pierz-----	95	Fair Low content of organic matter Too acid	0.12 0.84	Good		Poor Hard to reclaim Rock fragments	0.00 0.97
623B: Pierz-----	95	Poor Too sandy Low content of organic matter Too acid Droughty	0.00 0.12 0.84 0.95	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.00

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
708: Rushlake-----	85	Poor Too sandy Wind erosion Low content of organic matter Droughty	0.00 0.00 0.12 0.72	Fair Depth to saturated zone	0.53	Poor Too sandy Rock fragments Depth to saturated zone Hard to reclaim	0.00 0.00 0.53 0.92
730A: Sanburn-----	90	Poor Too sandy Low content of organic matter Droughty Too acid	0.00 0.12 0.21 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.82
730B: Sanburn-----	90	Poor Too sandy Low content of organic matter Droughty Too acid	0.00 0.12 0.22 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.82
732B: Bushville-----	95	Poor Too sandy Wind erosion Low content of organic matter Droughty Too acid	0.00 0.00 0.12 0.42 0.92	Poor Depth to saturated zone	0.00	Poor Too sandy Depth to saturated zone	0.00 0.00
768: Mosford-----	95	Poor Too sandy Low content of organic matter Too acid Droughty	0.00 0.12 0.97 0.99	Good		Poor Too sandy Rock fragments	0.00 0.12
771: Elkriver, rarely flooded-----	95	Fair Low content of organic matter Too acid	0.05 0.61	Good		Good	
799: Seelyeville, frequently flooded	45	Poor Wind erosion	0.00	Poor Depth to saturated zone	0.00	Poor Content of organic matter Depth to saturated zone	0.00 0.00

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
799: Bowstring, frequently flooded	45	Poor Wind erosion	0.00	Poor Depth to saturated zone	0.00	Poor Content of organic matter Depth to saturated zone	0.00 0.00
1013: Pits-----	90	Not rated		Not rated		Not rated	
1015: Udipsamments-----	90	Not rated		Not rated		Not rated	
1016: Udorthents-----	90	Not rated		Not rated		Not rated	
1028: Udorthents-----	45	Not rated		Not rated		Not rated	
Pits, gravel-----	40	Not rated		Not rated		Not rated	
1109: Isanti-----	90	Poor Too sandy Wind erosion Low content of organic matter Too acid Droughty	0.00 0.00 0.12 0.84 0.99	Poor Depth to saturated zone	0.00	Poor Too sandy Depth to saturated zone	0.00 0.00
1110: Isan-----	90	Fair Low content of organic matter Droughty	0.12 0.99	Poor Depth to saturated zone	0.00	Poor Depth to saturated zone	0.00
1223: Sandberg-----	60	Poor Too sandy Wind erosion Low content of organic matter Droughty Too acid	0.00 0.00 0.12 0.66 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.03 0.92
Arvilla-----	30	Poor Too sandy Low content of organic matter Droughty	0.00 0.12 0.75	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.50
1224: Hubbard-----	60	Poor Wind erosion Low content of organic matter Too sandy Droughty Too acid	0.00 0.12 0.16 0.58 0.92	Good		Fair Too sandy	0.16

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1224: Verndale-----	35	Poor Too sandy Low content of organic matter Too acid	0.00 0.12 0.68	Good		Poor Too sandy	0.00
1231: Hubbard-----	60	Poor Too sandy Wind erosion Low content of organic matter Droughty Too acid	0.00 0.00 0.12 0.64 0.92	Good		Poor Too sandy	0.00
Mosford-----	35	Poor Too sandy Low content of organic matter Too acid	0.00 0.12 0.97	Good		Poor Too sandy	0.00
1253B: Stonelake-----	60	Poor Too sandy Low content of organic matter Droughty Too acid	0.00 0.12 0.14 0.84	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.00
Sanburn-----	30	Poor Too sandy Low content of organic matter Droughty Too acid	0.00 0.12 0.25 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim	0.00 0.00 0.82
1253C: Stonelake-----	65	Poor Too sandy Low content of organic matter Droughty Too acid	0.00 0.12 0.15 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim Slope	0.00 0.00 0.00 0.84
Sanburn-----	25	Poor Too sandy Low content of organic matter Droughty Too acid	0.00 0.12 0.20 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim Slope	0.00 0.00 0.82 0.84
1253E: Stonelake-----	65	Poor Too sandy Wind erosion Droughty Low content of organic matter Too acid	0.00 0.00 0.07 0.12 0.84	Poor Slope	0.00	Poor Too sandy Slope Rock fragments Hard to reclaim	0.00 0.00 0.00 0.00

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1253E: Sanburn-----	25	Poor Too sandy Droughty Low content of organic matter Too acid	 0.00 0.09 0.12 0.92	Poor Slope	 0.00	Poor Too sandy Slope Rock fragments Hard to reclaim	 0.00 0.00 0.00 0.82
1254: Ricelake-----	90	Fair Low content of organic matter Too sandy Too acid	 0.12 0.28 0.95	Fair Depth to saturated zone	 0.12	Fair Depth to saturated zone Too sandy	 0.12 0.28
1255: Elkriver, occasionally flooded-----	90	Fair Low content of organic matter Too acid	 0.05 0.61	Fair Depth to saturated zone	 0.14	Fair Depth to saturated zone	 0.14
1256: Cantlin-----	90	Poor Too sandy Wind erosion Low content of organic matter Too acid Droughty	 0.00 0.00 0.12 0.84 0.92	Good		Poor Too sandy	 0.00
1257: Elkriver, rarely flooded-----	55	Fair Low content of organic matter Too acid	 0.05 0.61	Good		Good	
Mosford, rarely flooded-----	35	Poor Too sandy Low content of organic matter Too acid	 0.00 0.12 0.97	Good		Poor Too sandy Rock fragments	 0.00 0.12
1258B: Zimmerman, thick solum-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid	 0.00 0.00 0.12 0.68	Good		Poor Too sandy	 0.00

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1258C: Zimmerman, thick solum-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid	0.00 0.00 0.12 0.68	Good		Poor Too sandy Slope	0.00 0.96
1258E: Zimmerman, thick solum-----	95	Poor Too sandy Wind erosion Low content of organic matter Too acid	0.00 0.00 0.12 0.68	Fair Slope	0.82	Poor Too sandy Slope	0.00 0.00
1260B: Stonelake-----	55	Poor Wind erosion Low content of organic matter Droughty Too sandy Too acid	0.00 0.12 0.35 0.36 0.92	Good		Poor Rock fragments Hard to reclaim Too sandy	0.00 0.00 0.36
Nebish-----	30	Fair Low content of organic matter Too acid	0.88 0.92	Fair Shrink-swell	0.98	Good	
1260C: Stonelake-----	55	Poor Too sandy Wind erosion Low content of organic matter Droughty Too acid	0.00 0.00 0.12 0.32 0.92	Good		Poor Too sandy Rock fragments Hard to reclaim Slope	0.00 0.00 0.00 0.96
Nebish-----	30	Fair Low content of organic matter Too acid	0.12 0.92	Good		Fair Slope	0.96
1260E: Stonelake-----	60	Poor Too sandy Low content of organic matter Droughty Too acid	0.00 0.12 0.14 0.84	Fair Slope	0.82	Poor Too sandy Slope Rock fragments Hard to reclaim	0.00 0.00 0.00 0.00
Nebish-----	25	Fair Low content of organic matter Too acid	0.12 0.92	Fair Slope	0.82	Poor Slope	0.00

Table 15b.--Construction Materials--Continued

Map symbol and component name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1270B: Milaca, moderately wet-----	90	Fair Low content of organic matter Too acid	0.12 0.68	Fair Depth to saturated zone	0.89	Fair Depth to saturated zone	0.89
1288: Seelyeville, ponded	60	Good		Poor Depth to saturated zone	0.00	Poor Content of organic matter Depth to saturated zone	0.00 0.00
Markey, ponded-----	30	Fair Low content of organic matter	0.12	Poor Depth to saturated zone	0.00	Poor Content of organic matter Depth to saturated zone	0.00 0.00
1356: Water, miscellaneous	100	Not rated		Not rated		Not rated	
1946: Fordum, frequently flooded-----	65	Fair Low content of organic matter Too acid No water erosion limitation	0.50 0.92 0.99	Poor Depth to saturated zone	0.00	Poor Depth to saturated zone Rock fragments Hard to reclaim	0.00 0.00 0.50
Winterfield, frequently flooded	20	Poor Too sandy Low content of organic matter Too acid	0.00 0.12 0.95	Fair Depth to saturated zone	0.14	Poor Too sandy Depth to saturated zone Rock fragments	0.00 0.14 0.88
W: Water-----	100	Not rated		Not rated		Not rated	

Table 16.--Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and component name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
7A: Hubbard-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
7B: Hubbard-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
7C: Hubbard-----	95	Very limited Seepage	1.00	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00
32B: Nebish-----	85	Somewhat limited Seepage	0.70	Somewhat limited Piping Depth to saturated zone	0.73 0.05	Somewhat limited Deep to water Slow refill Cutbanks cave	0.60 0.30 0.10
32C: Nebish-----	85	Somewhat limited Seepage	0.70	Somewhat limited Piping	0.75	Very limited Deep to water	1.00
32D: Nebish-----	85	Somewhat limited Seepage Slope	0.70 0.03	Somewhat limited Piping	0.83	Very limited Deep to water	1.00
32E: Nebish-----	85	Somewhat limited Seepage Slope	0.70 0.28	Somewhat limited Piping	0.83	Very limited Deep to water	1.00
38B: Waukon-----	90	Somewhat limited Seepage	0.70	Somewhat limited Piping Depth to saturated zone	0.57 0.05	Somewhat limited Deep to water Slow refill Cutbanks cave	0.60 0.30 0.10
75: Bluffton, depressional-----	90	Somewhat limited Seepage	0.57	Very limited Ponding Depth to saturated zone Piping	1.00 1.00 0.97	Somewhat limited Slow refill Cutbanks cave	0.30 0.10
125: Beltrami-----	90	Somewhat limited Seepage	0.70	Very limited Depth to saturated zone Piping	1.00 0.29	Somewhat limited Slow refill Cutbanks cave	0.30 0.10
152C: Milaca-----	95	Somewhat limited Seepage	0.70	Somewhat limited Seepage	0.09	Very limited Deep to water	1.00

Table 16.--Water Management--Continued

Map symbol and component name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
152E: Milaca-----	95	Somewhat limited Seepage Slope	0.70 0.12	Somewhat limited Seepage	0.09	Very limited Deep to water	1.00
158A: Zimmerman-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
158B: Zimmerman-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
158C: Zimmerman-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
158E: Zimmerman-----	95	Very limited Seepage Slope	1.00 0.12	Very limited Seepage	1.00	Very limited Deep to water	1.00
161: Isanti, depressional	95	Very limited Seepage	1.00	Very limited Ponding Seepage Depth to saturated zone	1.00 1.00 1.00	Very limited Cutbanks cave	1.00
162: Lino-----	95	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 1.00	Very limited Cutbanks cave	1.00
164A: Mora-----	95	Somewhat limited Seepage	0.70	Very limited Depth to saturated zone Seepage	1.00 0.09	Very limited Deep to water	1.00
165: Parent-----	90	Somewhat limited Seepage	0.70	Very limited Depth to saturated zone Seepage	1.00 0.09	Very limited Deep to water	1.00
166: Ronneby-----	90	Somewhat limited Seepage	0.70	Very limited Depth to saturated zone Seepage	1.00 0.09	Very limited Deep to water	1.00
169B: Braham-----	90	Very limited Seepage	1.00	Somewhat limited Depth to saturated zone Piping	0.86 0.81	Very limited Cutbanks cave Slow refill Deep to water	1.00 0.30 0.06

Table 16.--Water Management--Continued

Map symbol and component name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
169C: Braham-----	90	Very limited Seepage	1.00	Somewhat limited Seepage	0.20	Very limited Deep to water	1.00
169D: Braham-----	90	Very limited Seepage Slope	1.00 0.03	Somewhat limited Seepage	0.20	Very limited Deep to water	1.00
204B: Cushing-----	90	Somewhat limited Seepage	0.70	Somewhat limited Depth to saturated zone	0.05	Somewhat limited Deep to water Slow refill Cutbanks cave	0.60 0.30 0.10
204C: Cushing-----	95	Somewhat limited Seepage Slope	0.70 0.01	Somewhat limited Seepage	0.09	Very limited Deep to water	1.00
258B: Sandberg-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
258C: Sandberg-----	95	Very limited Seepage	1.00	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00
258E: Sandberg-----	95	Very limited Seepage Slope	1.00 0.12	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00
260: Duelm-----	95	Very limited Seepage	1.00	Somewhat limited Seepage Depth to saturated zone	0.98 0.86	Very limited Cutbanks cave Deep to water	1.00 0.06
261: Isan, depression--	95	Very limited Seepage	1.00	Very limited Ponding Depth to saturated zone Seepage	1.00 1.00 0.98	Very limited Cutbanks cave	1.00
325: Prebish, depressional-----	95	Somewhat limited Seepage	0.57	Very limited Ponding Depth to saturated zone Seepage	1.00 1.00 0.09	Very limited Deep to water	1.00
341: Arvilla-----	95	Very limited Seepage	1.00	Somewhat limited Seepage	0.91	Very limited Deep to water	1.00

Table 16.--Water Management--Continued

Map symbol and component name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
346: Talmoon-----	90	Somewhat limited Seepage	0.05	Very limited Depth to saturated zone Piping	1.00 0.86	Somewhat limited Slow refill Cutbanks cave	0.30 0.10
373: Renshaw-----	95	Very limited Seepage	1.00	Somewhat limited Seepage	0.95	Very limited Deep to water	1.00
454B: Mahtomedi-----	95	Very limited Seepage	1.00	Somewhat limited Seepage	0.95	Very limited Deep to water	1.00
454C: Mahtomedi-----	95	Very limited Seepage	1.00	Somewhat limited Seepage	1.00	Very limited Deep to water	1.00
540: Seelyeville-----	95	Very limited Seepage	1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Somewhat limited Cutbanks cave	0.10
543: Markey-----	90	Very limited Seepage	1.00	Very limited Ponding Seepage Depth to saturated zone	1.00 1.00 1.00	Very limited Cutbanks cave	1.00
544: Cathro-----	95	Very limited Seepage	1.00	Very limited Ponding Depth to saturated zone	1.00 1.00	Somewhat limited Cutbanks cave	0.10
565: Eckvoll-----	90	Very limited Seepage	1.00	Very limited Depth to saturated zone Piping	1.00 0.93	Very limited Cutbanks cave	1.00
567: Verndale-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
623A: Pierz-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
623B: Pierz-----	95	Very limited Seepage	1.00	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00

Table 16.--Water Management--Continued

Map symbol and component name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
708: Rushlake-----	85	Very limited Seepage	1.00	Very limited Depth to saturated zone Seepage	1.00 0.93	Very limited Cutbanks cave Deep to water	1.00 0.01
730A: Sanburn-----	90	Very limited Seepage	1.00	Somewhat limited Seepage	0.95	Very limited Deep to water	1.00
730B: Sanburn-----	90	Very limited Seepage	1.00	Somewhat limited Seepage	0.95	Very limited Deep to water	1.00
732B: Bushville-----	95	Very limited Seepage	1.00	Very limited Depth to saturated zone Seepage	1.00 1.00	Very limited Deep to water	1.00
768: Mosford-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
771: Elkriver, rarely flooded-----	95	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 0.46	Very limited Cutbanks cave Deep to water	1.00 0.24
799: Seelyeville, frequently flooded	45	Very limited Seepage	1.00	Very limited Content of organic matter Depth to saturated zone	1.00 1.00	Somewhat limited Cutbanks cave	0.10
Bowstring, frequently flooded	45	Very limited Seepage	1.00	Very limited Content of organic matter Depth to saturated zone	1.00 1.00	Very limited Cutbanks cave	1.00
1013: Pits-----	90	Not rated		Not rated		Not rated	
1015: Udipsamments-----	90	Not rated		Not rated		Not rated	
1016: Udorthents-----	90	Not rated		Not rated		Not rated	
1028: Udorthents-----	45	Not rated		Not rated		Not rated	
Pits, gravel-----	40	Not rated		Not rated		Not rated	

Table 16.--Water Management--Continued

Map symbol and component name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1109: Isanti-----	90	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 1.00	Very limited Cutbanks cave	1.00
1110: Isan-----	90	Very limited Seepage	1.00	Very limited Depth to saturated zone Seepage	1.00 0.98	Very limited Cutbanks cave	1.00
1223: Sandberg-----	60	Very limited Seepage	1.00	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00
Arvilla-----	30	Very limited Seepage	1.00	Somewhat limited Seepage	0.91	Very limited Deep to water	1.00
1224: Hubbard-----	60	Very limited Seepage	1.00	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00
Verndale-----	35	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
1231: Hubbard-----	60	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
Mosford-----	35	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
1253B: Stonelake-----	60	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
Sanburn-----	30	Very limited Seepage	1.00	Somewhat limited Seepage	0.95	Very limited Deep to water	1.00
1253C: Stonelake-----	65	Very limited Seepage	1.00	Somewhat limited Seepage	0.95	Very limited Deep to water	1.00
Sanburn-----	25	Very limited Seepage	1.00	Somewhat limited Seepage	0.95	Very limited Deep to water	1.00
1253E: Stonelake-----	65	Very limited Seepage Slope	1.00 0.28	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00
Sanburn-----	25	Very limited Seepage Slope	1.00 0.28	Somewhat limited Seepage	0.95	Very limited Deep to water	1.00

Table 16.--Water Management--Continued

Map symbol and component name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1254: Ricelake-----	90	Very limited Seepage	1.00	Very limited Depth to saturated zone Piping Seepage	1.00 1.00 0.07	Very limited Cutbanks cave	1.00
1255: Elkriver, occasionally flooded-----	90	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 1.00	Very limited Cutbanks cave	1.00
1256: Cantlin-----	90	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 0.09	Very limited Cutbanks cave Deep to water	1.00 0.54
1257: Elkriver, rarely flooded-----	55	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 0.46	Very limited Cutbanks cave Deep to water	1.00 0.24
Mosford, rarely flooded-----	35	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 0.46	Very limited Cutbanks cave Deep to water	1.00 0.24
1258B: Zimmerman, thick solum-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
1258C: Zimmerman, thick solum-----	95	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
1258E: Zimmerman, thick solum-----	95	Very limited Seepage Slope	1.00 0.08	Very limited Seepage	1.00	Very limited Deep to water	1.00
1260B: Stonelake-----	55	Very limited Seepage	1.00	Very limited Seepage	1.00	Very limited Deep to water	1.00
Nebish-----	30	Somewhat limited Seepage	0.70	Somewhat limited Piping Depth to saturated zone	0.73 0.05	Somewhat limited Deep to water Slow refill Cutbanks cave	0.60 0.30 0.10

Table 16.--Water Management--Continued

Map symbol and component name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1260C: Stonelake-----	55	Very limited Seepage	1.00	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00
Nebish-----	30	Somewhat limited Seepage	0.70	Somewhat limited Piping	0.80	Very limited Deep to water	1.00
1260E: Stonelake-----	60	Very limited Seepage Slope	1.00 0.08	Somewhat limited Seepage	0.96	Very limited Deep to water	1.00
Nebish-----	25	Somewhat limited Seepage Slope	0.70 0.08	Somewhat limited Piping	0.81	Very limited Deep to water	1.00
1270B: Milaca, moderately wet-----	90	Somewhat limited Seepage	0.70	Somewhat limited Depth to saturated zone Seepage	0.86 0.10	Very limited Deep to water	1.00
1288: Seelyville, ponded	60	Very limited Seepage	1.00	Very limited Content of organic matter Ponding Depth to saturated zone	1.00 1.00 1.00	Somewhat limited Cutbanks cave	0.10
Markey, ponded-----	30	Very limited Seepage	1.00	Very limited Ponding Seepage Depth to saturated zone	1.00 1.00 1.00	Very limited Cutbanks cave	1.00
1356: Water, miscellaneous	100	Not rated		Not rated		Not rated	
1946: Fordum, frequently flooded-----	65	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 1.00	Very limited Cutbanks cave	1.00
Winterfield, frequently flooded	20	Very limited Seepage	1.00	Very limited Seepage Depth to saturated zone	1.00 1.00	Very limited Cutbanks cave	1.00
W: Water-----	100	Not rated		Not rated		Not rated	

# Soil Properties

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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 horizons of each soil. Pertinent soil and water features also are given.

## Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major horizons of each soil. Most soils have horizons of contrasting properties within the upper 5 or 6 feet.

*Depth* to the upper and lower boundaries of each horizon is indicated.

*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, 2001) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2000).

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 oven-dry 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

Tables 18 and 19 show estimates of some characteristics and features that affect soil behavior. These estimates are given for the major horizons 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 horizon is indicated.

In table 18, *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 horizon 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 linear extensibility, 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 (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at  $\frac{1}{3}$ -bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In table 18, 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 linear extensibility, 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* and saturated hydraulic conductivity refer to the ability of a soil to transmit water or air. Permeability 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, irrigation systems, and septic tank absorption fields. Measured values of saturated hydraulic conductivity are used in models for site-specific use.

*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 horizon. 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.

*Linear extensibility* percent is the linear expression of the volume difference of natural soil fabric at  $\frac{1}{3}$ -bar or  $\frac{1}{10}$ -bar water content and oven dryness. The volume change is reported as percent change for the whole soil. 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.

Linear extensibility of 3 percent or more can cause damage to buildings, roads, and other structures. Special design is often needed.

*Organic matter* is the plant and animal residue in the soil at various stages of decomposition. In table 18, 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 factors* are shown in table 18 as the K factor ( $K_w$  and  $K_f$ ) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of several factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

*Erosion factor  $K_w$*  indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

*Erosion factor  $K_f$*  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 annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.
- 4L. Calcareous loams, silt loams, clay loams, and silty clay loams.
4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6. Noncalcareous loams and silt loams that are

more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.

8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

*Wind erodibility index* is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

In table 19, *cation-exchange capacity* is the total amount of extractable bases 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. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

*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 equivalent* is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

*Gypsum* is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

## Water Features

*Soil moisture status* is an estimate of the fluctuating water content in a soil. It greatly influences vegetation type and plant growth; physical properties of soils,

such as permeability, workability, strength, linear extensibility, and frost action; and chemical interactions and transport. Many other properties, qualities, and interpretations also are affected. Soil moisture status is important in the classification of soils, wetland, and habitat.

Table 20 gives estimates of soil moisture for each component of a map unit at various depths for every month of the year. The depths displayed are representative values that are indicative of conditions that occur most of the time. *Dry* indicates a moisture condition under which most plants (especially crops) cannot extract water for growth. *Moist* indicates a moisture condition under which soil water is most readily available for plant growth. *Wet* indicates a condition under which water will stand in an unlined hole or at least a condition under which the soil is too wet for the growth of most agricultural species. A moisture status of 4.0-6.7 (wet) indicates that most of the time the component is saturated at some depth between 4.0 feet and 6.7 feet during the month designated. In some years the soil may be saturated at a depth of less than 4.0 feet or more than 6.7 feet; however, field observations indicate that the soil will be saturated between these depths in most years. In the summer, the soil may show the effects of drying plus intermittent rains that result in a moist or wet layer over a dry layer that gets moist or wet again.

In table 20, *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 zone in which the soil moisture status is wet, the infiltration rate, permeability after prolonged wetting, and the depth to a very slowly permeable horizon or horizons. 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 horizons.

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 horizon or horizons that impede 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 linear extensibility; soils that have a zone, high in the profile, in which the soil moisture status is wet on a permanent basis; soils that have a claypan or clay horizon or horizons 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 a dual hydrologic group (A/D, B/D, or C/D), 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.

Table 21 gives estimates of the frequency and duration of flooding for every month of the year. Flooding frequency is the annual probability of a flood event expressed as a class. *None* indicates no reasonable possibility of flooding (the chance of flooding is nearly 0 percent in any year, or flooding is likely less than once in 500 years). *Very rare* indicates that flooding is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year, or flooding is likely less than once in 100 years but more than once in 500 years). *Rare* indicates that flooding is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year, or flooding is likely 1 to 5 times in 100 years). *Occasional* indicates that flooding occurs infrequently under usual weather conditions (the

chance of flooding is 5 to 50 percent in any year, or flooding is likely 5 to 50 times in 100 years). *Frequent* indicates that flooding is likely to occur often under usual weather conditions (the chance of flooding is more than 50 percent in any year, or flooding is likely more than 50 times in 100 years; but the chance of flooding is less than 50 percent in all months in any year). *Very frequent* indicates that flooding is likely to occur very often under usual weather conditions (the chance of flooding is more than 50 percent in all months of any year).

Flooding duration is the average duration of inundation per flood occurrence expressed as a class. *Extremely brief* is 0.1 hour to 4.0 hours; *very brief* is 4 to 48 hours; *brief* is 2 to 7 days; *long* is 7 to 30 days; and *very long* is more than 30 days. 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.

*Ponding* is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation.

Table 22 gives estimates of the frequency, duration, and depth of ponding for every month of the year. The depths displayed are representative values that are indicative of conditions that occur most of the time.

Ponding frequency is the number of times ponding occurs over a period of time. *None* indicates no reasonable possibility of ponding (the chance of ponding is nearly 0 percent in any year). *Rare* indicates that ponding is unlikely but possible under unusual weather conditions (the chance of ponding ranges from nearly 0 percent to 5 percent in any year, or ponding is likely 0 to 5 times in 100 years). *Occasional* indicates that ponding is expected infrequently under usual weather conditions (the chance of ponding ranges from 5 to 50 percent in any one year, or ponding is likely 5 to 50 times in 100 years). *Frequent* indicates that ponding is likely to

occur under usual weather conditions (the chance of ponding is more than 50 percent in any year, or ponding is likely more than 50 times in 100 years).

Ponding duration is the average length of time of the ponding occurrence. It 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).

## Soil Features

Table 23 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

*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 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

*Potential for 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 a zone in which the soil moisture status is wet 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 saturated zone high in the profile during the 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 to pavements and other rigid structures.

*Risk of corrosion* pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of

corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel

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

Table 17.--Engineering Index Properties

(Absence of an entry indicates that the data were not estimated.)

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
7A: Hubbard-----	0-20	Loamy sand	SP-SM, SM	A-2	0	0	98-100	95-100	50-80	10-25	0-20	NP-4
	20-32	Sand, coarse sand, loamy sand	SP-SM	A-1, A-2-4, A-3	0	0	98-100	95-100	25-75	5-12	0-20	NP-4
	32-80	Sand, coarse sand	SW, SP	A-1, A-2, A-3	0	0	95-100	85-100	20-70	2-5	0-15	NP
7B: Hubbard-----	0-18	Loamy sand	SP-SM, SM	A-2	0	0	98-100	95-100	50-80	10-25	0-20	NP-4
	18-23	Sand, coarse sand, loamy sand	SP-SM	A-1, A-2-4, A-3	0	0	98-100	95-100	25-75	5-12	0-20	NP-4
	23-80	Sand, coarse sand	SP, SW	A-1, A-2, A-3	0	0	95-100	85-100	20-70	2-5	0-15	NP
7C: Hubbard-----	0-12	Loamy sand	SM, SP-SM	A-2	0	0	98-100	95-100	50-80	10-25	0-20	NP-4
	12-33	Sand, coarse sand, loamy sand	SP-SM	A-1, A-2-4, A-3	0	0	98-100	95-100	25-75	5-12	0-20	NP-4
	33-80	Sand, coarse sand	SP, SW	A-1, A-2, A-3	0	0	95-100	85-100	20-70	2-5	0-15	NP
32B: Nebish-----	0-5	Fine sandy loam	SC-SM, SM	A-4	0	0-3	95-100	85-100	55-85	35-50	20-35	NP-7
	5-43	Loam, clay loam	ML, CL	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	43-80	Loam, clay loam, sandy clay loam	CL, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20
32C: Nebish-----	0-7	Fine sandy loam	SC-SM, SM	A-4	0	0-3	95-100	85-100	55-85	35-50	20-35	NP-7
	7-11	Loamy fine sand, fine sandy loam, sandy loam	SC-SM, SM	A-2-4, A-4	0	0-3	95-100	85-100	50-85	30-50	15-25	NP-6
	11-44	Loam, clay loam	CL, ML	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	44-80	Loam, clay loam, sandy clay loam	CL, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In											
32D: Nebish-----	0-3	Fine sandy loam	SC-SM, SM	A-4	0	0-3	95-100	85-100	55-85	35-50	20-35	NP-7
	3-22	Loam, clay loam	CL, ML	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	22-80	Loam, clay loam, sandy clay loam	CL, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20
32E: Nebish-----	0-4	Fine sandy loam	SC-SM, SM	A-4	0	0-3	95-100	85-100	55-85	35-50	20-35	NP-7
	4-13	Loamy fine sand, fine sandy loam, sandy loam	SC-SM, SM	A-2-4, A-4	0	0-3	95-100	85-100	50-85	30-50	15-25	NP-6
	13-36	Loam, clay loam	CL, ML	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	36-80	Loam, clay loam, sandy clay loam	CL, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20
38B: Waukon-----	0-8	Fine sandy loam	SC-SM, SM	A-4	0-1	0-3	95-100	90-100	60-70	35-50	15-25	1-7
	8-12	Loamy fine sand, fine sandy loam, sandy loam	SC-SM, SM	A-2-4, A-4	0-1	0-3	95-100	85-100	50-85	30-50	15-25	NP-6
	12-43	Clay loam, loam	CL	A-7, A-6	0-1	0-3	95-100	90-100	75-95	50-85	30-45	10-20
	43-80	Loam, clay loam	CL	A-6	0-1	0-3	95-100	90-100	70-95	50-80	30-40	10-20
75: Bluffton, depressional---	0-13	Loam	CL	A-6, A-7	0	0	98-100	85-100	85-95	50-80	30-45	10-20
	13-40	Fine sandy loam, loam, sandy clay loam	CL, ML, SC, SM	A-4, A-6	0-2	0-3	95-100	85-100	70-90	40-60	20-35	3-18
	40-80	Loam, sandy clay loam, fine sandy loam	SM, SC, ML, CL	A-4, A-6	0-2	0-5	90-100	85-100	70-90	40-65	20-40	3-20

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
125: Beltrami-----	0-6	Fine sandy loam	SM, SC-SM	A-4	0-1	0-3	95-100	85-95	60-90	35-50	15-20	NP-5
	6-12	Fine sandy loam, loam, loamy sand	SC-SM, ML, CL-ML, SM	A-2, A-4	0-1	0-3	95-100	85-95	60-90	25-60	15-25	NP-7
	12-48	Loam, sandy clay loam, clay loam	CL	A-6, A-7	0-1	0-3	95-100	85-98	75-95	50-85	20-45	10-30
	48-80	Loam, clay loam	CL-ML, CL	A-4, A-6	0-1	1-3	95-100	85-95	70-95	50-80	20-40	5-20
152C: Milaca-----	0-4	Fine sandy loam	SM	A-4	0	0-2	90-100	80-100	60-80	35-50	15-22	NP-4
	4-12	Fine sandy loam, very fine sandy loam	SM	A-4	0	0-2	90-100	80-100	60-80	35-50	15-22	NP-4
	12-20	Sandy loam, fine sandy loam, loam	SM	A-2, A-4	0	0-5	85-95	75-95	50-70	30-40	15-22	NP-4
	20-42	Sandy loam, fine sandy loam	SM	A-2, A-4	0	0-5	85-95	75-95	50-70	30-40	15-22	NP-4
	42-80	Sandy loam, fine sandy loam, gravelly sandy loam	SM	A-2, A-4	0	0-5	80-95	70-90	50-70	25-40	15-22	NP-4
152E: Milaca-----	0-3	Fine sandy loam	SM	A-4	0	0-2	90-100	80-100	60-80	35-50	15-22	NP-4
	3-12	Fine sandy loam, very fine sandy loam	SM	A-4	0	0-2	90-100	80-100	60-80	35-50	15-22	NP-4
	12-20	Sandy loam, fine sandy loam, loam	SM	A-2, A-4	0	0-5	85-95	75-95	50-70	30-40	15-22	NP-4
	20-40	Sandy loam, fine sandy loam	SM	A-2, A-4	0	0-5	85-95	75-95	50-70	30-40	15-22	NP-4
	40-80	Sandy loam, fine sandy loam, gravelly sandy loam	SM	A-2, A-4	0	0-5	80-95	70-90	50-70	25-40	15-22	NP-4

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
158A: Zimmerman-----	0-7	Fine sand	SM, SP-SM	A-2	0	0	100	95-100	95-100	10-20	0-20	NP-4
	7-80	Fine sand, loamy fine sand	SM, SP, SP-SM	A-2, A-3	0	0	100	95-100	70-100	4-20	0-20	NP-4
158B: Zimmerman-----	0-6	Fine sand	SP-SM, SM	A-2	0	0	100	95-100	95-100	10-20	0-20	NP-4
	6-80	Fine sand, loamy fine sand	SP-SM, SP, SM	A-2, A-3	0	0	100	95-100	70-100	4-20	0-20	NP-4
158C: Zimmerman-----	0-6	Fine sand	SP-SM, SM	A-2	0	0	100	95-100	95-100	10-20	0-20	NP-4
	6-80	Fine sand, loamy fine sand	SM, SP, SP-SM	A-2, A-3	0	0	100	95-100	70-100	4-20	0-20	NP-4
158E: Zimmerman-----	0-3	Fine sand	SM, SP-SM	A-2	0	0	100	95-100	95-100	10-20	0-20	NP-4
	3-80	Fine sand, loamy fine sand	SP, SM, SP-SM	A-2, A-3	0	0	100	95-100	70-100	4-20	0-20	NP-4
161: Isanti, depressional---	0-16	Fine sandy loam	SM	A-2, A-4	0	0	100	100	75-100	15-40	15-20	NP
	16-28	Fine sand, sand, loamy fine sand	SM, SP-SM	A-2	0	0	100	100	85-100	10-35	15-20	NP
	28-80	Fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	100	85-100	9-35	15-20	NP
162: Lino-----	0-8	Loamy fine sand	SM	A-2	0	0	100	100	95-100	15-30	15-20	NP
	8-38	Fine sand, loamy fine sand	SP-SM, SM	A-2	0	0	100	100	95-100	12-25	15-20	NP
	38-80	Fine sand, sand	SP-SM, SP, SM	A-2, A-3	0	0	100	100	90-100	2-20	15-20	NP

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
164A: Mora-----	In											
	0-6	Loam	ML	A-4	0-1	0-2	90-100	80-98	70-95	50-80	15-25	NP-4
	6-15	Fine sandy loam, sandy loam, loam	SM, ML	A-4	0-1	0-2	90-100	80-98	70-90	40-80	15-20	NP-4
	15-36	Fine sandy loam, sandy loam, loam	ML, SM	A-4	0-1	0-2	90-100	80-98	70-90	40-60	15-20	NP-4
	36-48	Fine sandy loam, sandy loam	SM	A-2, A-4	0-1	0-4	85-100	75-98	60-80	30-40	15-20	NP-4
	48-80	Fine sandy loam, sandy loam, gravelly sandy loam	SM	A-2, A-4	0-1	0-4	85-95	70-90	60-80	30-40	15-20	NP-4
165: Parent-----	0-15	Loam	CL, CL-ML, ML	A-4, A-6	0-1	0-2	85-95	75-95	75-90	50-80	20-40	3-15
	15-33	Fine sandy loam, sandy loam, loam	ML, SM	A-2, A-4	0-1	0-5	85-95	75-95	55-75	30-55	15-20	NP-4
	33-40	Fine sandy loam, sandy loam, gravelly sandy loam	SM	A-2, A-4	0-5	1-12	75-95	75-95	40-75	25-45	15-20	NP-4
	40-80	Fine sandy loam, sandy loam, gravelly sandy loam	SM	A-2, A-4	0-5	1-10	80-95	70-90	40-75	25-45	15-20	NP-4
166: Ronneby-----	0-4	Loam	ML	A-4	0-1	0-5	95-100	80-95	75-95	50-75	15-25	NP-4
	4-12	Sandy loam, fine sandy loam, loam	ML, SM	A-4	0-1	0-5	85-100	80-95	60-85	35-65	15-25	NP-4
	12-45	Fine sandy loam, sandy loam, loam	ML, CL-ML, SC-SM, SM	A-4	0-1	0-5	85-95	75-95	60-85	35-60	20-30	2-7
	45-56	Sandy loam, fine sandy loam	SM	A-2, A-4	0-1	0-5	85-95	75-95	60-80	25-50	15-20	NP-4
	56-80	Sandy loam, fine sandy loam, gravelly sandy loam	SM	A-4, A-2	0-1	0-5	85-95	70-90	60-80	25-50	15-20	NP-4

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In											
169B: Braham-----	0-9	Loamy fine sand	SM	A-2	0	0	100	90-100	55-70	20-35	0-20	NP-4
	9-21	Loamy fine sand, loamy sand, fine sand	SP-SM, SM	A-2	0	0	100	90-100	65-90	10-20	0-20	NP-4
	21-46	Sandy clay loam, fine sandy loam, clay loam	SC, ML, CL	A-6, A-7	0-1	0-3	95-100	85-95	80-95	45-70	28-43	5-21
	46-80	Sandy clay loam, loam, clay loam	SC, CL, ML	A-6, A-7	0-1	0-3	95-100	85-95	80-95	45-70	28-43	5-21
169C: Braham-----	0-8	Loamy fine sand	SM	A-2	0	0	100	90-100	55-70	20-35	0-20	NP-4
	8-28	Loamy fine sand, loamy sand, fine sand	SP-SM, SM	A-2	0	0	100	90-100	65-90	10-20	0-20	NP-4
	28-48	Sandy clay loam, fine sandy loam, clay loam	ML, SC, CL	A-6, A-7	0-1	0-3	95-100	85-95	80-95	45-70	28-43	5-21
	48-80	Sandy clay loam, loam, clay loam	SC, CL, ML	A-6, A-7	0-1	0-3	95-100	85-95	80-95	45-70	28-43	5-21
169D: Braham-----	0-8	Loamy fine sand	SM	A-2	0	0	100	90-100	55-70	20-35	0-20	NP-4
	8-32	Loamy fine sand, loamy sand, fine sand	SP-SM, SM	A-2	0	0	100	90-100	65-90	10-20	0-20	NP-4
	32-55	Sandy clay loam, fine sandy loam, clay loam	SC, ML, CL	A-6, A-7	0-1	0-3	95-100	85-95	80-95	45-70	28-43	5-21
	55-80	Sandy clay loam, loam, clay loam	CL, SC, ML	A-6, A-7	0-1	0-3	95-100	85-95	80-95	45-70	28-43	5-21

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
204B: Cushing-----	0-6	Fine sandy loam	SM, ML, CL- ML, SC-SM	A-1, A-2, A-4	0	0-7	75-100	75-100	45-95	20-65	0-25	2-7
	6-22	Loam, silt loam, fine sandy loam	SM, SC-SM, CL-ML, ML	A-1, A-2, A-4	0	0-7	75-100	75-100	35-100	12-90	0-23	NP-6
	22-44	Clay loam, sandy clay loam, sandy loam	CL, SC	A-2, A-4, A-6, A-7	0	0-7	75-100	75-100	45-95	20-50	25-45	9-27
	44-80	Loam, sandy clay loam, sandy loam	SM, SC, SC-SM	A-1, A-2, A-4, A-6	0	0-7	75-100	75-100	45-95	20-50	0-34	2-20
204C: Cushing-----	0-7	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-1, A-2, A-4	0	0-7	75-100	75-100	45-95	20-65	0-25	2-7
	7-21	Loam, silt loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-1, A-2, A-4	0	0-7	75-100	75-100	35-100	12-90	0-23	NP-6
	21-44	Clay loam, sandy clay loam, sandy loam	CL, SC	A-2, A-4, A-6, A-7	0	0-7	75-100	75-100	45-95	20-50	25-45	9-27
	44-80	Loam, sandy clay loam, sandy loam	SC, SC-SM, SM	A-1, A-2, A-4, A-6	0	0-7	75-100	75-100	45-95	20-50	0-34	2-20
258B: Sandberg-----	0-14	Loamy coarse sand	SM, SP-SM	A-1, A-2	0	0-1	85-100	80-95	40-75	10-25	0-20	NP-4
	14-32	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand	SP-SM, SP	A-2, A-3, A-1	0-3	0-5	75-95	50-95	35-70	4-25	0-20	NP-4
	32-80	Gravelly coarse sand, coarse sand, sand	SP-SM, SP, SW	A-1, A-2, A-3	0-3	0-5	60-95	50-90	30-65	2-10	0-15	NP

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
258C: Sandberg-----	0-11	Loamy coarse sand	SP-SM, SM	A-1, A-2	0	0-1	85-100	80-95	40-75	10-25	0-20	NP-4
	11-26	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand, coarse sand	SP, SP-SM	A-2, A-3, A-1	0-3	0-5	75-95	50-95	35-70	4-25	0-20	NP-4
	26-80	Gravelly coarse sand, coarse sand, sand	SW, SP, SP-SM	A-1, A-2, A-3	0-3	0-5	60-95	50-90	30-65	2-10	0-15	NP
258E: Sandberg-----	0-11	Loamy coarse sand	SM, SP-SM	A-1, A-2	0	0-1	85-100	80-95	40-75	10-25	0-20	NP-4
	11-27	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand, coarse sand	SP-SM, SP	A-2, A-3, A-1	0-3	0-5	75-95	50-95	35-70	4-25	0-20	NP-4
	27-80	Gravelly coarse sand, coarse sand, sand	SP, SW, SP-SM	A-1, A-2, A-3	0-3	0-5	60-95	50-90	30-65	2-10	0-15	NP
260: Duelm-----	0-16	Loamy sand	SP-SM, SM	A-1, A-2	0	0	90-100	85-100	35-75	10-25	15-20	NP-4
	16-30	Loamy sand, coarse sand, sand	SM, SP-SM	A-1, A-2, A-3	0	0	90-100	85-100	35-75	5-25	15-20	NP-4
	30-80	Coarse sand, sand	SM, SP, SP-SM	A-1, A-2, A-3	0	0	85-100	75-100	35-75	3-15	0-20	NP-4
261: Isan, depressional---	0-14	Sandy loam	SC-SM, SM	A-2	0	0	95-100	92-100	50-75	15-35	0-30	NP-7
	14-34	Sand, loamy sand	SM, SP-SM	A-2	0	0	95-100	92-100	50-75	10-30	0-20	NP-4
	34-80	Sand, coarse sand	SP, SM	A-1, A-2, A-3	0	0	85-100	85-100	35-70	2-15	0-20	NP-4

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
325: Prebish, depressional---	0-15	Fine sandy loam	SM	A-4	0-1	0-2	90-100	75-95	55-80	35-50	15-20	NP-4
	15-41	Sandy loam, fine sandy loam, loam	SM	A-2, A-4	0-2	0-5	85-95	75-95	45-80	25-50	15-20	NP-4
	41-80	Sandy loam, fine sandy loam, gravelly sandy loam	SM	A-2	0-2	0-5	80-95	70-90	55-70	20-35	15-20	NP-4
341: Arvilla-----	0-14	Sandy loam	SC, SC-SM, SM	A-2, A-4, A-6	0	0	95-100	90-100	50-80	20-45	15-30	NP-15
	14-20	Sandy loam, loam, coarse sandy loam	SC-SM, SM, SC	A-2, A-4, A-6	0	0	90-100	85-100	50-80	20-45	15-40	NP-15
	20-80	Gravelly coarse sand, coarse sand, very gravelly coarse sand	SP-SM, SM, GP-GM, GP	A-1, A-2, A-3	0	0	35-100	25-100	10-60	0-15	---	NP
346: Talmoon-----	0-7	Loam	CL, CL-ML, ML	A-4	0	0-2	95-100	85-100	70-100	60-90	20-32	3-10
	7-12	Fine sandy loam, sandy loam, loam	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0-2	95-100	85-100	60-95	35-75	23-35	6-15
	12-32	Clay loam, silty clay loam, loam	CL, ML	A-4, A-6, A-7	0	0-2	95-100	85-100	70-100	50-95	30-50	9-20
	32-80	Loam, sandy clay loam, clay loam	SC-SM, SC, CL-ML, CL	A-4, A-6, A-7	0	0-2	95-100	85-100	75-100	45-80	25-45	6-18
373: Renshaw-----	0-9	Loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	90-100	70-100	50-75	20-40	5-15
	9-15	Loam, sandy clay loam, gravelly loam	SC-SM, SC, ML, CL	A-4, A-6	0	0-5	95-100	55-100	45-90	35-70	20-40	3-15
	15-80	Gravelly loamy sand, very gravelly loamy sand, gravelly coarse sand	SW, SW-SM, SM, GW-GM	A-1, A-2	0	0-5	45-95	30-80	10-60	0-15	0-25	NP-5

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
454B: Mahtomedi-----	0-9	Loamy coarse sand	SM, SC-SM	A-1, A-2	0	0-2	95-100	75-90	40-85	15-30	15-20	NP-4
	9-36	Sand, coarse sand, gravelly coarse sand	SM, SP-SM	A-1, A-2, A-3	0	0-10	70-95	50-90	30-75	5-15	15-20	NP
	36-80	Sand, coarse sand, gravelly sand	SP, SP-SM, SM	A-1, A-2, A-3	0	0-10	55-95	50-90	30-70	2-15	15-20	NP
454C: Mahtomedi-----	0-3	Loamy coarse sand	SM, SC-SM	A-1, A-2	0	0-2	95-100	75-90	40-85	15-30	15-20	NP-4
	3-17	Sand, coarse sand, gravelly sand	SP-SM, SM	A-1, A-2, A-3	0	0-10	70-95	50-90	30-75	5-15	15-20	NP
	17-80	Sand, coarse sand, gravelly sand	SM, SP-SM, SP	A-1, A-2, A-3	0	0-10	55-95	50-90	30-70	2-15	15-20	NP
540: Seelyeville-----	0-10	Muck	PT	A-8	0	0	---	---	---	---	---	---
	10-80	Muck, mucky peat	PT	A-8	0	0	---	---	---	---	---	---
543: Markey-----	0-36	Muck	PT	A-8	---	---	---	---	---	---	---	---
	36-42	Fine sand, loamy sand, coarse sand	SP, SP-SM, SM	A-2, A-3	0	0	100	75-100	60-75	0-20	0-20	NP-4
	42-80	Fine sand, sand, coarse sand	SP-SM, SM, SP	A-2, A-3	0	0	100	75-100	60-75	0-20	0-20	NP-4
544: Cathro-----	0-30	Muck	PT	A-8	0	0	---	---	---	---	---	---
	30-38	Sandy loam, loam	SC, CL-ML, CL, SC-SM	A-4, A-6	0	0-5	85-100	75-100	60-100	35-90	20-40	5-20
	38-80	Sandy loam, loam, clay loam	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0-5	85-100	75-100	60-100	35-90	20-40	5-20

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
565: Eckvoll-----	0-9	Loamy fine sand	SC-SM, SM	A-2, A-4	---	0-2	90-100	85-100	45-80	25-40	15-20	NP-7
	9-24	Fine sand, sand, loamy fine sand	SP-SM, SM	A-1, A-2, A-3	---	0-2	90-100	85-100	45-75	5-30	15-20	NP-4
	24-45	Clay loam, sandy clay loam, loam	SC, CL	A-4, A-6, A-7	---	0-5	90-100	85-98	65-95	45-75	25-50	7-25
	45-80	Loam, clay loam, fine sandy loam	CL	A-4, A-6, A-7	---	0-5	90-100	85-98	70-95	50-80	25-45	7-20
567: Verndale-----	0-10	Sandy loam	SM	A-2, A-4	0	0	100	85-100	60-85	25-45	0-20	NP-6
	10-19	Sandy loam, fine sandy loam, loam	SM, SC-SM	A-2-4, A-4	0	0	98-100	85-100	60-85	25-45	15-30	4-7
	19-28	Sand, coarse sand, loamy coarse sand	SW, SM	A-2-4, A-3	0	0	98-100	85-100	50-65	4-20	0-20	NP-4
	28-80	Sand, coarse sand	SW, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	96-100	75-100	45-60	3-10	0-20	NP-4
623A: Pierz-----	0-16	Sandy loam	SC-SM, SM, CL-ML	A-2-4, A-4	0-1	0-5	90-100	75-100	60-85	30-55	15-25	NP-5
	16-29	Sandy loam, loam, fine sandy loam	CL-ML, SC-SM, SC, CL	A-4, A-6	0-3	0-5	80-100	75-90	45-85	30-70	15-30	4-14
	29-80	Very gravelly coarse sand, gravelly coarse sand, gravelly sand	SP, GW, SW, GP	A-1, A-2-4, A-3	0-3	0-10	35-75	25-75	20-60	3-15	0-0	NP
623B: Pierz-----	0-9	Sandy loam	SC-SM, SM, CL-ML	A-2-4, A-4	0-1	0-5	90-100	75-100	60-85	30-55	15-25	NP-5
	9-22	Sandy loam, loam, fine sandy loam	CL-ML, SC, SC-SM, CL	A-4, A-6	0-3	0-5	80-100	75-90	45-85	30-70	15-30	4-14
	22-80	Very gravelly coarse sand, gravelly coarse sand, gravelly sand	GW, GP, SP, SW	A-1, A-2-4, A-3	0-3	0-10	35-75	25-75	20-60	3-15	0-0	NP

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
708: Rushlake-----	In											
	0-9	Coarse sand	SM, SP-SM, SP	A-1-b, A-2-4, A-3	0	0	95-100	75-100	10-55	2-15	---	NP
	9-80	Gravelly sand, gravelly loamy sand, coarse sand	SP, SP-SM	A-1-b, A-3	0	0-3	55-95	50-90	15-60	2-10	---	NP
730A: Sanburn-----	0-6	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0	0-5	85-100	80-100	65-85	25-40	15-26	NP-6
	6-18	Sandy loam, gravelly sandy loam, fine sandy loam	SC-SM, SC, SM	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-31	NP-13
	18-80	Sand, coarse sand, gravelly coarse sand	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP
730B: Sanburn-----	0-5	Fine sandy loam	SC-SM, SM	A-2-4, A-4	0	0-5	85-100	80-100	65-85	25-40	15-26	NP-6
	5-19	Sandy loam, gravelly sandy loam, fine sandy loam	SC-SM, SM, SC	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-31	NP-13
	19-80	Sand, coarse sand, gravelly coarse sand	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP
732B: Bushville-----	0-8	Fine sand	SM, SP-SM	A-2-4	0	0	100	95-100	55-85	10-25	---	NP
	8-28	Fine sand, sand, loamy fine sand	SM, SP-SM	A-2-4	0	0	100	95-100	55-85	10-25	---	NP
	28-33	Fine sandy loam, sandy loam	SC-SM, SC	A-4	0-2	0-3	85-95	80-95	55-75	40-50	15-22	4-9
	33-43	Sandy loam, fine sandy loam	SM, SC-SM	A-2-4, A-4	0-2	0-3	85-95	80-95	50-70	25-50	15-22	NP-6
	43-80	Sandy loam, fine sandy loam	SM, SC-SM	A-2-4, A-4	0-2	0-3	85-95	80-95	50-70	25-50	15-22	NP-6

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
768:												
Mosford-----	0-12	Sandy loam	SM	A-2-4, A-4	0	0	100	85-100	50-85	25-55	0-25	NP-6
	12-16	Sandy loam, coarse sandy loam, fine sandy loam	SM	A-4, A-2-4	0	0	100	85-100	55-85	25-55	0-25	NP-6
	16-21	Coarse sand, sand, loamy sand	SP, SP-SM	A-2-4, A-3	0	0	100	85-100	45-65	4-30	0-20	NP-4
	21-80	Coarse sand, sand, gravelly coarse sand	SP, SP-SM, SW	A-1, A-3	0	0	95-100	50-100	45-75	4-15	0-20	NP-4
771:												
Elkriver, rarely flooded-----	0-10	Fine sandy loam	ML, SM	A-4	0	0	100	85-100	50-95	30-65	0-25	NP-4
	10-35	Fine sandy loam, very fine sandy loam, loam	SM, ML	A-4	0	0	100	85-100	65-95	35-75	0-30	NP-6
	35-39	Very fine sandy loam, fine sandy loam, loam	ML, SM	A-4	0	0	100	85-100	65-95	35-75	0-30	NP-6
	39-80	Fine sand, sand, gravelly sand	SP, SP-SM, SM	A-1-b, A-2-4, A-3	0	0	95-100	65-100	40-75	4-15	0-20	NP-4
799:												
Seelyeville, frequently flooded-----	0-12	Muck	PT	A-8	0	0	---	---	---	---	---	---
	12-80	Muck, mucky peat	PT	A-8	0	0	---	---	---	---	---	---
Bowstring, frequently flooded-----	0-38	Muck	PT	A-8	0	0	---	---	---	---	---	---
	38-47	Stratified fine sand to fine sandy loam	SP-SM, SM, SC-SM	A-2	0	0	100	100	50-85	10-35	15-20	NP-5
	47-80	Muck	PT	A-8	0	0	---	---	---	---	---	---
1013: Pits.												

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
1015: Udipsamments.												
1016: Udorthents.												
1028: Udorthents.												
Pits, gravel.												
1109: Isanti-----	0-16	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	100	75-100	5-35	15-20	NP
	16-23	Fine sand, sand, loamy fine sand	SM, SP-SM	A-2	0	0	100	100	85-100	10-35	15-20	NP
	23-80	Fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	100	85-100	9-35	15-20	NP
1110: Isan-----	0-18	Sandy loam	SC-SM, SM	A-2	0	0	95-100	92-100	50-75	15-35	0-30	NP-7
	18-29	Sand, loamy sand	SP-SM, SM	A-2	0	0	95-100	92-100	50-75	10-30	0-20	NP-4
	29-80	Sand, coarse sand	SP, SM	A-1, A-2, A-3	0	0	85-100	85-100	35-70	2-15	0-20	NP-4
1223: Sandberg-----	0-11	Loamy coarse sand	SP-SM, SM	A-1, A-2	0	0-1	85-100	80-95	40-75	10-25	0-20	NP-4
	11-35	Gravelly loamy coarse sand, gravelly coarse sand, loamy sand	SP-SM, SP	A-2, A-3, A-1	0-3	0-5	75-95	50-95	35-70	4-25	0-20	NP-4
	35-80	Gravelly coarse sand, coarse sand, sand	SP-SM, SP, SW	A-1, A-2, A-3	0-3	0-5	60-95	50-90	30-65	2-10	0-15	NP
Arvilla-----	0-14	Coarse sandy loam	SC-SM, SM, SC	A-2, A-4, A-6	0	0	95-100	90-100	50-80	20-45	15-30	NP-15
	14-17	Sandy loam, loam, coarse sandy loam	SC-SM, SC, SM	A-2, A-4, A-6	0	0	90-100	85-100	50-80	20-45	15-40	NP-15
	17-80	Gravelly coarse sand, coarse sand, very gravelly coarse sand	GP, SP-SM, SM, GP-GM	A-1, A-2, A-3	0	0	35-100	25-100	10-60	0-15	---	NP

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
1224: Hubbard-----	0-11	Loamy coarse sand	SM, SP-SM	A-2	0	0	98-100	95-100	50-80	10-25	0-20	NP-4
	11-27	Sand, coarse sand, loamy sand	SP-SM	A-1, A-2-4, A-3	0	0	98-100	95-100	25-75	5-12	0-20	NP-4
	27-80	Sand, coarse sand	SW, SP	A-1, A-2, A-3	0	0	95-100	85-100	20-70	2-5	0-15	NP
Verndale-----	0-10	Coarse sandy loam	SM	A-2, A-4	0	0	100	85-100	60-85	25-45	0-20	NP-6
	10-16	Coarse sandy loam, fine sandy loam, loam	SC-SM, SM	A-2-4, A-4	0	0	98-100	85-100	60-85	25-45	15-30	4-7
	16-45	Sand, coarse sand, loamy coarse sand	SM, SW	A-2-4, A-3	0	0	98-100	85-100	50-65	4-20	0-20	NP-4
	45-80	Sand, coarse sand	SP-SM, SW, SP	A-3, A-1-b, A-2-4	0	0	96-100	75-100	45-60	3-10	0-20	NP-4
1231: Hubbard-----	0-13	Loamy sand	SP-SM, SM	A-2	0	0	98-100	95-100	50-80	10-25	0-20	NP-4
	13-19	Sand, coarse sand, loamy sand	SP-SM	A-1, A-2-4, A-3	0	0	98-100	95-100	25-75	5-12	0-20	NP-4
	19-80	Sand, coarse sand	SW, SP	A-1, A-2, A-3	0	0	95-100	85-100	20-70	2-5	0-15	NP
Mosford-----	0-13	Sandy loam	SM	A-2-4, A-4	0	0	100	85-100	50-85	25-55	0-25	NP-6
	13-16	Sandy loam, coarse sandy loam, fine sandy loam	SM	A-4, A-2-4	0	0	100	85-100	55-85	25-55	0-25	NP-6
	16-35	Coarse sand, sand, loamy sand	SP-SM, SP	A-2-4, A-3	0	0	100	85-100	45-65	4-30	0-20	NP-4
	35-80	Coarse sand, sand, gravelly coarse sand	SP, SP-SM, SW	A-1, A-3	0	0	95-100	50-100	45-75	4-15	0-20	NP-4

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
1253B: Stonelake-----	0-4	Gravelly loamy sand	SM, SP	A-1, A-2-4	0	0-10	55-90	55-70	10-60	0-35	15-20	NP-4
	4-11	Very gravelly coarse sand, gravelly coarse sand, gravelly loamy coarse sand	SW, SP, GW, GP	A-1	0	0-10	35-75	15-45	10-30	0-10	---	NP-4
	11-24	Very gravelly coarse sand, very gravelly loamy coarse sand	SP, GW, GP, SW	A-1	0	0-10	20-60	15-45	5-25	0-5	0-25	NP-7
	24-80	Very gravelly coarse sand, gravelly sand, coarse sand	GP, SP, SW, GW	A-1	0	0-10	20-85	15-85	5-25	0-10	---	NP
Sanburn-----	0-5	Sandy loam	SC-SM, SM	A-2-4, A-4	0	0-5	85-100	80-100	65-85	25-40	15-26	NP-6
	5-20	Sandy loam, gravelly sandy loam, fine sandy loam	SM, SC-SM, SC	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-31	NP-13
	20-80	Sand, coarse sand, gravelly coarse sand	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP
1253C: Stonelake-----	0-5	Gravelly loamy coarse sand	SM, SP	A-1, A-2-4	0	0-10	55-90	55-70	10-60	0-35	15-20	NP-4
	5-16	Very gravelly coarse sand, very gravelly loamy coarse sand	SW, SP, GW, GP	A-1	0	0-10	20-60	15-45	5-25	0-5	0-25	NP-7
	16-80	Very gravelly coarse sand, gravelly coarse sand, coarse sand	SW, SP, GP, GW	A-1	0	0-10	20-85	15-85	5-25	0-10	---	NP

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
1253C: Sanburn-----	0-8	Sandy loam	SM, SC-SM	A-2-4, A-4	0	0-5	85-100	80-100	65-85	25-40	15-26	NP-6
	8-17	Sandy loam, gravelly sandy loam, fine sandy loam	SM, SC-SM, SC	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-31	NP-13
	17-80	Sand, coarse sand, gravelly coarse sand	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP
1253E: Stonelake-----	0-2	Loamy coarse sand	SM, SP	A-1, A-2-4	0	0	80-100	75-85	10-60	0-35	15-20	NP-4
	2-8	Very gravelly coarse sand, gravelly coarse sand, very gravelly loamy coarse sand	GP, GW, SW, SP	A-1	0	0-10	35-75	15-45	10-30	0-10	---	NP-4
	8-16	Very gravelly coarse sand, very gravelly loamy coarse sand	SW, GP, GW, SP	A-1	0	0-10	20-60	15-45	5-25	0-5	0-25	NP-7
	16-80	Very gravelly coarse sand, gravelly coarse sand, coarse sand	SP, SW, GW, GP	A-1	0	0-10	20-85	15-85	5-25	0-10	---	NP
Sanburn-----	0-5	Sandy loam	SM, SC-SM	A-2-4, A-4	0	0-5	85-100	80-100	65-85	25-40	15-26	NP-6
	5-14	Sandy loam, gravelly sandy loam, fine sandy loam	SC, SC-SM, SM	A-2, A-4, A-6	0-1	0-10	75-100	65-90	45-90	10-40	15-31	NP-13
	14-80	Sand, coarse sand, gravelly coarse sand	SP	A-1	0-1	0-10	65-90	45-90	15-50	1-5	---	NP

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
1254: Ricelake-----	0-9	Fine sandy loam	SM	A-4	0	0	100	95-100	70-85	40-55	0-28	NP-9
	9-27	Loamy fine sand, fine sand, loamy sand	SM	A-2	0	0	100	95-100	55-95	30-75	---	NP-4
	27-48	Fine sandy loam, sandy loam, loam	CL-ML, ML, SC-SM, SM	A-2-4, A-4	0	0	100	95-100	60-95	30-75	0-28	NP-9
	48-80	Clay loam, loam	CL	A-4, A-6	0	0	100	85-95	75-90	55-70	28-40	9-20
1255: Elkriver, occasionally flooded-----	0-10	Fine sandy loam	ML, SM	A-4	0	0	100	85-100	50-95	30-65	0-25	NP-4
	10-26	Fine sandy loam, very fine sandy loam, loam	ML, SM	A-4	0	0	100	85-100	65-95	35-75	0-30	NP-6
	26-32	Very fine sandy loam, fine sandy loam, loam	ML, SM	A-4	0	0	100	85-100	65-95	35-75	0-30	NP-6
	32-80	Loamy fine sand, sand, gravelly sand	SP, SM, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	65-100	35-70	4-15	0-20	NP-4
1256: Cantlin-----	0-8	Loamy fine sand	SM	A-2	0	0	100	100	95-100	15-30	15-20	NP
	8-22	Fine sand, loamy fine sand	SM, SP-SM	A-2	0	0	100	100	95-100	12-25	15-20	NP
	22-80	Fine sand, sand	SM, SP, SP-SM	A-2, A-3	0	0	100	100	90-100	2-20	15-20	NP

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
1257: Elkriver, rarely flooded-----	0-11	Fine sandy loam	ML, SM	A-4	0	0	100	85-100	50-95	30-65	0-25	NP-4
	11-20	Fine sandy loam, very fine sandy loam, loam	SM, ML	A-4	0	0	100	85-100	65-95	35-75	0-30	NP-6
	20-34	Very fine sandy loam, fine sandy loam, loam	SM, ML	A-4	0	0	100	85-100	65-95	35-75	0-30	NP-6
	34-80	Fine sand, sand, gravelly sand	SP, SP-SM, SM	A-1-b, A-2-4, A-3	0	0	95-100	65-100	40-75	4-15	0-20	NP-4
Mosford, rarely flooded-----	0-11	Fine sandy loam	SM	A-2-4, A-4	0	0	100	85-100	50-85	25-55	0-25	NP-6
	11-16	Sandy loam, coarse sandy loam, fine sandy loam	SM	A-4, A-2-4	0	0	100	85-100	55-85	25-55	0-25	NP-6
	16-25	Coarse sand, fine sand, loamy sand	SP-SM, SP	A-2-4, A-3	0	0	100	85-100	45-65	4-30	0-20	NP-4
	25-80	Coarse sand, sand, gravelly coarse sand	SP-SM, SW, SP	A-1, A-3	0	0	95-100	50-100	45-75	4-15	0-20	NP-4
1258B: Zimmerman, thick solum-----	0-2	Fine sand	SP-SM, SM	A-2	0	0	100	95-100	95-100	10-20	---	NP
	2-62	Fine sand	SP-SM, SM	A-2	0	0	100	95-100	95-100	10-20	---	NP
	62-80	Fine sand, loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	0	100	95-100	70-100	4-20	0-20	NP-4
1258C: Zimmerman, thick solum-----	0-3	Fine sand	SP-SM, SM	A-2	0	0	100	95-100	95-100	10-20	---	NP
	3-70	Fine sand	SP-SM, SM	A-2	0	0	100	95-100	95-100	10-20	---	NP
	70-80	Fine sand, loamy fine sand	SP-SM, SP, SM	A-2, A-3	0	0	100	95-100	70-100	4-20	0-20	NP-4

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
1258E: Zimmerman, thick solum-----	0-2	Fine sand	SM, SP-SM	A-2	0	0	100	95-100	95-100	10-20	---	NP
	2-62	Fine sand	SM, SP-SM	A-2	0	0	100	95-100	95-100	10-20	---	NP
	62-80	Fine sand, loamy fine sand	SP-SM, SP, SM	A-2, A-3	0	0	100	95-100	70-100	4-20	0-20	NP-4
1260B: Stonelake-----	0-8	Loamy coarse sand	SP-SM	A-1, A-2	0	0-5	85-100	80-95	40-70	10-25	0-20	NP-4
	8-30	Very gravelly coarse sand, very gravelly loamy coarse sand	SW, GP, GW, SP	A-1	0	0-10	20-60	15-45	5-25	0-5	0-25	NP-7
	30-80	Very gravelly coarse sand, gravelly sand, coarse sand	GW, GP, SP, SW	A-1	0	0-10	20-85	15-85	5-25	0-10	---	NP
Nebish-----	0-6	Fine sandy loam	SC-SM, SM	A-2-4, A-4	0	0-3	95-100	85-100	55-85	30-50	20-35	NP-7
	6-9	Loamy fine sand, fine sandy loam, sandy loam	SC-SM, SM	A-2-4, A-4	0	0-3	95-100	85-100	50-85	30-50	15-25	NP-6
	9-43	Loam, clay loam	ML, CL	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	43-80	Loam, clay loam, sandy clay loam	CL, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
	In				Pct	Pct					Pct	
1260C: Stonelake-----	0-7	Loamy sand	SP-SM	A-1, A-2	0	0-5	85-100	80-95	40-70	10-25	0-20	NP-4
	7-20	Very gravelly coarse sand, gravelly coarse sand, loamy coarse sand	GW, SP-SM, SW	A-1	0	0-10	35-75	15-45	15-30	0-10	---	NP-4
	20-42	Very gravelly coarse sand, very gravelly loamy coarse sand	SW, GP, GW, SP	A-1	0	0-10	20-60	15-45	5-25	0-5	0-25	NP-7
	42-80	Very gravelly coarse sand, gravelly sand, coarse sand	SP-SM, GW, SP, GP	A-1	0	0-10	20-85	15-85	5-25	0-10	---	NP
Nebish-----	0-3	Fine sandy loam	SC-SM, SM	A-2-4, A-4	0	0-3	95-100	85-100	55-85	30-50	20-35	NP-7
	3-10	Loamy fine sand, fine sandy loam, sandy loam	SM, SC-SM	A-2-4, A-4	0	0-3	95-100	85-100	50-85	30-50	15-25	NP-6
	10-29	Loam, clay loam	ML, CL	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	29-80	Loam, clay loam, sandy clay loam	CL-ML, CL	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10	3-10	4	10	40	200		
					inches	inches						
				Pct	Pct					Pct		
1260E: Stonelake-----	In											
	0-5	Gravelly coarse sandy loam	SM, SP	A-1, A-2-4	0	0-10	55-90	55-70	10-60	0-35	15-20	NP-4
	5-11	Very gravelly coarse sand, gravelly coarse sand, gravelly loamy coarse sand	SP, SW, GW	A-1	0	0-10	35-75	15-45	15-30	0-10	---	NP-4
	11-20	Very gravelly coarse sand, very gravelly loamy coarse sand	SW, SP, GP, GW	A-1	0	0-10	20-60	15-45	5-25	0-5	0-25	NP-7
	20-80	Very gravelly coarse sand, gravelly sand, coarse sand	SP-SM, GP, GW, SP	A-1	0	0-10	20-85	15-85	5-25	0-10	---	NP
Nebish-----	0-5	Fine sandy loam	SM, SC-SM	A-2-4, A-4	0	0-3	95-100	85-100	55-85	30-50	20-35	NP-7
	5-9	Loamy fine sand, fine sandy loam, sandy loam	SM, SC-SM	A-2-4, A-4	0	0-3	95-100	85-100	50-85	30-50	15-25	NP-6
	9-27	Loam, clay loam	CL, ML	A-6, A-7	0	0-3	95-100	85-100	70-95	55-80	30-50	10-20
	27-80	Loam, clay loam, sandy clay loam	CL, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-95	50-80	20-40	5-20
1270B: Milaca, moderately wet	0-6	Fine sandy loam	SM	A-4	0	0-2	90-100	80-100	60-80	35-50	15-22	NP-4
	6-19	Fine sandy loam, very fine sandy loam	SM	A-4	0	0-2	90-100	80-100	60-80	35-50	15-22	NP-4
	19-28	Sandy loam, fine sandy loam, loam	SM	A-2, A-4	0	0-5	85-95	75-95	50-70	30-40	15-22	NP-4
	28-45	Sandy loam, fine sandy loam	SM	A-2, A-4	0	0-5	85-95	75-95	50-70	30-40	15-22	NP-4
	45-80	Sandy loam, fine sandy loam, gravelly sandy loam	SM	A-2, A-4	0	0-5	80-95	70-90	50-70	25-40	15-22	NP-4

Table 17.--Engineering Index Properties--Continued

Map symbol and component name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In											
1288: Seelyeville, ponded-----	0-15	Muck	PT	A-8	0	0	---	---	---	---	---	---
	15-80	Muck, mucky peat	PT	A-8	0	0	---	---	---	---	---	---
Markey, ponded--	0-27	Muck	PT	A-8	---	---	---	---	---	---	---	---
	27-32	Fine sand, loamy sand, coarse sand	SM, SP-SM, SP	A-2, A-3	0	0	100	75-100	60-75	0-20	0-20	NP-4
	32-80	Fine sand, sand, coarse sand	SP-SM, SP, SM	A-2, A-3	0	0	100	75-100	60-75	0-20	0-20	NP-4
1356: Water, miscellaneous.												
1946: Fordum, frequently flooded-----	0-7	Fine sandy loam	SC-SM, CL-ML, SM	A-4, A-1, A-2	0	0-5	80-100	75-100	45-95	20-65	0-30	NP-7
	7-28	Silt loam, sandy loam, gravelly loam	CL, ML, SC, SM	A-1, A-2, A-4	0	0-5	30-100	25-100	20-100	10-90	15-30	3-10
	28-80	Sand, very gravelly loamy fine sand	SP, SM, GP	A-1, A-2, A-3	0	0-5	30-100	25-100	7-95	1-50	0-20	NP-4
Winterfield, frequently flooded-----	0-8	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	0	100	95-100	50-90	15-45	0-25	NP-7
	8-20	Sand, coarse sand, loamy sand, loamy fine sand	SP-SM, SP, SM, SC-SM	A-2-4, A-3, A-4	0	0	100	95-100	50-90	2-45	0-25	NP-7
	20-80	Sand, gravelly sand, loamy fine sand	SP-SM, SP, SM	A-1-b, A-2-4, A-3	0	0	85-100	70-100	35-80	0-35	0-20	NP-4
W: Water.												

Table 18.--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 component name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
7A:												
Hubbard-----	0-20	4-10	1.45-1.60	6-20	0.08-0.12	0.0-2.9	2.0-4.0	.15	.15	5	2	134
	20-32	1-5	1.55-1.65	6-20	0.03-0.07	0.0-2.9	0.0-0.5	.15	.15			
	32-80	0-5	1.55-1.65	6-20	0.03-0.07	0.0-2.9	0.0-0.5	.15	.15			
7B:												
Hubbard-----	0-18	4-10	1.45-1.60	6-20	0.08-0.12	0.0-2.9	2.0-4.0	.15	.15	5	2	134
	18-23	1-5	1.55-1.65	6-20	0.03-0.07	0.0-2.9	0.0-0.5	.15	.15			
	23-80	0-5	1.55-1.65	6-20	0.03-0.07	0.0-2.9	0.0-0.5	.15	.15			
7C:												
Hubbard-----	0-12	4-10	1.45-1.60	6-20	0.08-0.12	0.0-2.9	2.0-4.0	.15	.15	5	2	134
	12-33	1-5	1.55-1.65	6-20	0.03-0.07	0.0-2.9	0.0-0.5	.15	.15			
	33-80	0-5	1.55-1.65	6-20	0.03-0.07	0.0-2.9	0.0-0.5	.15	.15			
32B:												
Nebish-----	0-5	5-18	1.35-1.50	2-6	0.13-0.18	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	5-43	22-35	1.50-1.65	0.6-2	0.15-0.19	3.0-5.9	0.5-1.0	.32	.32			
	43-80	18-30	1.50-1.70	0.6-2	0.11-0.19	0.0-2.9	0.0-0.5	.32	.32			
32C:												
Nebish-----	0-7	5-18	1.35-1.50	2-6	0.13-0.18	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	7-11	5-12	1.40-1.65	2-6	0.11-0.19	0.0-2.9	0.5-1.0	.24	.24			
	11-44	22-35	1.50-1.65	0.6-2	0.15-0.19	3.0-5.9	0.5-1.0	.32	.32			
	44-80	18-30	1.50-1.70	0.6-2	0.11-0.19	0.0-2.9	0.0-0.5	.32	.32			
32D:												
Nebish-----	0-3	5-18	1.35-1.50	2-6	0.13-0.18	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	3-22	22-35	1.50-1.65	0.6-2	0.15-0.19	3.0-5.9	0.5-1.0	.32	.32			
	22-80	18-30	1.50-1.70	0.6-2	0.11-0.19	0.0-2.9	0.0-0.5	.32	.32			
32E:												
Nebish-----	0-4	5-18	1.35-1.50	2-6	0.13-0.18	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	4-13	5-12	1.40-1.65	2-6	0.11-0.19	0.0-2.9	0.5-1.0	.24	.24			
	13-36	22-35	1.50-1.65	0.6-2	0.15-0.19	3.0-5.9	0.5-1.0	.32	.32			
	36-80	18-30	1.50-1.70	0.6-2	0.11-0.19	0.0-2.9	0.0-0.5	.32	.32			
38B:												
Waukon-----	0-8	4-16	1.45-1.60	2-6	0.13-0.15	0.0-2.9	2.0-5.0	.24	.24	5	3	86
	8-12	5-12	1.40-1.65	2-6	0.11-0.19	0.0-2.9	0.5-1.0	.24	.24			
	12-43	18-35	1.40-1.60	0.6-2	0.15-0.19	3.0-5.9	0.0-0.5	.32	.32			
	43-80	18-30	1.45-1.65	0.6-2	0.15-0.19	0.0-2.9	0.0-0.5	.32	.32			
75:												
Bluffton, depressional	0-13	14-25	1.25-1.40	0.6-2	0.20-0.24	0.0-2.9	3.0-7.0	.28	.28	5	5	56
	13-40	18-30	1.45-1.55	0.1-2	0.15-0.17	0.0-2.9	0.5-2.0	.28	.28			
	40-80	18-30	1.50-1.65	0.1-0.6	0.15-0.19	0.0-2.9	0.0-0.5	.28	.28			
125:												
Beltrami-----	0-6	5-12	1.35-1.50	2-6	0.13-0.18	0.0-2.9	2.0-4.0	.24	.24	5	3	86
	6-12	5-15	1.40-1.65	0.6-6	0.11-0.19	0.0-2.9	1.0-3.0	.32	.32			
	12-48	18-35	1.50-1.65	0.1-2	0.15-0.19	3.0-5.9	0.5-1.0	.32	.32			
	48-80	18-30	1.50-1.70	0.6-2	0.15-0.19	0.0-2.9	0.0-0.5	.32	.32			

Table 18.--Physical Properties of the Soils--Continued

Map symbol and component name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
152C: Milaca-----	0-4	8-15	1.40-1.60	2-6	0.13-0.18	0.0-2.9	0.5-1.0	.28	.28	4	3	86
	4-12	8-15	1.40-1.60	2-6	0.18-0.22	0.0-2.9	0.0-0.5	.28	.28			
	12-20	8-18	1.45-1.65	0.6-2	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	20-42	5-18	1.65-1.75	0.0-0.1	0.00-0.08	0.0-2.9	0.0-0.5	.28	.28			
	42-80	5-18	1.80-2.00	0.0-0.0	0.00-0.04	0.0-2.9	0.0-0.5	.20	.28			
152E: Milaca-----	0-3	8-15	1.40-1.60	2-6	0.13-0.18	0.0-2.9	0.5-1.0	.28	.28	4	3	86
	3-12	8-15	1.40-1.60	2-6	0.18-0.22	0.0-2.9	0.0-0.5	.28	.28			
	12-20	8-18	1.45-1.65	0.6-2	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	20-40	5-18	1.65-1.75	0.0-0.1	0.00-0.08	0.0-2.9	0.0-0.5	.28	.28			
	40-80	5-18	1.80-2.00	0.0-0.0	0.00-0.04	0.0-2.9	0.0-0.5	.20	.28			
158A: Zimmerman-----	0-7	2-6	1.45-1.65	6-20	0.07-0.09	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	7-80	1-10	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.15	.15			
158B: Zimmerman-----	0-6	2-6	1.45-1.65	6-20	0.07-0.09	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	6-80	1-10	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.15	.15			
158C: Zimmerman-----	0-6	2-6	1.45-1.65	6-20	0.07-0.09	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	6-80	1-10	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.15	.15			
158E: Zimmerman-----	0-3	2-6	1.45-1.65	6-20	0.07-0.09	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	3-80	1-10	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.15	.15			
161: Isanti, depressional--	0-16	5-12	1.30-1.50	2-20	0.13-0.18	0.0-2.9	3.0-15	.20	.20	3	3	86
	16-28	2-10	1.45-1.65	6-20	0.06-0.08	0.0-2.9	0.5-1.0	.17	.17			
	28-80	1-5	1.50-1.70	6-20	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			
162: Lino-----	0-8	2-10	1.40-1.60	6-20	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	8-38	2-10	1.50-1.70	6-20	0.06-0.08	0.0-2.9	0.0-0.5	.17	.17			
	38-80	2-5	1.55-1.70	6-20	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			
164A: Mora-----	0-6	6-18	1.30-1.60	0.6-2	0.17-0.20	0.0-2.9	0.5-3.0	.28	.28	4	5	56
	6-15	6-18	1.40-1.70	0.6-6	0.14-0.19	0.0-2.9	0.0-0.5	.28	.28			
	15-36	8-18	1.50-1.65	0.6-2	0.15-0.19	0.0-2.9	0.0-0.5	.28	.28			
	36-48	5-18	1.65-1.75	0.0-0.1	0.00-0.08	0.0-2.9	0.0-0.5	.28	.28			
	48-80	5-18	1.80-2.00	0.0-0.0	0.00-0.04	0.0-2.9	0.0-0.5	.20	.28			
165: Parent-----	0-15	12-27	1.30-1.45	0.6-2	0.20-0.22	0.0-2.9	4.0-7.0	.32	.32	4	5	56
	15-33	5-18	1.50-1.65	0.6-2	0.12-0.17	0.0-2.9	1.0-4.0	.28	.28			
	33-40	5-18	1.65-1.75	0.0-0.1	0.00-0.08	0.0-2.9	0.0-0.5	.28	.28			
	40-80	5-18	1.80-2.00	0.0-0.0	0.00-0.04	0.0-2.9	0.0-0.5	.20	.28			
166: Ronneby-----	0-4	5-18	1.30-1.60	0.6-2	0.18-0.23	0.0-2.9	3.0-8.0	.32	.32	4	5	56
	4-12	5-18	1.40-1.65	0.6-6	0.12-0.19	0.0-2.9	0.5-2.0	.28	.28			
	12-45	6-18	1.40-1.65	0.6-2	0.12-0.19	0.0-2.9	0.5-1.0	.28	.28			
	45-56	5-18	1.65-1.80	0.0-0.1	0.03-0.08	0.0-2.9	0.0-0.5	.28	.28			
	56-80	5-18	1.80-2.00	0.0-0.0	0.00-0.04	0.0-2.9	0.0-0.5	.20	.28			

Table 18.--Physical Properties of the Soils--Continued

Map symbol and component name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
<b>169B:</b>												
<b>Braham</b> -----	0-9	2-8	1.40-1.60	6-20	0.10-0.12	0.0-2.9	1.0-3.0	.17	.17	5	2	134
	9-21	2-8	1.45-1.60	6-20	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	21-46	18-30	1.50-1.70	0.2-2	0.15-0.18	3.0-5.9	0.0-0.5	.37	.37			
	46-80	16-30	1.55-1.75	0.6-2	0.15-0.18	3.0-5.9	0.0-0.5	.37	.37			
<b>169C:</b>												
<b>Braham</b> -----	0-8	2-8	1.40-1.60	6-20	0.10-0.12	0.0-2.9	1.0-3.0	.17	.17	5	2	134
	8-28	2-8	1.45-1.60	6-20	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	28-48	18-30	1.50-1.70	0.2-2	0.15-0.18	3.0-5.9	0.0-0.5	.37	.37			
	48-80	16-30	1.55-1.75	0.6-2	0.15-0.18	3.0-5.9	0.0-0.5	.37	.37			
<b>169D:</b>												
<b>Braham</b> -----	0-8	2-8	1.40-1.60	6-20	0.10-0.12	0.0-2.9	1.0-3.0	.17	.17	5	2	134
	8-32	2-8	1.45-1.60	6-20	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	32-55	18-30	1.50-1.70	0.2-2	0.15-0.18	3.0-5.9	0.0-0.5	.37	.37			
	55-80	16-30	1.55-1.75	0.6-2	0.15-0.18	3.0-5.9	0.0-0.5	.37	.37			
<b>204B:</b>												
<b>Cushing</b> -----	0-6	6-14	1.35-1.65	0.6-2	0.10-0.22	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	6-22	4-16	1.55-1.65	0.6-2	0.10-0.22	0.0-2.9	0.1-1.0	.32	.32			
	22-44	18-35	1.55-1.70	0.6-2	0.10-0.19	0.0-2.9	0.0-0.5	.32	.32			
	44-80	8-21	1.45-1.80	0.1-0.6	0.09-0.19	0.0-2.9	0.0-0.5	.32	.32			
<b>204C:</b>												
<b>Cushing</b> -----	0-7	6-14	1.35-1.65	0.6-2	0.10-0.22	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	7-21	4-16	1.55-1.65	0.6-2	0.10-0.22	0.0-2.9	0.1-1.0	.32	.32			
	21-44	18-35	1.55-1.70	0.6-2	0.10-0.19	0.0-2.9	0.0-0.5	.32	.32			
	44-80	8-21	1.45-1.80	0.1-0.6	0.09-0.19	0.0-2.9	0.0-0.5	.32	.32			
<b>258B:</b>												
<b>Sandberg</b> -----	0-14	2-10	1.40-1.60	6-20	0.10-0.12	0.0-2.9	1.0-3.0	.15	.15	5	2	134
	14-32	0-10	1.50-1.65	6-20	0.03-0.10	0.0-2.9	0.5-1.0	.05	.10			
	32-80	0-5	1.50-1.65	20-40	0.02-0.06	0.0-2.9	0.0-0.5	.05	.10			
<b>258C:</b>												
<b>Sandberg</b> -----	0-11	2-10	1.40-1.60	6-20	0.10-0.12	0.0-2.9	1.0-3.0	.15	.15	5	2	134
	11-26	0-10	1.50-1.65	6-20	0.03-0.10	0.0-2.9	0.5-1.0	.05	.10			
	26-80	0-5	1.50-1.65	20-40	0.02-0.06	0.0-2.9	0.0-0.5	.05	.10			
<b>258E:</b>												
<b>Sandberg</b> -----	0-11	2-10	1.40-1.60	6-20	0.10-0.12	0.0-2.9	1.0-3.0	.15	.15	5	2	134
	11-27	0-10	1.50-1.65	6-20	0.03-0.10	0.0-2.9	0.5-1.0	.05	.10			
	27-80	0-5	1.50-1.65	20-40	0.02-0.06	0.0-2.9	0.0-0.5	.05	.10			
<b>260:</b>												
<b>Duelm</b> -----	0-16	2-10	1.40-1.60	6-20	0.08-0.12	0.0-2.9	2.0-6.0	.17	.17	5	2	134
	16-30	1-8	1.55-1.65	6-20	0.06-0.11	0.0-2.9	0.0-0.5	.15	.15			
	30-80	0-6	1.55-1.65	6-20	0.02-0.07	0.0-2.9	0.0-0.5	.15	.15			
<b>261:</b>												
<b>Isan, depressional</b> ----	0-14	5-14	1.30-1.55	2-6	0.10-0.15	0.0-2.9	3.0-10	.20	.20	3	3	86
	14-34	2-8	1.50-1.65	6-20	0.06-0.10	0.0-2.9	0.5-3.0	.17	.17			
	34-80	1-5	1.55-1.70	6-20	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
<b>325:</b>												
<b>Prebish, depressional</b>	0-15	5-20	1.35-1.55	2-6	0.16-0.18	0.0-2.9	4.0-8.0	.20	.20	4	3	86
	15-41	5-18	1.50-1.70	0.1-2	0.14-0.16	0.0-2.9	0.0-0.5	.28	.28			
	41-80	5-18	1.80-2.00	0.0-0.0	0.00-0.04	0.0-2.9	0.0-0.5	.20	.28			

Table 18.--Physical Properties of the Soils--Continued

Map symbol and component name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
341: Arvilla-----	0-14	6-18	1.40-1.60	2-6	0.13-0.15	0.0-2.9	1.0-4.0	.20	.20	3	3	86
	14-20	6-18	1.40-1.60	2-6	0.11-0.14	0.0-2.9	1.0-2.0	.20	.20			
	20-80	2-10	1.40-1.60	6-20	0.02-0.05	0.0-2.9	0.0-0.5	.10	.20			
346: Talmoon-----	0-7	8-20	1.10-1.35	0.6-2	0.20-0.22	0.0-2.9	2.0-4.0	.28	.28	5	5	56
	7-12	15-27	1.20-1.40	0.6-2	0.13-0.22	0.0-2.9	0.5-1.0	.37	.37			
	12-32	22-35	1.40-1.60	0.1-0.6	0.16-0.19	3.0-5.9	0.0-0.5	.37	.37			
	32-80	18-30	1.40-1.60	0.1-0.6	0.15-0.19	3.0-5.9	0.0-0.5	.37	.37			
373: Renshaw-----	0-9	20-26	1.20-1.30	0.6-2	0.18-0.20	0.0-2.9	2.0-4.0	.28	.28	3	6	48
	9-15	18-27	1.30-1.45	0.6-6	0.11-0.18	0.0-2.9	0.0-1.0	.28	.32			
	15-80	0-5	1.45-1.65	6-60	0.03-0.06	0.0-2.9	0.0-0.5	.10	.24			
454B: Mahtomedi-----	0-9	2-15	1.40-1.60	6-20	0.10-0.12	0.0-2.9	0.5-1.0	.15	.15	5	2	134
	9-36	0-10	1.45-1.75	6-20	0.05-0.07	0.0-2.9	0.0-0.5	.05	.10			
	36-80	0-10	1.45-1.75	6-20	0.04-0.09	0.0-2.9	0.0-0.5	.05	.10			
454C: Mahtomedi-----	0-3	2-15	1.40-1.60	6-20	0.10-0.12	0.0-2.9	0.5-1.0	.15	.15	5	2	134
	3-17	0-10	1.45-1.75	6-20	0.05-0.07	0.0-2.9	0.0-0.5	.05	.10			
	17-80	0-10	1.45-1.75	6-20	0.04-0.09	0.0-2.9	0.0-0.5	.05	.10			
540: Seelyeville-----	0-10	---	0.10-0.25	0.2-6	0.35-0.45	---	25-99	---	---	3	2	134
	10-80	---	0.10-0.25	0.2-6	0.35-0.45	---	25-99	---	---			
543: Markey-----	0-36	---	0.15-0.45	0.2-6	0.35-0.45	---	55-85	---	---	2	2	134
	36-42	0-10	1.40-1.65	6-20	0.03-0.08	0.0-2.9	1.0-4.0	.15	.15			
	42-80	0-10	1.40-1.65	6-20	0.03-0.08	0.0-2.9	0.0-0.5	.15	.15			
544: Cathro-----	0-30	---	0.28-0.45	0.1-6	0.45-0.55	---	60-85	---	---	2	2	134
	30-38	7-25	1.50-1.70	0.1-2	0.11-0.22	0.0-2.9	2.0-8.0	.20	.24			
	38-80	10-30	1.50-1.70	0.1-2	0.11-0.22	0.0-2.9	0.0-0.5	.20	.24			
565: Eckvoll-----	0-9	5-9	1.30-1.70	6-20	0.10-0.12	0.0-2.9	1.0-3.0	.17	.17	5	2	134
	9-24	2-9	1.30-1.70	6-20	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	24-45	18-35	1.40-1.70	0.1-2	0.16-0.18	3.0-5.9	0.0-0.5	.37	.37			
	45-80	16-32	1.30-1.70	0.1-2	0.17-0.19	3.0-5.9	0.0-0.5	.37	.37			
567: Verndale-----	0-10	7-12	1.50-1.70	2-6	0.13-0.17	0.0-2.9	2.0-4.0	.20	.20	3	3	86
	10-19	7-18	1.60-1.70	0.6-2	0.14-0.18	0.0-2.9	0.5-1.0	.24	.24			
	19-28	2-6	1.45-1.60	6-20	0.06-0.08	0.0-2.9	0.0-0.5	.10	.10			
	28-80	0-4	1.45-1.60	6-20	0.02-0.06	0.0-2.9	0.0-0.5	.10	.10			
623A: Pierz-----	0-16	4-18	1.40-1.55	2-6	0.13-0.17	0.0-2.9	2.0-4.0	.20	.20	4	3	86
	16-29	10-18	1.45-1.65	0.6-6	0.16-0.20	0.0-2.9	0.5-1.0	.28	.28			
	29-80	0-5	1.55-1.65	20-20	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
623B: Pierz-----	0-9	4-18	1.40-1.55	2-6	0.13-0.17	0.0-2.9	2.0-4.0	.20	.20	4	3	86
	9-22	10-18	1.45-1.65	0.6-6	0.16-0.20	0.0-2.9	0.5-1.0	.28	.28			
	22-80	0-5	1.55-1.65	20-20	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			

Table 18.--Physical Properties of the Soils--Continued

Map symbol and component name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
708: Rushlake-----	0-9	1-5	1.50-1.70	6-20	0.04-0.07	0.0-2.9	0.5-4.0	.15	.15	5	1	160
	9-80	1-10	1.50-1.70	6-20	0.02-0.10	0.0-2.9	0.0-0.5	.05	.10			
730A: Sanburn-----	0-6	4-12	1.35-1.60	2-6	0.12-0.15	0.0-2.9	1.0-3.0	.20	.20	3	3	86
	6-18	6-15	1.45-1.65	2-6	0.07-0.12	0.0-2.9	0.5-1.0	.17	.24			
	18-80	1-4	1.50-1.60	6-20	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
730B: Sanburn-----	0-5	4-12	1.35-1.60	2-6	0.12-0.15	0.0-2.9	1.0-3.0	.20	.20	3	3	86
	5-19	6-15	1.45-1.65	2-6	0.07-0.12	0.0-2.9	0.5-1.0	.17	.24			
	19-80	1-4	1.50-1.60	6-20	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
732B: Bushville-----	0-8	2-8	1.45-1.55	6-20	0.07-0.10	0.0-2.9	0.5-1.0	.15	.15	4	1	220
	8-28	2-8	1.50-1.70	6-20	0.06-0.09	0.0-2.9	0.0-0.5	.15	.15			
	28-33	10-18	1.55-1.65	0.6-2	0.10-0.15	0.0-2.9	0.0-0.5	.24	.28			
	33-43	5-18	1.65-1.75	0.0-0.1	0.03-0.08	0.0-2.9	0.0-0.5	.24	.28			
	43-80	5-18	1.80-2.00	0.0-0.0	0.00-0.04	0.0-2.9	0.0-0.5	.24	.28			
768: Mosford-----	0-12	7-18	1.50-1.70	2-6	0.13-0.18	0.0-2.9	2.0-4.0	.20	.20	3	3	86
	12-16	7-18	1.50-1.70	2-6	0.12-0.17	0.0-2.9	0.5-2.0	.24	.24			
	16-21	2-6	1.45-1.60	6-20	0.03-0.11	0.0-2.9	0.0-0.5	.15	.15			
	21-80	2-4	1.45-1.60	6-20	0.02-0.07	0.0-2.9	0.0-0.5	.05	.10			
771: Elkriver, rarely flooded-----	0-10	5-18	1.45-1.55	0.6-6	0.16-0.20	0.0-2.9	1.5-3.0	.20	.20	4	3	86
	10-35	5-18	1.45-1.55	0.6-6	0.15-0.20	0.0-2.9	1.5-3.0	.20	.20			
	35-39	5-18	1.45-1.55	0.6-6	0.15-0.19	0.0-2.9	0.5-2.0	.15	.15			
	39-80	1-10	1.60-1.70	6-20	0.02-0.10	0.0-2.9	0.0-0.5	.10	.15			
799: Seelyeville, frequently flooded---	0-12	---	0.10-0.25	0.2-6	0.35-0.45	---	25-99	---	---	3	2	134
	12-80	---	0.10-0.25	0.2-6	0.35-0.45	---	25-99	---	---			
Bowstring, frequently flooded-----	0-38	0-5	0.15-0.30	0.1-6	0.35-0.45	---	40-90	---	---	3	2	134
	38-47	1-12	1.40-1.60	0.6-20	0.08-0.14	0.0-2.9	2.0-10	---	---			
	47-80	0-5	0.15-0.30	0.1-6	0.35-0.45	---	40-90	---	---			
1013: Pits.												
1015: Udipsamments.												
1016: Udorthents.												
1028: Udorthents.												
Pits, gravel.												
1109: Isanti-----	0-16	2-10	1.35-1.55	6-20	0.10-0.12	0.0-2.9	3.0-15	.17	.17	5	2	134
	16-23	2-10	1.45-1.65	6-20	0.06-0.08	0.0-2.9	0.5-1.0	.17	.17			
	23-80	1-5	1.50-1.70	6-20	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			

Table 18.--Physical Properties of the Soils--Continued

Map symbol and component name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
1110: Isan-----	0-18 18-29 29-80	5-14 2-8 1-5	1.30-1.55 1.50-1.65 1.55-1.70	2-6 6-20 6-20	0.10-0.15 0.06-0.10 0.04-0.06	0.0-2.9 0.0-2.9 0.0-2.9	3.0-10 0.5-3.0 0.0-0.5	.20 .17 .15	.20 .17 .15	3 3 3	3 3 3	86
1223: Sandberg-----	0-11 11-35 35-80	2-10 0-10 0-5	1.40-1.60 1.50-1.65 1.50-1.65	6-20 6-20 20-40	0.10-0.12 0.03-0.10 0.02-0.06	0.0-2.9 0.0-2.9 0.0-2.9	1.0-3.0 0.5-1.0 0.0-0.5	.15 .05 .05	.15 .10 .10	5 5 5	2 2 2	134
Arvilla-----	0-14 14-17 17-80	6-18 6-18 2-10	1.40-1.60 1.40-1.60 1.40-1.60	2-6 2-6 6-20	0.13-0.15 0.11-0.14 0.02-0.05	0.0-2.9 0.0-2.9 0.0-2.9	1.0-4.0 1.0-2.0 0.0-0.5	.20 .20 .10	.20 .20 .20	3 3 3	3 3 3	86
1224: Hubbard-----	0-11 11-27 27-80	4-10 1-5 0-5	1.45-1.60 1.55-1.65 1.55-1.65	6-20 6-20 6-20	0.08-0.12 0.03-0.07 0.03-0.07	0.0-2.9 0.0-2.9 0.0-2.9	2.0-4.0 0.0-0.5 0.0-0.5	.15 .15 .15	.15 .15 .15	5 5 5	2 2 2	134
Verndale-----	0-10 10-16 16-45 45-80	7-12 7-18 2-6 0-4	1.50-1.70 1.60-1.70 1.45-1.60 1.45-1.60	2-6 0.6-2 6-20 6-20	0.13-0.17 0.14-0.18 0.06-0.08 0.02-0.06	0.0-2.9 0.0-2.9 0.0-2.9 0.0-2.9	2.0-4.0 0.5-1.0 0.0-0.5 0.0-0.5	.20 .24 .10 .10	.20 .24 .10 .10	3 3 3 3	3 3 3 3	86
1231: Hubbard-----	0-13 13-19 19-80	4-10 1-5 0-5	1.45-1.60 1.55-1.65 1.55-1.65	6-20 6-20 6-20	0.08-0.12 0.03-0.07 0.03-0.07	0.0-2.9 0.0-2.9 0.0-2.9	2.0-4.0 0.0-0.5 0.0-0.5	.15 .15 .15	.15 .15 .15	5 5 5	2 2 2	134
Mosford-----	0-13 13-16 16-35 35-80	7-18 7-18 2-6 2-4	1.50-1.70 1.50-1.70 1.45-1.60 1.45-1.60	2-6 2-6 6-20 6-20	0.13-0.18 0.12-0.17 0.03-0.11 0.02-0.07	0.0-2.9 0.0-2.9 0.0-2.9 0.0-2.9	2.0-4.0 0.5-2.0 0.0-0.5 0.0-0.5	.20 .24 .15 .05	.20 .24 .15 .10	3 3 3 3	3 3 3 3	86
1253B: Stonelake-----	0-4 4-11 11-24 24-80	1-10 1-4 1-8 1-4	1.45-1.60 1.45-1.60 1.45-1.60 1.45-1.65	6-20 20-60 20-60 20-60	0.06-0.15 0.03-0.04 0.03-0.08 0.02-0.05	0.0-2.9 0.0-2.9 0.0-2.9 0.0-2.9	1.0-4.0 0.0-0.5 0.0-0.5 0.0-0.5	.05 .05 .05 .05	.10 .10 .10 .10	5 5 5 5	8 8 8 8	0
Sanburn-----	0-5 5-20 20-80	4-12 6-15 1-4	1.35-1.60 1.45-1.65 1.50-1.60	2-6 2-6 6-20	0.12-0.15 0.07-0.12 0.02-0.04	0.0-2.9 0.0-2.9 0.0-2.9	1.0-3.0 0.5-1.0 0.0-0.5	.20 .17 .10	.20 .24 .15	3 3 3	3 3 3	86
1253C: Stonelake-----	0-5 5-16 16-80	1-10 1-8 1-4	1.45-1.60 1.45-1.60 1.45-1.65	6-20 20-60 20-60	0.06-0.15 0.03-0.08 0.02-0.05	0.0-2.9 0.0-2.9 0.0-2.9	1.0-4.0 0.0-0.5 0.0-0.5	.05 .05 .05	.10 .10 .10	5 5 5	8 8 8	0
Sanburn-----	0-8 8-17 17-80	4-12 6-15 1-4	1.35-1.60 1.45-1.65 1.50-1.60	2-6 2-6 6-20	0.12-0.15 0.07-0.12 0.02-0.04	0.0-2.9 0.0-2.9 0.0-2.9	1.0-3.0 0.5-1.0 0.0-0.5	.20 .17 .10	.20 .24 .15	3 3 3	3 3 3	86
1253E: Stonelake-----	0-2 2-8 8-16 16-80	1-10 1-4 1-8 1-4	1.45-1.60 1.45-1.60 1.45-1.60 1.45-1.65	6-20 20-60 20-60 20-60	0.06-0.15 0.03-0.04 0.03-0.08 0.02-0.05	0.0-2.9 0.0-2.9 0.0-2.9 0.0-2.9	1.0-4.0 0.0-0.5 0.0-0.5 0.0-0.5	.17 .05 .05 .05	.17 .10 .10 .10	5 5 5 5	2 2 2 2	134
Sanburn-----	0-5 5-14 14-80	4-12 6-15 1-4	1.35-1.60 1.45-1.65 1.50-1.60	2-6 2-6 6-20	0.12-0.15 0.07-0.12 0.02-0.04	0.0-2.9 0.0-2.9 0.0-2.9	1.0-3.0 0.5-1.0 0.0-0.5	.20 .17 .10	.20 .24 .15	3 3 3	3 3 3	86

Table 18.--Physical Properties of the Soils--Continued

Map symbol and component name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
1254: Ricelake-----	0-9	5-18	1.30-1.50	2-6	0.16-0.18	0.0-2.9	2.0-5.0	.20	.20	5	3	86
	9-27	1-7	1.35-1.60	6-20	0.06-0.11	0.0-2.9	0.0-0.5	.15	.15			
	27-48	5-18	1.35-1.60	0.6-6	0.13-0.17	0.0-2.9	0.0-0.5	.24	.24			
	48-80	18-32	1.30-1.70	0.1-2	0.14-0.19	3.0-5.9	0.0-0.5	.32	.32			
1255: Elkriver, occasionally flooded-----	0-10	5-18	1.45-1.55	0.6-6	0.16-0.20	0.0-2.9	1.5-3.0	.20	.20	4	3	86
	10-26	5-18	1.45-1.55	0.6-6	0.15-0.20	0.0-2.9	1.5-3.0	.20	.20			
	26-32	5-18	1.45-1.55	0.6-6	0.15-0.19	0.0-2.9	0.5-2.0	.15	.15			
	32-80	1-10	1.60-1.70	6-20	0.02-0.10	0.0-2.9	0.0-0.5	.10	.15			
1256: Cantlin-----	0-8	2-10	1.40-1.60	6-20	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	8-22	2-10	1.50-1.70	6-20	0.06-0.08	0.0-2.9	0.0-0.5	.17	.17			
	22-80	2-5	1.55-1.70	6-20	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			
1257: Elkriver, rarely flooded-----	0-11	5-18	1.45-1.55	0.6-6	0.16-0.20	0.0-2.9	1.5-3.0	.20	.20	4	3	86
	11-20	5-18	1.45-1.55	0.6-6	0.15-0.20	0.0-2.9	1.5-3.0	.20	.20			
	20-34	5-18	1.45-1.55	0.6-6	0.15-0.19	0.0-2.9	0.5-2.0	.15	.15			
	34-80	1-10	1.60-1.70	6-20	0.02-0.10	0.0-2.9	0.0-0.5	.10	.15			
Mosford, rarely flooded-----	0-11	7-18	1.50-1.70	2-6	0.13-0.18	0.0-2.9	2.0-4.0	.20	.20	3	3	86
	11-16	7-18	1.50-1.70	2-6	0.12-0.17	0.0-2.9	0.5-2.0	.24	.24			
	16-25	2-6	1.45-1.60	6-20	0.03-0.11	0.0-2.9	0.0-0.5	.15	.15			
	25-80	2-4	1.45-1.60	6-20	0.02-0.07	0.0-2.9	0.0-0.5	.05	.10			
1258B: Zimmerman, thick solum	0-2	2-5	1.40-1.65	6-20	0.07-0.09	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	2-62	2-5	1.40-1.65	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.17	.17			
	62-80	1-10	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.15	.15			
1258C: Zimmerman, thick solum	0-3	2-5	1.40-1.65	6-20	0.07-0.09	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	3-70	2-5	1.40-1.65	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.17	.17			
	70-80	1-10	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.15	.15			
1258E: Zimmerman, thick solum	0-2	2-5	1.40-1.65	6-20	0.07-0.09	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	2-62	2-5	1.40-1.65	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.17	.17			
	62-80	1-10	1.50-1.70	6-20	0.06-0.10	0.0-2.9	0.0-0.5	.15	.15			
1260B: Stonelake-----	0-8	1-5	1.45-1.60	20-60	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	8-30	1-8	1.45-1.60	20-60	0.03-0.08	0.0-2.9	0.0-0.5	.05	.10			
	30-80	1-4	1.45-1.65	20-60	0.02-0.05	0.0-2.9	0.0-0.5	.05	.10			
Nebish-----	0-6	5-18	1.35-1.50	2-6	0.13-0.18	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	6-9	5-12	1.40-1.65	2-6	0.11-0.19	0.0-2.9	0.5-1.0	.24	.24			
	9-43	22-35	1.50-1.65	0.6-2	0.15-0.19	3.0-5.9	0.5-1.0	.32	.32			
	43-80	18-30	1.50-1.70	0.6-2	0.11-0.19	0.0-2.9	0.0-0.5	.32	.32			
1260C: Stonelake-----	0-7	1-5	1.45-1.60	20-60	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	7-20	1-4	1.45-1.60	20-60	0.03-0.04	0.0-2.9	0.0-0.5	.05	.10			
	20-42	1-8	1.45-1.60	20-60	0.03-0.08	0.0-2.9	0.0-0.5	.05	.10			
	42-80	1-4	1.45-1.65	20-60	0.02-0.05	0.0-2.9	0.0-0.5	.05	.10			



Table 19.--Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated.)

Map symbol and component name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum
	In	meq/100 g	pH	Pct	Pct
7A:					
Hubbard-----	0-20	6.0-16	5.1-7.3	---	---
	20-32	1.0-4.0	5.1-7.3	---	---
	32-80	0.0-4.0	5.6-7.8	0-15	---
7B:					
Hubbard-----	0-18	6.0-16	5.1-7.3	---	---
	18-23	1.0-4.0	5.1-7.3	---	---
	23-80	0.0-4.0	5.6-7.8	0-15	---
7C:					
Hubbard-----	0-12	6.0-16	5.1-7.3	---	---
	12-33	1.0-4.0	5.1-7.3	---	---
	33-80	0.0-4.0	5.6-7.8	0-15	---
32B:					
Nebish-----	0-5	4.0-14	5.6-7.3	---	---
	5-43	10-18	5.6-7.8	---	---
	43-80	9.0-16	7.4-8.4	5-25	---
32C:					
Nebish-----	0-7	4.0-14	5.6-7.3	---	---
	7-11	3.0-8.0	5.6-7.3	---	---
	11-44	10-18	5.6-7.8	---	---
	44-80	9.0-16	7.4-8.4	5-25	---
32D:					
Nebish-----	0-3	4.0-14	5.6-7.3	---	---
	3-22	10-18	5.6-7.8	---	---
	22-80	9.0-16	7.4-8.4	5-25	---
32E:					
Nebish-----	0-4	4.0-14	5.6-7.3	---	---
	4-13	3.0-8.0	5.6-7.3	---	---
	13-36	10-18	5.6-7.8	---	---
	36-80	9.0-16	7.4-8.4	5-25	---
38B:					
Waukon-----	0-8	6.0-20	6.1-7.3	---	---
	8-12	3.0-8.0	5.6-7.3	---	---
	12-43	7.0-21	6.1-8.4	0-5	---
	43-80	7.0-18	7.4-8.4	5-25	---
75:					
Bluffton, depressional-----	0-13	12-30	5.6-7.3	---	---
	13-40	7.0-25	5.6-7.3	---	---
	40-80	7.0-20	7.4-8.4	5-30	---
125:					
Beltrami-----	0-6	4.0-14	6.1-7.3	---	---
	6-12	4.0-14	5.6-7.3	---	---
	12-48	9.0-19	5.6-7.8	---	---
	48-80	8.0-16	7.4-8.4	5-25	---

Table 19.--Chemical Properties of the Soils--Continued

Map symbol and component name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	meq/100 g	pH	Pct	Pct
<b>152C:</b>					
Milaca-----	0-4	4.0-12	5.1-6.5	---	---
	4-12	3.0-10	5.1-6.5	---	---
	12-20	3.0-12	5.1-6.5	---	---
	20-42	2.0-11	5.6-7.3	---	---
	42-80	2.0-11	5.6-7.3	0-15	---
<b>152E:</b>					
Milaca-----	0-3	4.0-12	5.1-6.5	---	---
	3-12	3.0-10	5.1-6.5	---	---
	12-20	3.0-12	5.1-6.5	---	---
	20-40	2.0-11	5.6-7.3	---	---
	40-80	2.0-11	5.6-7.3	0-15	---
<b>158A:</b>					
Zimmerman-----	0-7	2.0-5.0	5.1-6.5	---	---
	7-80	1.0-6.0	5.1-7.3	---	---
<b>158B:</b>					
Zimmerman-----	0-6	2.0-5.0	5.1-6.5	---	---
	6-80	1.0-6.0	5.1-7.3	---	---
<b>158C:</b>					
Zimmerman-----	0-6	2.0-5.0	5.1-6.5	---	---
	6-80	1.0-6.0	5.1-7.3	---	---
<b>158E:</b>					
Zimmerman-----	0-3	2.0-5.0	5.1-6.5	---	---
	3-80	1.0-6.0	5.1-7.3	---	---
<b>161:</b>					
Isanti, depressional	0-16	8.0-36	5.1-6.5	---	---
	16-28	1.0-8.0	5.1-6.5	---	---
	28-80	0.0-3.0	5.6-6.5	---	---
<b>162:</b>					
Lino-----	0-8	1.0-10	5.1-6.0	---	---
	8-38	2.0-6.0	5.1-6.0	---	---
	38-80	1.0-3.0	5.1-6.5	---	---
<b>164A:</b>					
Mora-----	0-6	2.0-17	5.1-6.5	---	---
	6-15	2.0-11	5.1-6.5	---	---
	15-36	3.0-11	5.6-6.5	---	---
	36-48	2.0-11	5.6-7.3	---	---
	48-80	2.0-11	5.6-7.3	0-15	---
<b>165:</b>					
Parent-----	0-15	13-30	5.6-7.3	---	---
	15-33	4.0-19	5.6-7.3	---	---
	33-40	2.0-11	6.1-7.3	---	---
	40-80	2.0-11	6.1-7.3	0-15	---
<b>166:</b>					
Ronneby-----	0-4	8.0-27	5.1-6.5	---	---
	4-12	2.0-15	5.1-6.5	---	---
	12-45	2.0-13	5.6-6.5	---	---
	45-56	2.0-11	5.6-7.3	---	---
	56-80	2.0-11	5.6-7.3	0-15	---

Table 19.--Chemical Properties of the Soils--Continued

Map symbol and component name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum
	In	meq/100 g	pH	Pct	Pct
<b>169B:</b>					
Braham-----	0-9	2.0-9.0	5.6-7.3	---	---
	9-21	1.0-5.0	5.6-7.3	---	---
	21-46	7.0-21	5.1-7.3	---	---
	46-80	7.0-21	7.4-8.4	5-25	0-1
<b>169C:</b>					
Braham-----	0-8	2.0-9.0	5.6-7.3	---	---
	8-28	1.0-5.0	5.6-7.3	---	---
	28-48	7.0-21	5.1-7.3	---	---
	48-80	7.0-21	7.4-8.4	5-25	0-1
<b>169D:</b>					
Braham-----	0-8	2.0-9.0	5.6-7.3	---	---
	8-32	1.0-5.0	5.6-7.3	---	---
	32-55	7.0-21	5.1-7.3	---	---
	55-80	7.0-21	7.4-8.4	5-25	0-1
<b>204B:</b>					
Cushing-----	0-6	6.0-15	5.1-7.8	---	---
	6-22	3.0-15	5.1-7.8	---	---
	22-44	11-29	5.1-7.8	---	---
	44-80	5.0-18	5.1-8.4	0-10	---
<b>204C:</b>					
Cushing-----	0-7	6.0-15	5.1-7.8	---	---
	7-21	3.0-15	5.1-7.8	---	---
	21-44	11-29	5.1-7.8	---	---
	44-80	5.0-18	5.1-8.4	0-10	---
<b>258B:</b>					
Sandberg-----	0-14	2.0-12	5.6-7.8	0-5	---
	14-32	1.0-6.0	6.1-7.8	0-5	---
	32-80	1.0-4.0	7.4-8.4	5-10	---
<b>258C:</b>					
Sandberg-----	0-11	2.0-12	5.6-7.8	0-5	---
	11-26	1.0-6.0	6.1-7.8	0-5	---
	26-80	1.0-4.0	7.4-8.4	5-10	---
<b>258E:</b>					
Sandberg-----	0-11	2.0-12	5.6-7.8	0-5	---
	11-27	1.0-6.0	6.1-7.8	0-5	---
	27-80	1.0-4.0	7.4-8.4	5-10	---
<b>260:</b>					
Duelm-----	0-16	5.0-18	5.6-7.3	---	---
	16-30	0.0-4.0	5.1-7.3	---	---
	30-80	0.0-5.0	5.6-7.8	0-15	---
<b>261:</b>					
Isan, depressional---	0-14	10-25	5.6-7.3	---	---
	14-34	2.0-10	5.1-6.5	---	---
	34-80	1.0-5.0	5.6-7.3	---	---
<b>325:</b>					
Prebish, depressional	0-15	11-27	5.6-7.3	---	---
	15-41	5.0-11	5.6-7.3	---	---
	41-80	1.0-9.0	5.6-7.3	0-15	---

Table 19.--Chemical Properties of the Soils--Continued

Map symbol and component name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	meq/100 g	pH	Pct	Pct
<b>341:</b>					
Arvilla-----	0-14	5.0-20	6.1-7.3	---	---
	14-20	5.0-15	6.1-7.3	---	---
	20-80	1.0-5.0	7.4-8.4	1-5	---
<b>346:</b>					
Talmoon-----	0-7	7.0-20	5.1-7.3	---	---
	7-12	7.0-18	5.1-7.3	---	---
	12-32	8.0-20	5.6-7.3	---	---
	32-80	7.0-18	7.4-8.4	5-30	---
<b>373:</b>					
Renshaw-----	0-9	21-25	6.0-7.3	0	---
	9-15	1.0-10	6.0-7.3	0	---
	15-80	1.0-10	6.6-8.4	1-15	---
<b>454B:</b>					
Mahtomedi-----	0-9	2.0-11	5.1-6.5	---	---
	9-36	0.0-6.0	5.1-6.5	---	---
	36-80	0.0-6.0	5.1-7.3	0-15	---
<b>454C:</b>					
Mahtomedi-----	0-3	2.0-11	5.1-6.5	---	---
	3-17	0.0-6.0	5.1-6.5	---	---
	17-80	0.0-6.0	5.1-7.3	0-15	---
<b>540:</b>					
Seelyeville-----	0-10	140-200	5.1-7.3	---	---
	10-80	140-200	5.1-7.3	---	---
<b>543:</b>					
Markey-----	0-36	110-170	4.5-7.3	---	---
	36-42	1.0-3.0	5.6-7.3	---	---
	42-80	1.0-3.0	5.6-7.3	---	---
<b>544:</b>					
Cathro-----	0-30	120-170	4.5-6.5	---	---
	30-38	2.0-25	6.6-7.8	0-10	---
	38-80	2.0-25	6.6-8.4	5-30	---
<b>565:</b>					
Eckvoll-----	0-9	3.0-14	6.1-7.3	---	---
	9-24	1.0-7.0	6.1-7.3	---	---
	24-45	8.0-18	6.1-7.3	---	---
	45-80	6.0-16	7.4-8.4	5-30	---
<b>567:</b>					
Verndale-----	0-10	7.0-15	5.1-7.3	---	---
	10-19	3.0-12	5.1-7.3	---	---
	19-28	2.0-4.0	5.1-7.3	---	---
	28-80	0.0-3.0	5.1-7.3	---	---
<b>623A:</b>					
Pierz-----	0-16	3.0-17	5.1-6.5	---	---
	16-29	4.0-11	5.1-6.5	---	---
	29-80	0.0-3.0	5.1-6.5	---	---
<b>623B:</b>					
Pierz-----	0-9	3.0-17	5.1-6.5	---	---
	9-22	4.0-11	5.1-6.5	---	---
	22-80	0.0-3.0	5.1-6.5	---	---

Table 19.--Chemical Properties of the Soils--Continued

Map symbol and component name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum
	In	meq/100 g	pH	Pct	Pct
708:					
Rushlake-----	0-9	2.0-9.0	6.1-7.8	0-15	---
	9-80	1.0-6.0	6.5-8.4	0-30	---
730A:					
Sanburn-----	0-6	3.0-11	5.1-6.5	---	---
	6-18	4.0-11	5.1-6.5	---	---
	18-80	1.0-4.0	5.1-6.5	---	---
730B:					
Sanburn-----	0-5	3.0-11	5.1-6.5	---	---
	5-19	4.0-11	5.1-6.5	---	---
	19-80	1.0-4.0	5.1-6.5	---	---
732B:					
Bushville-----	0-8	1.0-5.0	5.1-6.5	---	---
	8-28	1.0-4.0	5.1-6.5	---	---
	28-33	4.0-11	5.1-6.5	---	---
	33-43	3.0-10	5.1-7.3	---	---
	43-80	3.0-10	5.6-7.3	---	---
768:					
Mosford-----	0-12	7.0-9.0	5.1-7.3	---	---
	12-16	4.0-22	5.1-7.3	---	---
	16-21	1.0-3.0	5.1-7.3	---	---
	21-80	0.0-2.0	5.1-7.8	0-15	---
771:					
Elkriver, rarely flooded-----	0-10	6.0-19	5.1-7.3	---	---
	10-35	6.0-19	5.1-7.3	---	---
	35-39	4.0-15	5.6-7.8	0-8	---
	39-80	0.0-6.0	5.6-7.8	0-8	---
799:					
Seelyeville, frequently flooded--	0-12	140-200	5.1-7.3	---	---
	12-80	140-200	5.1-7.3	---	---
Bowstring, frequently flooded-----	0-38	80-190	5.6-7.3	---	---
	38-47	10-40	5.6-7.3	---	---
	47-80	80-190	5.6-7.3	---	---
1013:					
Pits.					
1015:					
Udipsamments.					
1016:					
Udorthents.					
1028:					
Udorthents.					
Pits, gravel.					
1109:					
Isanti-----	0-16	7.0-36	5.1-6.5	---	---
	16-23	1.0-8.0	5.1-6.5	---	---
	23-80	0.0-3.0	5.6-6.5	---	---

Table 19.--Chemical Properties of the Soils--Continued

Map symbol and component name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	meq/100 g	pH	Pct	Pct
<b>1110:</b>					
Isan-----	0-18	10-25	5.6-7.3	---	---
	18-29	2.0-10	5.1-6.5	---	---
	29-80	1.0-5.0	5.6-7.3	---	---
<b>1223:</b>					
Sandberg-----	0-11	2.0-12	5.6-7.8	0-5	---
	11-35	1.0-6.0	6.1-7.8	0-5	---
	35-80	1.0-4.0	7.4-8.4	5-10	---
Arvilla-----	0-14	5.0-20	6.1-7.3	---	---
	14-17	5.0-15	6.1-7.3	---	---
	17-80	1.0-5.0	7.4-8.4	1-5	---
<b>1224:</b>					
Hubbard-----	0-11	6.0-16	5.1-7.3	---	---
	11-27	1.0-4.0	5.1-7.3	---	---
	27-80	0.0-4.0	5.6-7.8	0-15	---
Verndale-----	0-10	7.0-15	5.1-7.3	---	---
	10-16	3.0-12	5.1-7.3	---	---
	16-45	2.0-4.0	5.1-7.3	---	---
	45-80	0.0-3.0	5.1-7.3	---	---
<b>1231:</b>					
Hubbard-----	0-13	6.0-16	5.1-7.3	---	---
	13-19	1.0-4.0	5.1-7.3	---	---
	19-80	0.0-4.0	5.6-7.8	0-15	---
Mosford-----	0-13	7.0-9.0	5.1-7.3	---	---
	13-16	4.0-22	5.1-7.3	---	---
	16-35	1.0-3.0	5.1-7.3	---	---
	35-80	0.0-2.0	5.1-7.8	0-15	---
<b>1253B:</b>					
Stonelake-----	0-4	2.0-14	5.1-6.5	---	---
	4-11	0.0-2.0	5.1-6.5	---	---
	11-24	0.0-2.0	5.1-6.5	---	---
	24-80	0.0-2.0	5.1-7.8	0-10	---
Sanburn-----	0-5	3.0-11	5.1-6.5	---	---
	5-20	4.0-11	5.1-6.5	---	---
	20-80	1.0-4.0	5.1-6.5	---	---
<b>1253C:</b>					
Stonelake-----	0-5	2.0-14	5.1-6.5	---	---
	5-16	0.0-2.0	5.1-6.5	---	---
	16-80	0.0-2.0	5.1-7.8	0-10	---
Sanburn-----	0-8	3.0-11	5.1-6.5	---	---
	8-17	4.0-11	5.1-6.5	---	---
	17-80	1.0-4.0	5.1-6.5	---	---
<b>1253E:</b>					
Stonelake-----	0-2	2.0-14	5.1-6.5	---	---
	2-8	0.0-2.0	5.1-6.5	---	---
	8-16	0.0-2.0	5.1-6.5	---	---
	16-80	0.0-2.0	5.1-7.8	0-10	---
Sanburn-----	0-5	3.0-11	5.1-6.5	---	---
	5-14	4.0-11	5.1-6.5	---	---
	14-80	1.0-4.0	5.1-6.5	---	---

Table 19.--Chemical Properties of the Soils--Continued

Map symbol and component name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum
	In	meq/100 g	pH	Pct	Pct
1254: Ricelake-----	0-9	6.0-21	6.1-7.3	---	---
	9-27	1.0-5.0	6.1-7.3	---	---
	27-48	2.0-11	6.1-7.3	---	---
	48-80	7.0-19	6.1-7.8	0-15	---
1255: Elkriver, occasionally flooded	0-10	6.0-19	5.1-7.3	---	---
	10-26	6.0-19	5.1-7.3	---	---
	26-32	4.0-15	5.6-7.8	0-8	---
	32-80	0.0-6.0	5.6-7.8	0-8	---
1256: Cantlin-----	0-8	1.0-10	5.1-6.0	---	---
	8-22	2.0-6.0	5.1-6.0	---	---
	22-80	1.0-3.0	5.1-6.5	---	---
1257: Elkriver, rarely flooded-----	0-11	6.0-19	5.1-7.3	---	---
	11-20	6.0-19	5.1-7.3	---	---
	20-34	4.0-15	5.6-7.8	0-8	---
	34-80	0.0-6.0	5.6-7.8	0-8	---
Mosford, rarely flooded-----	0-11	7.0-9.0	5.1-7.3	---	---
	11-16	4.0-22	5.1-7.3	---	---
	16-25	1.0-3.0	5.1-7.3	---	---
	25-80	0.0-2.0	5.1-7.8	0-15	---
1258B: Zimmerman, thick solum-----	0-2	2.0-8.0	5.1-6.5	---	---
	2-62	1.0-6.0	5.1-6.5	---	---
	62-80	1.0-6.0	5.1-7.3	---	---
1258C: Zimmerman, thick solum-----	0-3	2.0-8.0	5.1-6.5	---	---
	3-70	1.0-6.0	5.1-6.5	---	---
	70-80	1.0-6.0	5.1-7.3	---	---
1258E: Zimmerman, thick solum-----	0-2	2.0-8.0	5.1-6.5	---	---
	2-62	1.0-6.0	5.1-6.5	---	---
	62-80	1.0-6.0	5.1-7.3	---	---
1260B: Stonelake-----	0-8	1.0-7.0	5.1-6.5	---	---
	8-30	0.0-2.0	5.1-6.5	---	---
	30-80	0.0-2.0	5.1-7.4	0-10	---
Nebish-----	0-6	4.0-14	5.6-7.3	---	---
	6-9	3.0-8.0	5.6-7.3	---	---
	9-43	10-18	5.6-7.8	---	---
	43-80	9.0-16	7.4-7.8	5-25	---

Table 19.--Chemical Properties of the Soils--Continued

Map symbol and component name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum
	In	meq/100 g	pH	Pct	Pct
1260C:					
Stonelake-----	0-7	1.0-7.0	5.1-6.5	---	---
	7-20	0.0-2.0	5.1-6.5	---	---
	20-42	0.0-2.0	5.1-6.5	---	---
	42-80	0.0-2.0	5.1-7.8	0-10	---
Nebish-----	0-3	4.0-14	5.6-7.3	---	---
	3-10	3.0-8.0	5.6-7.3	---	---
	10-29	10-18	5.6-7.8	---	---
	29-80	9.0-16	7.4-7.8	5-25	---
1260E:					
Stonelake-----	0-5	2.0-14	5.1-6.5	---	---
	5-11	0.0-2.0	5.1-6.5	---	---
	11-20	0.0-2.0	5.1-6.5	---	---
	20-80	0.0-2.0	5.1-7.8	0-10	---
Nebish-----	0-5	4.0-14	5.6-7.3	---	---
	5-9	3.0-8.0	5.6-7.3	---	---
	9-27	10-18	5.6-7.8	---	---
	27-80	9.0-16	7.4-7.8	5-25	---
1270B:					
Milaca, moderately wet-----	0-6	4.0-12	5.1-6.5	---	---
	6-19	3.0-10	5.1-6.5	---	---
	19-28	3.0-12	5.1-6.5	---	---
	28-45	2.0-11	5.6-7.3	---	---
	45-80	2.0-11	5.6-7.3	---	---
1288:					
Seelyeville, ponded--	0-15	140-200	5.1-7.3	---	---
	15-80	140-200	5.1-7.3	---	---
Markey, ponded-----	0-27	110-170	4.5-7.3	---	---
	27-32	1.0-3.0	5.6-7.3	---	---
	32-80	1.0-3.0	5.6-7.3	---	---
1356:					
Water, miscellaneous.					
1946:					
Fordum, frequently flooded-----	0-7	10-35	5.1-7.3	---	---
	7-28	3.0-20	5.1-7.3	---	---
	28-80	2.0-6.0	5.6-7.3	---	---
Winterfield, frequently flooded--	0-8	2.0-15	5.6-7.3	---	---
	8-20	1.0-10	5.6-7.3	---	---
	20-80	1.0-5.0	5.6-7.3	---	---
W:					
Water.					

Table 20.--Soil Moisture Status by Depth

(See text for definitions of terms used in this table. Depths of layers are in feet.)

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
7A: Hubbard-----	A	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
7B: Hubbard-----	A	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
7C: Hubbard-----	A	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
32B: Nebish-----	B	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-4.6: Moist 4.6-6.7: Wet	0.0-3.6: Moist 3.6-6.7: Wet	0.0-3.9: Moist 3.9-6.7: Wet	0.0-4.6: Moist 4.6-6.7: Wet	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-5.9: Moist 5.9-6.7: Wet	0.0-4.6: Moist 4.6-6.7: Wet	0.0-5.2: Moist 5.2-6.7: Wet
32C: Nebish-----	B	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
32D: Nebish-----	B	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
32E: Nebish-----	B	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
38B: Waukon-----	B	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-4.6: Moist 4.6-6.7: Wet	0.0-3.6: Moist 3.6-6.7: Wet	0.0-3.9: Moist 3.9-6.7: Wet	0.0-4.6: Moist 4.6-6.7: Wet	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-5.9: Moist 5.9-6.7: Wet	0.0-4.6: Moist 4.6-6.7: Wet	0.0-5.2: Moist 5.2-6.7: Wet

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
75: Bluffton, depressional	B/D	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.5: Moist 0.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet
125: Beltrami-----	B	0.0-3.9: Moist 3.9-6.7: Wet	0.0-6.7: Moist ---	0.0-2.0: Moist 2.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.6: Moist 1.6-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-3.9: Moist 3.9-6.7: Wet	0.0-6.7: Moist ---	0.0-3.9: Moist 3.9-6.7: Wet	0.0-2.6: Moist 2.6-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-2.3: Moist 2.3-6.7: Wet
152C: Milaca-----	C	0.0-6.7: Moist											
152E: Milaca-----	C	0.0-6.7: Moist											
158A: Zimmerman-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
158B: Zimmerman-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
158C: Zimmerman-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
158E: Zimmerman-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
161: Isanti, depressional	B/D	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.5: Moist 0.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet
162: Lino-----	A	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.8: Moist 1.8-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.5: Moist 4.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet
164A: Mora-----	C	0.0-6.7: Moist --- ---	0.0-6.7: Moist --- ---	0.0-3.5: Moist 3.5-5.0: Wet 5.0-6.7: Moist	0.0-1.0: Moist 1.0-5.0: Wet 5.0-6.7: Moist	0.0-2.0: Moist 2.0-5.0: Wet 5.0-6.7: Moist	0.0-3.0: Moist 3.0-5.0: Wet 5.0-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-4.0: Moist 4.0-5.0: Wet 5.0-6.7: Moist	0.0-3.7: Moist 3.7-5.0: Wet 5.0-6.7: Moist	0.0-3.5: Moist 3.5-5.0: Wet 5.0-6.7: Moist
165: Parent-----	C/D	0.0-2.0: Moist 2.0-5.0: Wet 5.0-6.7: Moist	0.0-2.5: Moist 2.5-5.0: Wet 5.0-6.7: Moist	0.0-0.8: Moist 0.8-5.0: Wet 5.0-6.7: Moist	0.0-0.5: Moist 0.5-5.0: Wet 5.0-6.7: Moist	0.0-0.5: Moist 0.5-5.0: Wet 5.0-6.7: Moist	0.0-0.8: Moist 0.8-5.0: Wet 5.0-6.7: Moist	0.0-2.0: Moist 2.0-5.0: Wet 5.0-6.7: Moist	0.0-2.5: Moist 2.5-5.0: Wet 5.0-6.7: Moist	0.0-2.0: Moist 2.0-5.0: Wet 5.0-6.7: Moist	0.0-1.5: Moist 1.5-5.0: Wet 5.0-6.7: Moist	0.0-0.7: Moist 0.7-5.0: Wet 5.0-6.7: Moist	0.0-1.0: Moist 1.0-5.0: Wet 5.0-6.7: Moist
166: Ronneby-----	C	0.0-6.7: Moist --- ---	0.0-6.7: Moist --- ---	0.0-3.5: Moist 3.5-5.0: Wet 5.0-6.7: Moist	0.0-0.7: Moist 0.7-5.0: Wet 5.0-6.7: Moist	0.0-1.5: Moist 1.5-5.0: Wet 5.0-6.7: Moist	0.0-2.5: Moist 2.5-5.0: Wet 5.0-6.7: Moist	0.0-3.5: Moist 3.5-5.0: Wet 5.0-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-3.5: Moist 3.5-5.0: Wet 5.0-6.7: Moist	0.0-3.2: Moist 3.2-5.0: Wet 5.0-6.7: Moist	0.0-3.2: Moist 3.2-5.0: Wet 5.0-6.7: Moist
169B: Braham-----	B	0.0-6.7: Moist --- ---	0.0-6.7: Moist --- ---	0.0-3.5: Moist 3.5-6.7: Wet	0.0-2.5: Moist 2.5-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-4.6: Moist 4.6-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.5: Moist 4.5-6.7: Wet

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
169C: Braham-----	B	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
169D: Braham-----	B	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
204B: Cushing-----	B	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-4.6: Moist 4.6-6.7: Wet	0.0-3.6: Moist 3.6-6.7: Wet	0.0-3.9: Moist 3.9-6.7: Wet	0.0-4.6: Moist 4.6-6.7: Wet	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-5.9: Moist 5.9-6.7: Wet	0.0-4.6: Moist 4.6-6.7: Wet	0.0-5.2: Moist 5.2-6.7: Wet
204C: Cushing-----	B	0.0-6.7: Moist ---											
258B: Sandberg-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
258C: Sandberg-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
258E: Sandberg-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
260: Duelm-----	A	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-2.5: Moist 2.5-6.7: Wet	0.0-2.5: Moist 2.5-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.3: Moist 3.3-6.7: Wet

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
261: Isan, depressional	B/D	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.5: Moist 0.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet
325: Prebish, depressional	C/D	0.0-0.5: Moist 0.5-5.0: Wet 5.0-6.7: Moist	0.0-1.0: Moist 1.0-5.0: Wet 5.0-6.7: Moist	0.0-1.0: Moist 1.0-5.0: Wet 5.0-6.7: Moist	0.0-5.0: Wet 5.0-6.7: Moist ---	0.0-5.0: Wet 5.0-6.7: Moist ---	0.0-5.0: Wet 5.0-6.7: Moist ---	0.0-0.5: Moist 0.5-5.0: Wet 5.0-6.7: Moist	0.0-1.0: Moist 1.0-5.0: Wet 5.0-6.7: Moist	0.0-1.0: Moist 1.0-5.0: Wet 5.0-6.7: Moist	0.0-0.5: Moist 0.5-5.0: Wet 5.0-6.7: Moist	0.0-0.3: Moist 0.3-5.0: Wet 5.0-6.7: Moist	0.0-0.3: Moist 0.3-5.0: Wet 5.0-6.7: Moist
341: Arvilla-----	B	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist
346: Talmoon-----	B/D	0.0-2.0: Moist 2.0-6.7: Wet	0.0-2.5: Moist 2.5-6.7: Wet	0.0-0.8: Moist 0.8-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.8: Moist 0.8-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-2.5: Moist 2.5-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-0.7: Moist 0.7-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet
373: Renshaw-----	B	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist
454B: Mahtomedi-----	A	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
454C: Mahtomedi-----	A	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
540: Seelyeville---	A/D	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.5: Moist 0.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
543: Markey-----	A/D	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.5: Moist 0.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet
544: Cathro-----	A/D	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.5: Moist 0.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet
565: Eckvoll-----	B	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-3.0: Moist 3.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-2.5: Moist 2.5-6.7: Wet	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-4.6: Moist 4.6-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.5: Moist 4.5-6.7: Wet
567: Verndale-----	B	0.0-6.7: Moist											
623A: Pierz-----	B	0.0-6.7: Moist											
623B: Pierz-----	B	0.0-6.7: Moist											
708: Rushlake-----	A	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-2.5: Moist 2.5-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.3: Moist 3.3-6.7: Wet
730A: Sanburn-----	B	0.0-6.7: Moist											
730B: Sanburn-----	B	0.0-6.7: Moist											

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
732B: Bushville-----	C	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-3.5: Moist 3.5-5.0: Wet 5.0-6.7: Moist	0.0-1.0: Moist 1.0-5.0: Wet 5.0-6.7: Moist	0.0-2.0: Moist 2.0-5.0: Wet 5.0-6.7: Moist	0.0-3.0: Moist 3.0-5.0: Wet 5.0-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-4.0: Moist 4.0-5.0: Wet 5.0-6.7: Moist	0.0-3.7: Moist 3.7-5.0: Wet 5.0-6.7: Moist	0.0-3.5: Moist 3.5-5.0: Wet 5.0-6.7: Moist
768: Mosford-----	B	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist
771: Elkriver, rarely flooded-----	B	0.0-5.0: Moist 5.0-6.7: Wet	0.0-5.5: Moist 5.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-5.0: Moist 5.0-6.7: Wet	0.0-6.0: Moist 6.0-6.7: Wet	0.0-6.7: Moist ---	0.0-5.0: Moist 5.0-6.7: Wet	0.0-4.5: Moist 4.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet
799: Seelyeville, frequently flooded-----	A/D	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.8: Moist 1.8-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.8: Moist 0.8-6.7: Wet	0.0-1.2: Moist 1.2-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.7: Moist 0.7-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet
Bowstring, frequently flooded-----	A/D	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.8: Moist 1.8-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.8: Moist 0.8-6.7: Wet	0.0-1.2: Moist 1.2-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.7: Moist 0.7-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet
1013: Pits.													
1015: Udipsammments.													
1016: Udorthents.													
1028: Udorthents. Pits, gravel.													

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
1109: Isanti-----	A/D	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.7: Moist 1.7-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet
1110: Isan-----	B/D	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.7: Moist 1.7-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-0.5: Moist 0.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet
1223: Sandberg-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
Arvilla-----	B	0.0-6.7: Moist											
1224: Hubbard-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
Verndale-----	B	0.0-6.7: Moist											
1231: Hubbard-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
Mosford-----	B	0.0-6.7: Moist											
1253B: Stonelake-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
Sanburn-----	B	0.0-6.7: Moist											

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
1253C:													
Stonelake-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
Sanburn-----	B	0.0-6.7: Moist											
1253E:													
Stonelake-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
Sanburn-----	B	0.0-6.7: Moist											
1254:													
Ricelake-----	B	0.0-3.9: Moist 3.9-6.7: Wet	0.0-6.7: Moist ---	0.0-2.0: Moist 2.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.6: Moist 1.6-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-3.9: Moist 3.9-6.7: Wet	0.0-6.7: Moist ---	0.0-3.9: Moist 3.9-6.7: Wet	0.0-2.6: Moist 2.6-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-2.3: Moist 2.3-6.7: Wet
1255:													
Elkriver, occasionally flooded-----	B	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.5: Moist 4.5-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-2.5: Moist 2.5-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet
1256:													
Cantlin-----	A	0.0-5.2: Moist 5.2-6.7: Wet	0.0-5.5: Moist 5.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-5.0: Moist 5.0-6.7: Wet	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.8: Moist 4.8-6.7: Wet
1257:													
Elkriver, rarely flooded-----	B	0.0-5.0: Moist 5.0-6.7: Wet	0.0-5.5: Moist 5.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-5.0: Moist 5.0-6.7: Wet	0.0-6.0: Moist 6.0-6.7: Wet	0.0-6.7: Moist ---	0.0-5.0: Moist 5.0-6.7: Wet	0.0-4.5: Moist 4.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
1257: Mosford, rarely flooded-----	B	0.0-5.0: Moist 5.0-6.7: Wet	0.0-5.5: Moist 5.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-5.0: Moist 5.0-6.7: Wet	0.0-6.0: Moist 6.0-6.7: Wet	0.0-6.7: Moist --- Wet	0.0-5.0: Moist 5.0-6.7: Wet	0.0-4.5: Moist 4.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet
1258B: Zimmerman, thick solum--	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
1258C: Zimmerman, thick solum--	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
1258E: Zimmerman, thick solum--	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
1260B: Stonelake-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
Nebish-----	B	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-4.6: Moist 4.6-6.7: Wet	0.0-3.6: Moist 3.6-6.7: Wet	0.0-3.9: Moist 3.9-6.7: Wet	0.0-4.6: Moist 4.6-6.7: Wet	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-5.9: Moist 5.9-6.7: Wet	0.0-4.6: Moist 4.6-6.7: Wet	0.0-5.2: Moist 5.2-6.7: Wet
1260C: Stonelake-----	A	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---						
Nebish-----	B	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist							

Table 20.--Soil Moisture Status by Depth--Continued

Map symbol and component name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
1260E: Stonelake-----	A	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-0.7: Dry 0.7-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---
Nebish-----	B	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist	0.0-6.7: Moist
1270B: Milaca, moderately wet-----	C	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-3.5: Moist 3.5-4.0: Wet 4.0-6.7: Moist	0.0-2.5: Moist 2.5-4.0: Wet 4.0-6.7: Moist	0.0-3.0: Moist 3.0-4.0: Wet 4.0-6.7: Moist	0.0-3.5: Moist 3.5-4.0: Wet 4.0-6.7: Moist	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-6.7: Moist ---	0.0-3.5: Moist 3.5-4.0: Wet 4.0-6.7: Moist	0.0-3.5: Moist 3.5-4.0: Wet 4.0-6.7: Moist
1288: Seelyeville, ponded-----	A/D	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet
Markey, ponded	A/D	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet	0.0-6.7: Wet
1356: Water, misc.													
1946: Fordum, frequently flooded-----	D	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.8: Moist 1.8-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-6.7: Wet ---	0.0-0.8: Moist 0.8-6.7: Wet	0.0-1.2: Moist 1.2-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet	0.0-0.7: Moist 0.7-6.7: Wet	0.0-1.0: Moist 1.0-6.7: Wet
Winterfield, frequently flooded-----	A	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-1.5: Moist 1.5-6.7: Wet	0.0-1.8: Moist 1.8-6.7: Wet	0.0-2.0: Moist 2.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-4.5: Moist 4.5-6.7: Wet	0.0-4.0: Moist 4.0-6.7: Wet	0.0-3.0: Moist 3.0-6.7: Wet	0.0-3.5: Moist 3.5-6.7: Wet
W: Water.													

Table 21.--Flooding Frequency and Duration

(See text for definitions of terms used in this table. Absence of an entry indicates that no estimation was made.)

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
7A: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
7B: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
7C: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
32B: Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
32C: Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
32D: Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
32E: Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
38B: Waukon-----	None	None	None	None	None	None	None	None	None	None	None	None
75: Bluffton, depressional---	None	None	None	None	None	None	None	None	None	None	None	None
125: Beltrami-----	None	None	None	None	None	None	None	None	None	None	None	None
152C: Milaca-----	None	None	None	None	None	None	None	None	None	None	None	None
152E: Milaca-----	None	None	None	None	None	None	None	None	None	None	None	None
158A: Zimmerman-----	None	None	None	None	None	None	None	None	None	None	None	None
158B: Zimmerman-----	None	None	None	None	None	None	None	None	None	None	None	None
158C: Zimmerman-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 21.--Flooding Frequency and Duration--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
158E: Zimmerman-----	None	None	None	None	None	None	None	None	None	None	None	None
161: Isanti, depressional---	None	None	None	None	None	None	None	None	None	None	None	None
162: Lino-----	None	None	None	None	None	None	None	None	None	None	None	None
164A: Mora-----	None	None	None	None	None	None	None	None	None	None	None	None
165: Parent-----	None	None	None	None	None	None	None	None	None	None	None	None
166: Ronneby-----	None	None	None	None	None	None	None	None	None	None	None	None
169B: Braham-----	None	None	None	None	None	None	None	None	None	None	None	None
169C: Braham-----	None	None	None	None	None	None	None	None	None	None	None	None
169D: Braham-----	None	None	None	None	None	None	None	None	None	None	None	None
204B: Cushing-----	None	None	None	None	None	None	None	None	None	None	None	None
204C: Cushing-----	None	None	None	None	None	None	None	None	None	None	None	None
258B: Sandberg-----	None	None	None	None	None	None	None	None	None	None	None	None
258C: Sandberg-----	None	None	None	None	None	None	None	None	None	None	None	None
258E: Sandberg-----	None	None	None	None	None	None	None	None	None	None	None	None
260: Duelm-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 21.--Flooding Frequency and Duration--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
261: Isan, depressional---	None	None	None	None	None	None	None	None	None	None	None	None
325: Prebish, depressional---	None	None	None	None	None	None	None	None	None	None	None	None
341: Arvilla-----	None	None	None	None	None	None	None	None	None	None	None	None
346: Talmoon-----	None	None	None	None	None	None	None	None	None	None	None	None
373: Renshaw-----	None	None	None	None	None	None	None	None	None	None	None	None
454B: Mahtomedi-----	None	None	None	None	None	None	None	None	None	None	None	None
454C: Mahtomedi-----	None	None	None	None	None	None	None	None	None	None	None	None
540: Seelyeville----	None	None	None	None	None	None	None	None	None	None	None	None
543: Markey-----	None	None	None	None	None	None	None	None	None	None	None	None
544: Cathro-----	None	None	None	None	None	None	None	None	None	None	None	None
565: Eckvoll-----	None	None	None	None	None	None	None	None	None	None	None	None
567: Verndale-----	None	None	None	None	None	None	None	None	None	None	None	None
623A: Pierz-----	None	None	None	None	None	None	None	None	None	None	None	None
623B: Pierz-----	None	None	None	None	None	None	None	None	None	None	None	None
708: Rushlake-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 21.--Flooding Frequency and Duration--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
730A: Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
730B: Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
732B: Bushville-----	None	None	None	None	None	None	None	None	None	None	None	None
768: Mosford-----	None	None	None	None	None	None	None	None	None	None	None	None
771: Elkriver, rarely flooded-----	None	None	Rare Very brief	Rare Very brief	Rare Very brief	Rare Very brief	None	None	None	None	None	None
799: Seelyeville, frequently flooded-----	None	None	Frequent Long	Frequent Long	Frequent Long	Frequent Long	Occasional Brief	Occasional Brief	None	None	None	None
Bowstring, frequently flooded-----	None	None	Frequent Long	Frequent Long	Frequent Long	Frequent Long	Occasional Brief	Occasional Brief	None	None	None	None
1013: Pits.												
1015: Udipsammets----	None	None	None	None	None	None	None	None	None	None	None	None
1016: Udorthents-----	None	None	None	None	None	None	None	None	None	None	None	None
1028: Udorthents.  Pits, gravel.												
1109: Isanti-----	None	None	None	None	None	None	None	None	None	None	None	None
1110: Isan-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 21.--Flooding Frequency and Duration--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
1223: Sandberg-----	None	None	None	None	None	None	None	None	None	None	None	None
Arvilla-----	None	None	None	None	None	None	None	None	None	None	None	None
1224: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
Verndale-----	None	None	None	None	None	None	None	None	None	None	None	None
1231: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
Mosford-----	None	None	None	None	None	None	None	None	None	None	None	None
1253B: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
1253C: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
1253E: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
1254: Ricelake-----	None	None	None	None	None	None	None	None	None	None	None	None
1255: Elkriver, occasionally flooded-----	None	None	Occasional Brief	Occasional Brief	Occasional Brief	Occasional Brief	Occasional Very brief	Occasional Very brief	None	None	None	None
1256: Cantlin-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 21.--Flooding Frequency and Duration--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
1257: Elkriver, rarely flooded-----	None	None	Rare Very brief	Rare Very brief	Rare Very brief	Rare Very brief	None	None	None	None	None	None
Mosford, rarely flooded-----	None	None	Rare Very brief	Rare Very brief	Rare Very brief	Rare Very brief	None	None	None	None	None	None
1258B: Zimmerman, thick solum-----	None	None	None	None	None	None	None	None	None	None	None	None
1258C: Zimmerman, thick solum-----	None	None	None	None	None	None	None	None	None	None	None	None
1258E: Zimmerman, thick solum-----	None	None	None	None	None	None	None	None	None	None	None	None
1260B: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
1260C: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
1260E: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
1270B: Milaca, moderately wet	None	None	None	None	None	None	None	None	None	None	None	None
1288: Seelyeville, ponded-----	None	None	None	None	None	None	None	None	None	None	None	None
Markey, ponded--	None	None	None	None	None	None	None	None	None	None	None	None

Table 21.--Flooding Frequency and Duration--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
1356: Water, miscellaneous.												
1946: Fordum, frequently flooded-----	None	None	Frequent Long	Frequent Long	Frequent Long	Frequent Long	Occasional Brief	Occasional Brief	None	None	None	None
Winterfield, frequently flooded-----	None	None	Frequent Long	Frequent Brief	Occasional Brief	Occasional Brief	Occasional Very brief	Occasional Very brief	None	None	None	None
W: Water.												

Table 22.--Ponding Frequency, Duration, and Depth

(Depth refers to the depth, in feet, of the water above the surface. See text for definitions of terms used in this table. Absence of an entry indicates that no estimation was made.)

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
7A: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
7B: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
7C: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
32B: Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
32C: Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
32D: Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
32E: Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None
38B: Waukon-----	None	None	None	None	None	None	None	None	None	None	None	None
75: Bluffton, depressional---	None	None	Frequent Long Depth: 1.0	Frequent Very long Depth: 1.0	Frequent Long Depth: 1.0	Frequent Brief Depth: 0.5	None	None	None	None	None	None
125: Beltrami-----	None	None	None	None	None	None	None	None	None	None	None	None
152C: Milaca-----	None	None	None	None	None	None	None	None	None	None	None	None
152E: Milaca-----	None	None	None	None	None	None	None	None	None	None	None	None
158A: Zimmerman-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 22.--Ponding Frequency, Duration, and Depth--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
158B: Zimmerman-----	None	None	None	None	None	None	None	None	None	None	None	None
158C: Zimmerman-----	None	None	None	None	None	None	None	None	None	None	None	None
158E: Zimmerman-----	None	None	None	None	None	None	None	None	None	None	None	None
161: Isanti, depressional---	None	None	Frequent Long Depth: 1.0	Frequent Very long Depth: 1.0	Frequent Long Depth: 1.0	Frequent Brief Depth: 0.5	None	None	None	None	None	None
162: Lino-----	None	None	None	None	None	None	None	None	None	None	None	None
164A: Mora-----	None	None	None	None	None	None	None	None	None	None	None	None
165: Parent-----	None	None	None	None	None	None	None	None	None	None	None	None
166: Ronneby-----	None	None	None	None	None	None	None	None	None	None	None	None
169B: Braham-----	None	None	None	None	None	None	None	None	None	None	None	None
169C: Braham-----	None	None	None	None	None	None	None	None	None	None	None	None
169D: Braham-----	None	None	None	None	None	None	None	None	None	None	None	None
204B: Cushing-----	None	None	None	None	None	None	None	None	None	None	None	None
204C: Cushing-----	None	None	None	None	None	None	None	None	None	None	None	None
258B: Sandberg-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 22.--Ponding Frequency, Duration, and Depth--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
258C: Sandberg-----	None	None	None	None	None	None	None	None	None	None	None	None
258E: Sandberg-----	None	None	None	None	None	None	None	None	None	None	None	None
260: Duelm-----	None	None	None	None	None	None	None	None	None	None	None	None
261: Isan, depressional---	None	None	Frequent Long Depth: 1.0	Frequent Very long Depth: 1.0	Frequent Long Depth: 1.0	Frequent Brief Depth: 0.5	None	None	None	None	None	None
325: Prebish, depressional---	None	None	Frequent Long Depth: 1.0	Frequent Very long Depth: 1.0	Frequent Long Depth: 1.0	Frequent Brief Depth: 0.5	None	None	None	None	None	None
341: Arvilla-----	None	None	None	None	None	None	None	None	None	None	None	None
346: Talmoon-----	None	None	None	None	None	None	None	None	None	None	None	None
373: Renshaw-----	None	None	None	None	None	None	None	None	None	None	None	None
454B: Mahtomedi-----	None	None	None	None	None	None	None	None	None	None	None	None
454C: Mahtomedi-----	None	None	None	None	None	None	None	None	None	None	None	None
540: Seelyeville----	None	None	Frequent Long Depth: 1.0	Frequent Very long Depth: 1.0	Frequent Long Depth: 1.0	Frequent Brief Depth: 0.5	None	None	None	None	None	None

Table 22.--Ponding Frequency, Duration, and Depth--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
543: Markey-----	None	None	Frequent Long Depth: 1.0	Frequent Very long Depth: 1.0	Frequent Long Depth: 1.0	Frequent Brief Depth: 0.5	None	None	None	None	None	None
544: Cathro-----	None	None	Frequent Long Depth: 1.0	Frequent Very long Depth: 1.0	Frequent Long Depth: 1.0	Frequent Brief Depth: 0.5	None	None	None	None	None	None
565: Eckvoll-----	None	None	None	None	None	None	None	None	None	None	None	None
567: Verndale-----	None	None	None	None	None	None	None	None	None	None	None	None
623A: Pierz-----	None	None	None	None	None	None	None	None	None	None	None	None
623B: Pierz-----	None	None	None	None	None	None	None	None	None	None	None	None
708: Rushlake-----	None	None	None	None	None	None	None	None	None	None	None	None
730A: Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
730B: Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
732B: Bushville-----	None	None	None	None	None	None	None	None	None	None	None	None
768: Mosford-----	None	None	None	None	None	None	None	None	None	None	None	None
771: Elkriver, rarely flooded-----	None	None	None	None	None	None	None	None	None	None	None	None
799: Seelyeville, frequently flooded-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 22.--Ponding Frequency, Duration, and Depth--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
799: Bowstring, frequently flooded-----	None	None	None	None	None	None	None	None	None	None	None	None
1013: Pits-----	None	None	None	None	None	None	None	None	None	None	None	None
1015: Udipsamments----	None	None	None	None	None	None	None	None	None	None	None	None
1016: Udorthents-----	None	None	None	None	None	None	None	None	None	None	None	None
1028: Udorthents-----	None	None	None	None	None	None	None	None	None	None	None	None
Pits, gravel----	None	None	None	None	None	None	None	None	None	None	None	None
1109: Isanti-----	None	None	None	None	None	None	None	None	None	None	None	None
1110: Isan-----	None	None	None	None	None	None	None	None	None	None	None	None
1223: Sandberg-----	None	None	None	None	None	None	None	None	None	None	None	None
Arvilla-----	None	None	None	None	None	None	None	None	None	None	None	None
1224: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
Verndale-----	None	None	None	None	None	None	None	None	None	None	None	None
1231: Hubbard-----	None	None	None	None	None	None	None	None	None	None	None	None
Mosford-----	None	None	None	None	None	None	None	None	None	None	None	None
1253B: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 22.--Ponding Frequency, Duration, and Depth--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
1253C: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
1253E: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Sanburn-----	None	None	None	None	None	None	None	None	None	None	None	None
1254: Ricelake-----	None	None	None	None	None	None	None	None	None	None	None	None
1255: Elkriver, occasionally flooded-----	None	None	None	None	None	None	None	None	None	None	None	None
1256: Cantlin-----	None	None	None	None	None	None	None	None	None	None	None	None
1257: Elkriver, rarely flooded-----	None	None	None	None	None	None	None	None	None	None	None	None
Mosford, rarely flooded-----	None	None	None	None	None	None	None	None	None	None	None	None
1258B: Zimmerman, thick solum-----	None	None	None	None	None	None	None	None	None	None	None	None
1258C: Zimmerman, thick solum-----	None	None	None	None	None	None	None	None	None	None	None	None
1258E: Zimmerman, thick solum-----	None	None	None	None	None	None	None	None	None	None	None	None
1260B: Stonelake-----	None	None	None	None	None	None	None	None	None	None	None	None
Nebish-----	None	None	None	None	None	None	None	None	None	None	None	None

Table 22.--Ponding Frequency, Duration, and Depth--Continued

Map symbol and component name	January	February	March	April	May	June	July	August	September	October	November	December
1260C: Stonelake-----	None											
Nebish-----	None											
1260E: Stonelake-----	None											
Nebish-----	None											
1270B: Milaca, moderately wet	None											
1288: Seelyeville, ponded-----	Frequent Very long Depth: 2.0	Frequent Very long Depth: 2.0	Frequent Very long Depth: 3.0	Frequent Very long Depth: 3.0	Frequent Very long Depth: 3.0	Frequent Very long Depth: 2.5	Frequent Very long Depth: 1.0	Frequent Very long Depth: 0.5	Frequent Very long Depth: 1.0	Frequent Very long Depth: 2.0	Frequent Very long Depth: 2.5	Frequent Very long Depth: 2.0
Markey, ponded--	Frequent Very long Depth: 2.0	Frequent Very long Depth: 2.0	Frequent Very long Depth: 3.0	Frequent Very long Depth: 3.0	Frequent Very long Depth: 3.0	Frequent Very long Depth: 2.5	Frequent Very long Depth: 1.0	Frequent Very long Depth: 0.5	Frequent Very long Depth: 1.0	Frequent Very long Depth: 2.0	Frequent Very long Depth: 2.5	Frequent Very long Depth: 2.0
1356: Water, miscellaneous.												
1946: Fordum, frequently flooded-----	None											
Winterfield, frequently flooded-----	None											
W: Water.												

Table 23.--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 component name	Pct. of map unit	Restrictive layer		Subsidence		Potential for frost action	Risk of corrosion	
		Kind	Depth to top	Initial	Total		Uncoated steel	Concrete
7A: Hubbard-----	95	---	>80	0	---	Low	Low	Low
7B: Hubbard-----	95	---	>80	0	---	Low	Low	Low
7C: Hubbard-----	95	---	>80	0	---	Low	Low	Low
32B: Nebish-----	85	---	>80	0	---	Moderate	Moderate	Low
32C: Nebish-----	85	---	>80	0	---	Moderate	Moderate	Low
32D: Nebish-----	85	---	>80	0	---	Moderate	Moderate	Low
32E: Nebish-----	85	---	>80	0	---	Moderate	Moderate	Low
38B: Waukon-----	90	---	>80	0	---	Moderate	Low	Low
75: Bluffton, depressional	90	---	>80	0	---	High	High	Moderate
125: Beltrami-----	90	---	>80	0	---	High	Moderate	Low
152C: Milaca-----	95	---	>80	0	---	Moderate	Low	Moderate
152E: Milaca-----	95	---	>80	0	---	Moderate	Low	Moderate
158A: Zimmerman-----	95	---	>80	0	---	Low	Low	High
158B: Zimmerman-----	95	---	>80	0	---	Low	Low	High
158C: Zimmerman-----	95	---	>80	0	---	Low	Low	High
158E: Zimmerman-----	95	---	>80	0	---	Low	Low	High
161: Isanti, depressional---	95	---	>80	0	---	Moderate	High	Moderate
162: Lino-----	95	---	>80	0	---	Moderate	Low	High
164A: Mora-----	95	---	>80	0	---	High	Moderate	Moderate

Table 23.--Soil Features--Continued

Map symbol and component name	Pct. of map unit	Restrictive layer		Subsidence		Potential for frost action	Risk of corrosion	
		Kind	Depth to top	Initial In	Total In		Uncoated steel	Concrete
165: Parent-----	90	---	>80	0	---	High	High	Moderate
166: Ronneby-----	90	---	>80	0	---	High	Moderate	Moderate
169B: Braham-----	90	---	>80	0	---	Low	Low	Moderate
169C: Braham-----	90	---	>80	0	---	Low	Low	Moderate
169D: Braham-----	90	---	>80	0	---	Low	Low	Moderate
204B: Cushing-----	90	---	>80	0	---	Moderate	Moderate	Moderate
204C: Cushing-----	95	---	>80	0	---	Moderate	Moderate	Moderate
258B: Sandberg-----	95	---	>80	0	---	Low	Moderate	Low
258C: Sandberg-----	95	---	>80	0	---	Low	Moderate	Low
258E: Sandberg-----	95	---	>80	0	---	Low	Moderate	Low
260: Duelm-----	95	---	>80	0	---	Moderate	Low	Moderate
261: Isan, depressional----	95	---	>80	0	---	Moderate	High	Moderate
325: Prebish, depressional--	95	---	>80	0	---	High	High	Low
341: Arvilla-----	95	---	>80	0	---	Low	Moderate	Low
346: Talmoon-----	90	---	>80	0	---	High	High	Moderate
373: Renshaw-----	95	---	>80	0	---	Low	Moderate	Low
454B: Mahtomedi-----	95	---	>80	0	---	Low	Low	High
454C: Mahtomedi-----	95	---	>80	0	---	Low	Low	High
540: Seelyeville-----	95	---	>80	0	50-55	High	High	Moderate
543: Markey-----	90	---	>80	0	25-30	High	High	Low
544: Cathro-----	95	---	>80	---	19-22	High	High	Low

Table 23.--Soil Features--Continued

Map symbol and component name	Pct. of map unit	Restrictive layer		Subsidence		Potential for frost action	Risk of corrosion	
		Kind	Depth to top	Initial	Total		Uncoated steel	Concrete
						In		
565: Eckvoll-----	90	---	>80	0	---	High	Moderate	Low
567: Verndale-----	95	---	>80	0	---	Low	Low	Low
623A: Pierz-----	95	---	>80	0	---	Low	Low	Moderate
623B: Pierz-----	95	---	>80	0	---	Low	Low	Moderate
708: Rushlake-----	85	---	>80	0	---	Moderate	Moderate	Low
730A: Sanburn-----	90	---	>80	0	---	Low	Low	Moderate
730B: Sanburn-----	90	---	>80	0	---	Low	Low	Moderate
732B: Bushville-----	95	---	>80	0	---	Low	Moderate	Moderate
768: Mosford-----	95	---	>80	0	---	Low	Low	Moderate
771: Elkriver, rarely flooded-----	95	---	>80	0	---	Moderate	Moderate	Moderate
799: Seelyeville, frequently flooded-----	45	---	>80	---	50-55	High	High	Moderate
Bowstring, frequently flooded-----	45	---	>80	---	20-30	High	High	Low
1013: Pits-----	90	Bedrock (lithic)	0-4	---	---	---	---	---
1015: Udipsamments.								
1016: Udorthents.								
1028: Udorthents.  Pits, gravel.								
1109: Isanti-----	90	---	>80	0	---	Moderate	High	Moderate
1110: Isan-----	90	---	>80	0	---	Moderate	High	Moderate
1223: Sandberg-----	60	---	>80	0	---	Low	Moderate	Low
Arvilla-----	30	---	>80	0	---	Low	Moderate	Low

Table 23.--Soil Features--Continued

Map symbol and component name	Pct. of map unit	Restrictive layer		Subsidence		Potential for frost action	Risk of corrosion	
		Kind	Depth to top	Initial	Total		Uncoated steel	Concrete
1224:								
Hubbard-----	60	---	>80	0	---	Low	Low	Low
Verndale-----	35	---	>80	0	---	Low	Low	Low
1231:								
Hubbard-----	60	---	>80	0	---	Low	Low	Low
Mosford-----	35	---	>80	0	---	Low	Low	Moderate
1253B:								
Stonelake-----	60	---	>80	0	---	Low	Low	Moderate
Sanburn-----	30	---	>80	0	---	Low	Low	Moderate
1253C:								
Stonelake-----	65	---	>80	0	---	Low	Low	Moderate
Sanburn-----	25	---	>80	0	---	Low	Low	Moderate
1253E:								
Stonelake-----	65	---	>80	0	---	Low	Low	Moderate
Sanburn-----	25	---	>80	0	---	Low	Low	Moderate
1254:								
Ricelake-----	90	---	>80	0	---	High	High	Low
1255:								
Elkriver, occasionally flooded-----	90	---	>80	0	---	Moderate	Moderate	Moderate
1256:								
Cantlin-----	90	---	>80	0	---	Low	Low	Moderate
1257:								
Elkriver, rarely flooded-----	55	---	>80	0	---	Moderate	Moderate	Moderate
Mosford, rarely flooded	35	---	>80	0	---	Low	Low	Moderate
1258B:								
Zimmerman, thick solum	95	---	>80	0	---	Low	Low	High
1258C:								
Zimmerman, thick solum	95	---	>80	0	---	Low	Low	High
1258E:								
Zimmerman, thick solum	95	---	>80	0	---	Low	Low	High
1260B:								
Stonelake-----	55	---	>80	0	---	Low	Low	Moderate
Nebish-----	30	---	>80	0	---	Moderate	Moderate	Low
1260C:								
Stonelake-----	55	---	>80	0	---	Low	Low	Moderate
Nebish-----	30	---	>80	0	---	Moderate	Moderate	Low





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# Glossary

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**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.

**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.

**Argillic horizon.** A subsoil horizon characterized by an accumulation of illuvial clay.

**Aspect.** The direction in which a slope faces.

**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).

**Beach deposits.** Material, such as sand and gravel, that is generally laid down parallel to an active or relict shoreline of a postglacial or glacial lake.

**Bedding planes.** Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

**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.

**Blowout.** A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

**Bog.** Waterlogged, spongy ground, consisting

primarily of mosses, containing acidic, decaying vegetation (such as sphagnum, sedges, and heaths) that develops into peat.

- Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.
- 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.
- Canopy.** The leafy crown of trees or shrubs. (See Crown.)
- 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.
- Catsteps.** Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.
- 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.
- 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.
- COLE (coefficient of linear extensibility).** See Linear extensibility.
- 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.
- 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.

**Crown.** The upper part of a tree or shrub, including the living branches and their foliage.

**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.

**Delta.** A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

**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.

**Depression.** Any relatively sunken part of the earth's surface; especially a low-lying area surrounded by higher ground. A closed depression has no natural outlet for surface drainage.

**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.

**Disintegration moraine.** A drift topography characterized by chaotic mounds and pits, generally randomly oriented, developed in supraglacial drift by collapse and flow as the underlying stagnant ice melted. Slopes may be steep and unstable. Abrupt changes between materials of differing lithology are common.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class** (natural). Refers to the frequency and duration of 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.

**Drainageway.** A relatively small, linear depression that, at some time, moves concentrated water and either does not have a defined channel or has only a small defined channel.

- 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.
- End moraine.** A ridgelike accumulation that is being or was produced at the outer margin of an actively flowing glacier at any given time.
- 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.
- Fan terrace.** A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.
- 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 oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.
- Fine textured soil.** Sandy clay, silty clay, or clay.
- Firebreak.** An 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.
- 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.
- Forest cover.** All trees and other woody plants (underbrush) covering the ground in a forest.

- Forest type.** A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.
- 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.
- 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.
- Geomorphology.** The science that treats the general configuration of the earth's surface; specifically, the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms.
- 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.
- Hard to reclaim (in tables).** Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.
- 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.
- Herbaceous peat.** An accumulation of organic material, decomposed to some degree, that is predominantly the remains of sedges, reeds, cattails, and other herbaceous plants.
- High-chroma zones.** Zones having chroma of 3 or more. Typical color in areas of iron concentrations.
- 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.

**Ice-walled lake plain.** A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted, the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

**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.

**Increasesers.** Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasesers 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 concentrations.** High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

**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.

**Kame moraine.** An end moraine that contains numerous kames. A group of kames along the front of a stagnant glacier, commonly comprising the slumped remnants of a formerly continuous outwash plain built up over the foot of rapidly wasting or stagnant ice.

**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.

$K_{sat}$ . Saturated hydraulic conductivity. (See Permeability.)

**Lacustrine deposit.** Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

**Lake bed.** The bottom of a lake; a lake basin.

**Lake plain.** A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

**Lakeshore.** A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

**Lake terrace.** A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

**Lamella.** A thin (commonly less than 1 cm thick), discontinuous or continuous, generally horizontal layer of fine material (especially clay and iron oxides) that has been pedogenically concentrated (illuviated within a coarser textured eluviated layer several centimeters to several decimeters thick).

**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.

**Linear extensibility.** Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at  $1/3$ - or  $1/10$ -bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the

resulting value is COLE, coefficient of linear extensibility.

**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-chroma zones.** Zones having chroma of 2 or less. Typical color in areas of iron depletions.

**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).

**Muck.** Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

**Mucky peat.** Unconsolidated soil material consisting primarily of organic matter that is in an intermediate stage of decomposition such that a significant part of the material can be recognized and a significant part of the material cannot be recognized.

**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.

**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.

**Paleoterrace.** An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

**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.

**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:

Impermeable .....	less than 0.0015 inch
Very slow .....	0.0015 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.

**Pitted outwash plain.** An outwash plain marked by many irregular depressions, such as kettles, shallow pits, and potholes, which formed by melting of incorporated ice masses; common in Wisconsin and Minnesota.

**Pitting** (in tables). Pits caused by melting around ice. They form on the soil after plant cover is removed.

**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.

**Ponding.** Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

**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.

**Rise.** A slight increase in elevation of the land surface, typically with a broad summit and gently sloping sides.

**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.

**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 groundwater runoff or seepage flow from ground water.

**Saline soil.** A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**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.

**Saprolite.** Unconsolidated residual material underlying the soil and grading to hard bedrock below.

**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.

**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.

**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.

**Slickensides.** Polished and grooved surfaces produced by one mass sliding past another. In

soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

**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.

**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.

**Sodium adsorption ratio (SAR).** A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

**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 and by the passage 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.

**Stagnation moraine.** A body of drift released by the melting of a glacier that ceased flowing.

Commonly, but not always, occurs near ice margins; composed of till, ice-contact stratified drift, and small areas of glacial lake sediment. Typical landforms are knob-and-kettle topography, locally including ice-walled lake plains.

**Stone line.** A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

**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.

**Strippcropping.** 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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Stubble mulch.** Stubble or other crop residue left on the soil or partly worked into the soil. 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.

**Subsidence.** The potential decrease in surface elevation as a result of the drainage of wet soils that have organic layers or semifluid mineral layers. Subsidence, as a result of drainage, is attributed to (1) shrinkage from drying, (2) consolidation because of the loss of ground-water buoyancy, (3) compaction from tillage or manipulation, (4) wind erosion, (5) burning, and (6) biochemical oxidation.

**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 or loosen a layer that restricts roots.

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.

**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.

**Swale.** A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine caused by uneven glacial deposition.

**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.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

**Thin layer** (in tables). Otherwise suitable soil material 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.

**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.

**Variation.** 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 oven-dry 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.

**Woody peat.** An accumulation of organic material that is predominantly composed of trees, shrubs, and other woody plants.