United States Department of Agriculture

Natural Resources Conservation Service

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

Soil Survey of Floyd County, Iowa

How To Use This Soil Survey

General Soil Map

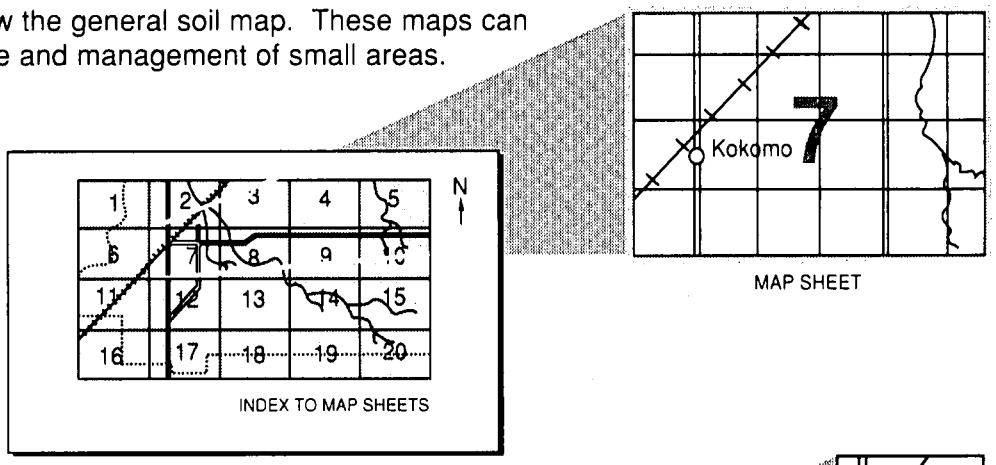
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

Detailed Soil Maps

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

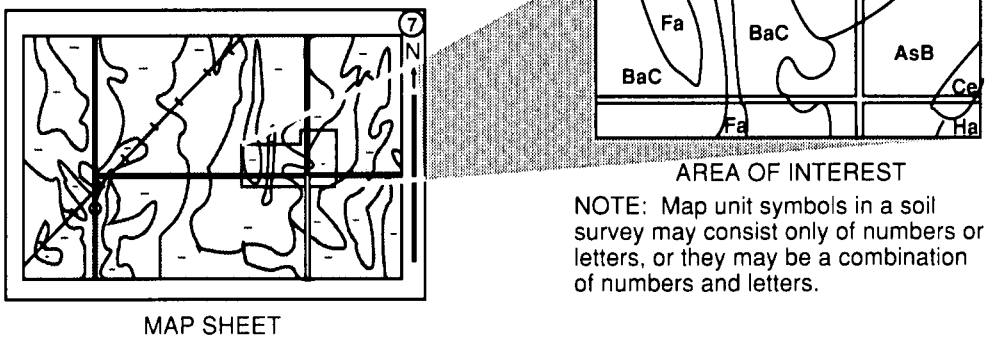
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

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



MAP SHEET

AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The 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 1987. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1989. This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. It is part of the technical assistance furnished to the Floyd County Soil and Water Conservation District. Funds appropriated by Floyd County were used to defray part of the cost of the survey.

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

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Soybeans in an area of Floyd loam, 1 to 4 percent slopes.

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Issued December 1995

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Summary of Tables

Preface

This soil survey contains information that can be used in land-planning programs in Floyd 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 over bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

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

Soil Survey of Floyd County, Iowa

By Kermit D. Voy, Natural Resources Conservation Service

Fieldwork by Kermit D. Voy, Jim Sanner, Shannon Gomes, and Jim Martzke, Natural Resources Conservation Service

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

FLOYD COUNTY is in the eastern part of north-central Iowa (fig. 1). It has an area of 320,800 acres, or about 501 square miles. Charles City, the county seat, is in the east-central part of the county. It is about 135 miles northeast of Des Moines, the State capital.

Enterprises in the county are chiefly agricultural. Manufacturing and the production of farm machinery and pharmaceuticals for poultry are the main industries off of the farm. The principal crops grown are corn and soybeans. Raising hogs is the chief livestock enterprise.

The Cedar River flows through the eastern part of the county. The Shell Rock River drains the western part. Other principal streams in the county are the Winnebago and Little Cedar Rivers and Flood Creek.

This survey updates the soil survey of Floyd County published in 1926 *(16)*. It provides additional information and larger maps, which show the soils in greater detail.

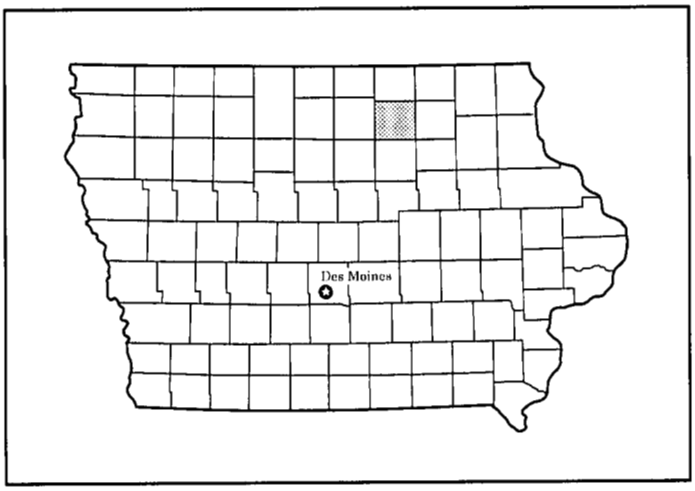

Figure 1.—Location of Floyd County in Iowa.

General Nature of the County

This section provides information about the history and development of the county, transportation facilities, relief and drainage, natural resources, agriculture, ground-water pollution hazards, and climate.

History and Development

The first inhabitants of Floyd County were from the Sioux, Sac, Fox, and Winnebago Indian Nations. The first known white settlers arrived in 1850. Joseph Kelly from Monroe, Wisconsin, settled on the eastern shore of the Cedar River, near what is now Charles City.

The county was established by the Iowa Legislature in 1851 and organized in 1854. It is bounded by Mitchell, Chickasaw, Butler, and Cerro Gordo Counties. In 1900, the population of Floyd County was 7,823. In 1980, it was 19,597.

Transportation Facilities

The major highways in the county are U.S. Highways 18 and 218 and State Highway 14. U.S. Highway 18, which runs east and west, and U.S. Highway 218, which runs predominantly north and south, intersect at Charles City. State Highway 14 also runs north and south and intersects with U.S. Highway 18 at Charles City. Other roads, which are surfaced with concrete or crushed rock, also connect these routes.

Other forms of transportation are available in the county. The main lines of some railroads are routed through Charles City, Marble Rock, Rockford, Nora Springs, and Rudd. A small municipal airport is in Charles City. Bus routes also provide service to Charles City.

Relief and Drainage

Most of the soils of Floyd County are nearly level to gently sloping. The moderately sloping to steep soils are mainly along the Cedar and Shell Rock Rivers and their tributary streams.

The Cedar and Little Cedar Rivers drain about 50 percent of the county. Flood Creek drains about 20 percent of the county, and the Shell Rock-Winnebago system drains the remaining 30 percent.

Much of the surface runoff and water from tile drainage systems leaves the county by way of the rivers and streams *(21)*. About 45 to 50 percent of this water enters the upper part of the Cedar Valley aquifer. The aquifer also receives water from sinkholes, agricultural drainage wells, and streams that empty directly into it through an underground drainage conduit system. Some of the water in the aquifer emerges as spring water in the larger stream valleys in the county.

Some streams lose much of their flow before it reaches their confluence with the Shell Rock River, especially during dry periods. They include Dry Run Creek, Flood Creek, and Ackley Creek. Flood Creek has a watershed area of nearly 65,000 acres in Floyd County and 35,000 acres in Butler and Mitchell Counties. The headwaters of Flood Creek are in an area where the Shell Rock Formation overlies the Cedar Valley Formation. Shaly layers interbedded in the Shell Rock Formation keep the water in the stream channel from percolating downward. Southeast of the town of Rudd, however, the Shell Rock Formation does not overlie the Cedar Valley Formation *(23)*. As a result, runoff from the Flood Creek watershed percolates into the underlying Cedar Valley Formation. This activity is particularly evident in dry years. In the summer and autumn of 1987, this span of Flood Creek contained little or no water even though a good flow of water could be observed upstream near Rudd. Just south of Roseville where Flood Creek intersects with State Highway 14, the watershed is nearly twice as large as it is near Rudd; however, in this area in the summer and autumn of 1987, all of the streamflow observed near Rudd had disappeared along with additional water from tile drainage systems and tributary streams along the way. Many small streams in the county also flow in the upper part of the watershed, but the streamflow ceases before it reaches the Cedar River.

The total watershed area of Flood Creek, Dry Run Creek, and Ackley Creek is 228.8 square miles, or approximately 146,000 acres. Of this, 182 square miles, or about 116,500 acres, is in Floyd County *(5)*. It makes up about 36 percent of the total land area of the county.

A significant number of agricultural drainage wells are used for tile drainage outlets in the county. Currently, an estimated 75 to 125 wells are used as outlets. These wells range from elaborate cistern structures that receive water from as many as three drainage systems to shallow sinkholes that have simply been enlarged. The sinkholes generally have no cistern but have an upright corrugated metal pipe with a hole cut in the side for water to enter from the drainage tile *(20)*.

Natural Resources

In addition to agricultural land, the natural resources in the county include limestone, shale, sand, gravel, trees, and water.

Many sand and gravel pits are along the rivers and streams throughout the county. The sand and gravel are used mainly as material for surfacing roads and as concrete aggregate. The limestone is near the surface in many areas throughout the county. After it is crushed, it is used commercially as road building material and as concrete aggregate and is a source of lime for agronomic uses. Some of the limestone is used for decorative purposes or as flagstone. In the past the Juniper Hill shale beds near Rockford were used as a source of clay for the manufacture of agricultural drainage tile and brick. The Cerro Gordo shale bed that outcrops in the Rockford area contains numerous kinds of fossils. Students, tourists, and residents of the county can collect abundant kinds of fossil faunas, including brachiopods, corals, gastropods, and crinoid stems *(7)*.

Trees in the county have commercial importance as well as esthetic value. Sawmills in the region produce oak, walnut, and other hardwood logs. The trees provide cover and dens for wildlife in the county. They also provide scenery for people boating, fishing, or participating in other outdoor activities.

A number of underground aquifers are sources of water for the rural areas and towns in the county. The

lower part of the Cedar Valley aquifer is protected by an overlying bed of shale in Floyd County. It is the source of water for many of the newer agricultural wells.

Agriculture

Most of the acreage in the county is farmland. It is used mainly for corn or soybeans, but some of the acreage is used for pasture, oats, hay, or woodland. The soybeans and much of the corn are sold as cash crops. In 1985, corn was grown on 143,000 acres and soybeans on 104,000 acres.

The principal livestock enterprise in the county is raising hogs. In 1985, about 189,000 hogs were marketed. Livestock enterprises that are important but less extensive in the county are feeding cattle, managing cow-calf operations, dairying, and raising sheep.

For some years the farms in the county have been decreasing in number and increasing in size. In 1985, the county had a total of 1,060 farms and the average farm was 286 acres in size.

Ground-Water Pollution Hazards

Sinkholes, streams, agricultural drainage wells, and soils having only a thin layer of material over limestone bedrock that has crevices are means for pollutants to enter the ground-water system.

Many sinkholes are in drainageways. In places they receive all of the runoff from watersheds that are as large as several hundred acres in extent. This runoff moves directly into the underground water supplies through the crevices in the bedrock.

Nearly half of the county is drained by streams in which the water at least partially sinks into the Cedar Valley aquifer. This is the same area where most of the sinkholes occur.

The agricultural drainage wells generally are relatively shallow. Water in the wells drains into the upper part of the Cedar Valley aquifer. If these wells are deep, the shale layer that protects the lower part of the Cedar Valley aquifer may be permeated and the wells may pollute the otherwise protected water source.

Soils that are shallow over limestone bedrock only filter out a small amount of the fertilizer and farm chemicals as the water percolates downward into the ground-water system. Limiting the rate and controlling the timing of applications of fertilizer and chemicals minimize the hazard of ground-water pollution.

Climate

Floyd County is cold in winter and is quite hot with occasional cool spells in summer. Precipitation during the winter frequently occurs as snowstorms. During the warm months, it is chiefly showers, which are often heavy and occur when warm, moist air moves in from the south. The total annual rainfall is normally adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Charles City, Iowa, in the period 1951 to 1984. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 19 degrees F and the average daily minimum temperature is 10 degrees. The lowest temperature on record, which occurred at Charles City on March 1, 1962, is -32 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred at Charles City on July 27, 1955, is 100 degrees.

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

The total annual precipitation is 33.24 inches. Of this, 24 inches, or about 73 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 6.30 inches at Charles City on August 10, 1980. Thunderstorms occur on about 43 days each year.

The average seasonal snowfall is about 39 inches. The greatest snow depth at any one time during the period of record was 33 inches. On the average, 54 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are local in extent and of short duration. They result in sparse damage in narrow belts. Hailstorms occur at times during the warmer part of the year in irregular patterns and in relatively small areas.

How This Survey Was Made

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

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, 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. 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 under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

Map Unit Composition

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

areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

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

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

General Soil Map Units

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

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

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

Soil Descriptions

1. Clyde-Kenyon-Floyd Association

Nearly level to moderately sloping, moderately well drained to poorly drained soils formed in loamy sediments and the underlying glacial till; on uplands

This association consists of soils on moderately broad ridge crests and long side slopes and in broad drainageways. The drainageways form an integrated dendritic pattern and are frequently of low gradient. Rounded granite boulders and stones were common on the surface, but most of them were removed when the soils were first cultivated. A stone line is common at the boundary between the mantle of the loamy sediments and the underlying glacial till. Slopes generally range from 0 to 9 percent, but in a few areas near streams, they are more sloping.

This association makes up about 39 percent of the county. It is about 25 percent Clyde soils, 17 percent Kenyon soils, 16 percent Floyd soils, and 42 percent minor soils (fig. 2).

Clyde soils are poorly drained and are nearly level and very gently sloping. They are in drainageways. Kenyon soils are moderately well drained and are nearly level to moderately sloping. They are on convex ridge crests and side slopes. Floyd soils are somewhat poorly drained and are very gently sloping. They are on the lower side slopes and in waterways.

Typically, the surface layer of the Clyde soils is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 13 inches thick. The subsoil is about 24 inches thick. The upper part is olive gray, mottled, friable loam, the next part is grayish brown, mottled, friable sandy loam, and the lower part is mottled grayish brown and light olive brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

Typically, the surface layer of the Kenyon soils is black loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 4 inches thick. The subsoil is about 32 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown and light olive brown, mottled, friable and firm loam. The substratum to a depth of about 60 inches is light olive brown loam.

Typically, the surface layer of the Floyd soils is black loam about 9 inches thick. The subsurface layer is black and very dark gray loam about 11 inches thick. The subsoil is friable, mottled, and about 25 inches thick. The upper part is olive brown loam, the next part is light olive brown sandy clay loam, and the lower part is grayish brown and light olive brown loam. The substratum to a depth of about 60 inches is light olive brown, mottled loam.

The most extensive minor soils in this association are the Bassett, Oran, Ostrander, Racine, Readlyn, Schley, and Bolan soils. Bassett soils are moderately well drained and are on ridge crests and the upper part of side slopes. Oran and Readlyn soils are somewhat poorly drained and are on nearly level ridge crests and gently sloping side slopes. Ostrander, Racine, and Bolan soils are well drained and are on ridges and side slopes. Schley soils are somewhat poorly drained and are on the lower side slopes and in waterways.

Nearly all of the areas of this association are used intensively for row crops. Corn, soybeans, and small grain are grown. Grasses and legumes are grown for hay and pasture. The soils in this association are well

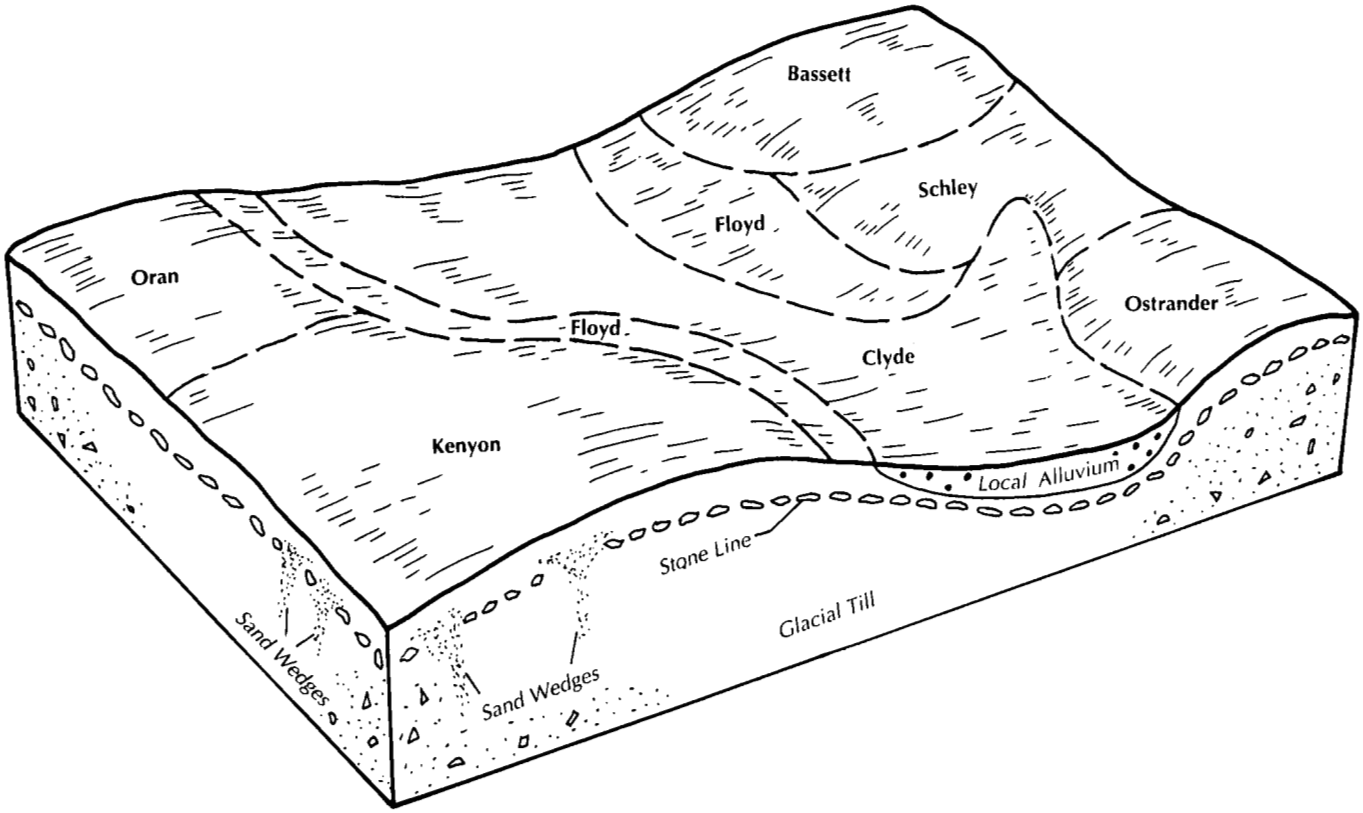

Figure 2.—Pattern of soils and parent material in the Clyde-Floyd-Kenyon association.

suited, suited, or moderately well suited to row crops. Available water capacity is high in nearly all of these soils.

The main management concerns are controlling water erosion, improving drainage, and maintaining good tilth and fertility. A system of conservation tillage that leaves crop residue on the surface, terraces, contour farming, and grassed waterways help to prevent excessive soil loss. The soils in this association formed in two different materials. The underlying glacial till material is more dense and less permeable than the overlying erosional sediments. As a result, subsurface water moves laterally downslope and often surfaces as hillside seepage. A combination of terraces, conservation tillage, and drainage tile is often the most effective means of controlling erosion and preventing excessive wetness.

2. Readlyn-Tripoli Association

Nearly level to gently sloping, somewhat poorly drained and poorly drained soils formed in loamy sediments and the underlying glacial till; on uplands

This association consists of soils on broad, nearly level upland divides and low gently sloping ridges and in a few distinct drainageways. A stone line is common at the boundary between the mantle of the loamy sediments and the underlying glacial till. Slopes dominantly range from 0 to 3 percent, but in some areas they range to 5 percent.

This association makes up about 17 percent of the county. It is about 45 percent Readlyn soils, 30 percent Tripoli soils, and 25 percent minor soils.

Readlyn soils are somewhat poorly drained and are on nearly level to gently sloping ridge crests and side slopes. Tripoli soils are poorly drained and are on broad, nearly level ridge crests and along broad drainageways.

Typically, the surface layer of the Readlyn soils is black loam about 10 inches thick. The subsurface layer is very dark grayish brown loam about 7 inches thick. The subsoil is mottled and about 29 inches thick. The upper part is very dark grayish brown, dark grayish brown, and light olive brown, friable clay loam, and the lower part is light olive brown and light brownish gray, firm loam. The substratum to a depth of about 60 inches is light olive brown and light brownish gray, calcareous loam.

Typically, the surface layer of the Tripoli soils is black silty clay loam about 8 inches thick. The subsurface layer is about 7 inches thick. It is black and very dark gray silty clay loam and clay loam. The subsoil is mottled and about 23 inches thick. The upper part is grayish brown, friable clay loam, the next part is yellowish brown, friable loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam.

The most extensive minor soils in this association are the Bolan, Clyde, Dickinson, Maxfield, and Oran soils. Bolan soils are well drained and are on ridges. Clyde soils are poorly drained and are in low waterways. Dickinson soils are somewhat excessively drained and are on ridges. Maxfield soils are poorly drained. They developed in 20 to 40 inches of loess and the underlying glacial till. Oran soils are somewhat poorly drained and have a thin, dark surface layer. They are on nearly level to gently sloping ridge crests and side slopes.

This association is used intensively for corn and soybeans. It is well suited to these crops. Most of the soils in this association have a high available water capacity.

The main management concerns are improving drainage and maintaining good tilth and fertility. In some areas of this association, controlling soil blowing and water erosion is also a management concern. Installing subsurface tile drains helps to remove excess water. A system of conservation tillage that leaves crop residue on the surface helps to control soil blowing, prevent excessive water erosion, and maintain tilth.

3. Lourdes-Protivin-Clyde Association

Nearly level to moderately sloping, moderately well drained to poorly drained soils formed in loamy sediments and the underlying very firm and friable glacial till; on uplands

This association consists of soils on moderately wide, slightly rounded ridge crests, on long side slopes, and in broad to narrow drainageways. The drainageways are well developed and form a dendritic pattern. Some soils on short side slopes are moderately sloping. Rounded granite boulders and stones were common on the surface, but most of them were removed when the soils were first cultivated. A stone line is common at the boundary between the mantle of the loamy sediments and the underlying glacial till. Slopes range from 0 to 9 percent.

This association makes up about 6 percent of the county. It is about 28 percent Lourdes soils, 18 percent Protivin soils, 10 percent Clyde soils, and 44 percent minor soils (fig. 3).

Lourdes soils are moderately well drained and are gently sloping and moderately sloping. They are on convex ridge crests and side slopes. Protivin soils are somewhat poorly drained and are very gently sloping. They are on side slopes in the uplands. Clyde soils are poorly drained and are in nearly level drainageways.

Typically, the surface layer of the Lourdes soils is very dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is about 41 inches thick. The upper part is brown, friable loam, the next part is yellowish brown, firm clay loam, and the lower part is mottled yellowish brown and grayish brown, very firm clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, very firm, calcareous clay loam.

Typically, the surface layer of the Protivin soils is black clay loam about 7 inches thick. The subsurface layer is about 10 inches thick. It is black and very dark grayish brown clay loam and loam. The subsoil is about 25 inches thick. The upper part is dark grayish brown, friable loam, the next part is mottled dark gray and strong brown, very firm clay loam, and the lower part is mottled gray and light olive brown, very firm clay loam. The substratum to a depth of about 60 inches is mottled olive brown and olive, very firm clay loam.

Typically, the surface layer of the Clyde soils is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 13 inches thick. The subsoil is about 24 inches thick. The upper part is olive gray, mottled, friable loam, the next part is grayish brown, mottled, friable sandy loam, and the lower part is mottled grayish brown and light olive brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

The most extensive minor soils in this association are the Cresco, Floyd, Jameston, Schley, and Riceville soils. Cresco soils are moderately well drained and are on ridge crests and the upper part of side slopes. Floyd and Schley soils are somewhat poorly drained. They are on the lower side slopes and in drainageways. They have a friable loamy subsoil. Jameston soils are poorly drained and are in waterways. Riceville soils are somewhat poorly drained. They are on side slopes.

Nearly all of the areas of this association are used intensively for row crops. Corn, soybeans, and small grain are grown. Grasses and legumes are grown for hay and pasture. The soils in this association are moderately suited, suited, or well suited to row crops. Available water capacity is high in nearly all of these soils.

The main management concerns are improving drainage, controlling water erosion, and maintaining good tilth and fertility. Because of the high density of

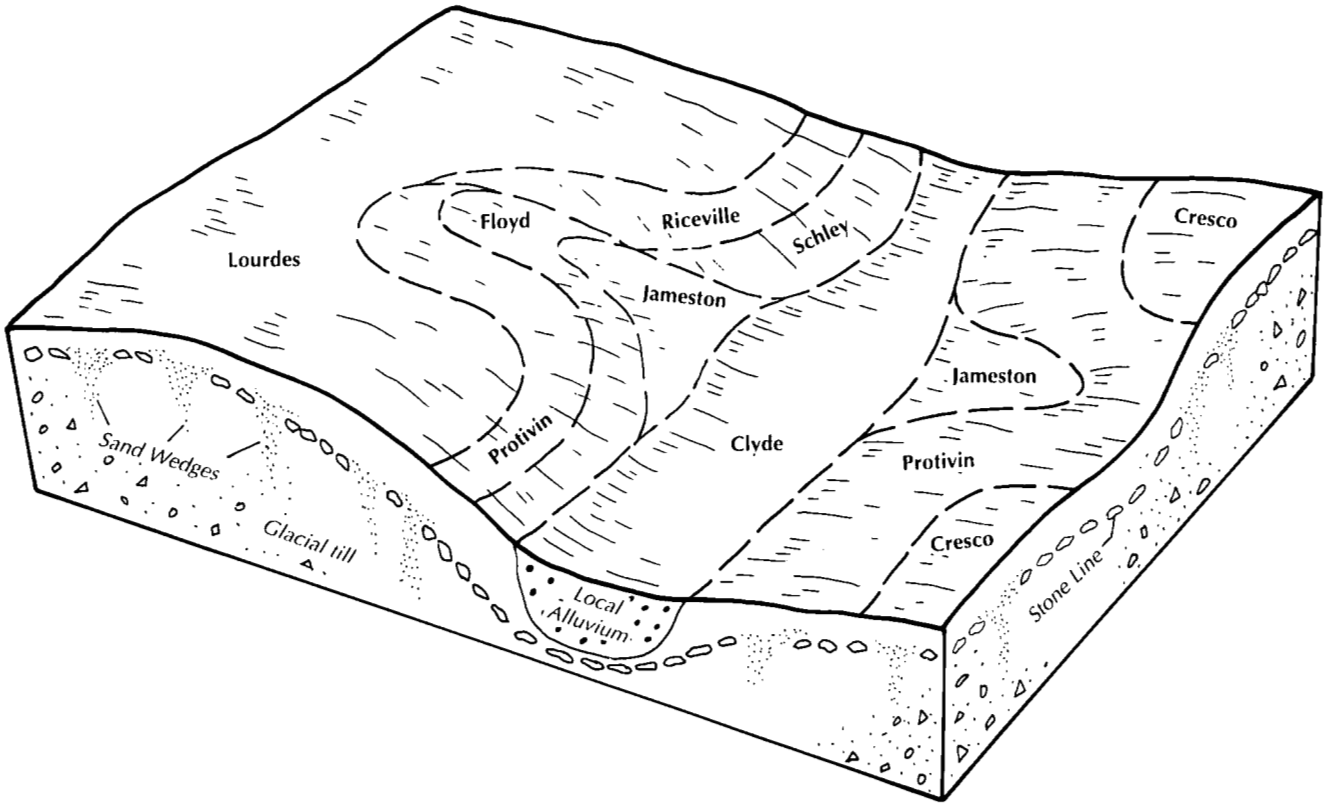

Figure 3.—Pattern of soils and parent material in the Lourdes-Protivin-Clyde association.

the subsoil of the Protivin and Lourdes soils, tile drains do not function well in all areas of these soils. Spacing the tile drainage lines closer together than is typical helps to overcome this limitation. A system of conservation tillage that leaves crop residue on the surface, terraces, contour farming, and grassed waterways help to prevent excessive soil loss. The soils in this association formed in two different materials. The underlying material is more dense and less permeable than the overlying material. As a result, subsurface water moves laterally down the slope and often surfaces as hillside seepage. A combination of terraces, conservation tillage, and drainage tile is often the most effective means of controlling erosion and preventing excessive wetness.

4. Maxfield-Klinger-Dinsdale Association

Nearly level to gently sloping, poorly drained, somewhat poorly drained, and well drained soils formed in loess and the underlying glacial till; on uplands

This association consists of soils on broad, nearly level upland divides, on gently sloping ridge crests, on side slopes, and in broad waterways. Slopes generally range from 0 to 3 percent, but in some areas they range to 5 percent.

This association makes up about 16 percent of the county. It is about 31 percent Maxfield soils, 23 percent Klinger soils, 10 percent Dinsdale soils, and 36 percent minor soils (fig. 4).

Maxfield soils are poorly drained and are on broad, nearly level ridge crests and along broad waterways. Klinger soils are somewhat poorly drained and are on nearly level ridge crests and side slopes and in waterways. Dinsdale soils are well drained and are on gently sloping ridge crests and side slopes.

Typically, the surface layer of the Maxfield soils is black silty clay loam about 9 inches thick. The subsurface layer is black and very dark gray silty clay loam about 10 inches thick. The subsoil is mottled and about 29 inches thick. The upper part is olive gray and olive, firm silty clay loam, and the lower part is yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown loam.

Typically, the surface layer of the Klinger soils is black silty clay loam about 9 inches thick. The subsurface layer also is silty clay loam about 9 inches thick. The upper part is black, and the lower part is very

dark grayish brown. The subsoil is about 37 inches thick. The upper part is dark grayish brown, friable silty clay loam, the next part is yellowish brown, firm loam, and the lower part is yellowish brown and brownish yellow, firm clay loam that is mottled in the lower 6 inches. The substratum to a depth of about 60 inches is yellowish brown loam.

Typically, the surface layer of the Dinsdale soils is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 40 inches thick. The upper part is brown, friable silty clay loam, the next part is yellowish brown, friable silty clay loam, and the lower part is brown, yellowish brown, and light olive brown, firm loam. The substratum to a depth of about 60 inches is light olive brown and olive clay loam.

The most extensive minor soils in this association are the Waubeek, Franklin, Oran, Dickinson, and Bolan soils. Waubeek soils are well drained and moderately well drained and are on gently sloping ridge crests and side slopes. Franklin and Oran soils are somewhat poorly drained and are on broad ridge crests. Bolan and Dickinson soils are well drained and are on dunelike ridges. The minor soils have more sand in the surface layer and subsoil than the major soils.

This association is used intensively for corn and soybeans. It is well suited to these crops. Available water capacity is high in nearly all of the soils in this association.

The main management concerns are improving drainage, controlling water erosion in gently sloping areas, controlling soil blowing, and maintaining good tilth and fertility. Installing subsurface tile drains helps to remove excess water. A system of conservation tillage that leaves crop residue on the surface helps to control soil blowing, prevent excessive water erosion, and maintain tilth.

5. Ostrander-Rockton-Winneshiek Association

Nearly level to moderately sloping, well drained soils formed in loamy sediments and glacial material overlying limestone bedrock; on uplands and high stream benches

This association consists of soils on flats, ridge crests, and side slopes. Slopes range from 0 to 50

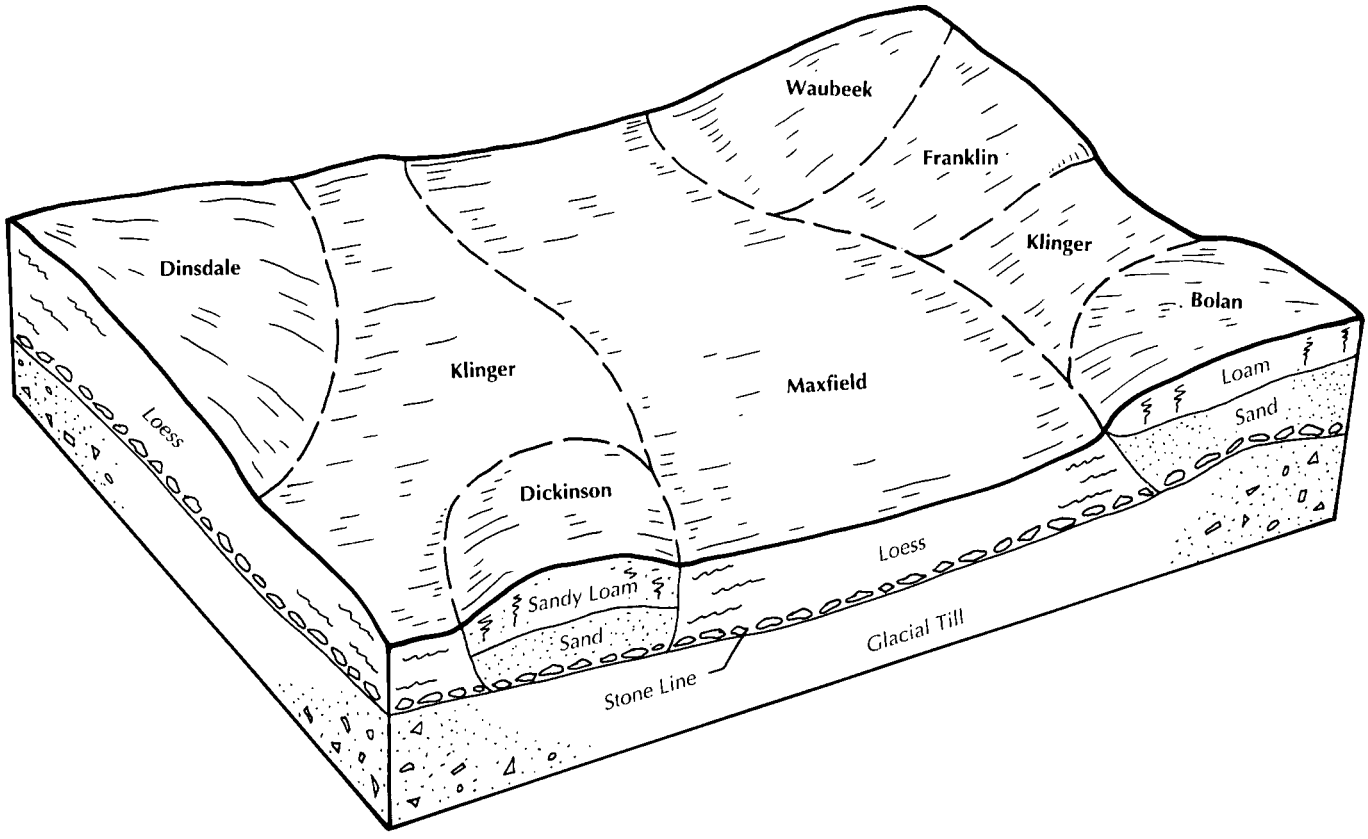

Figure 4.—Pattern of soils and parent material in the Maxfield-Klinger-Dinsdale association.

percent. The steeper areas are adjacent to streams and are typically wooded.

This association makes up about 8 percent of the county. It is about 50 percent Ostrander soils, 28 percent Rockton soils, 9 percent Winneshiek soils, and 13 percent minor soils.

The major soils are well drained. They are in broad, nearly level areas and on convex, gently sloping or moderately sloping ridge crests and side slopes. Rockton and Winneshiek soils are underlain with limestone bedrock at a depth of 20 to 40 inches.

Typically, the surface layer of the Ostrander soils is black loam about 9 inches thick. The subsurface layer is very dark brown and dark brown loam about 7 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown and dark yellowish brown, friable loam, the next part is yellowish brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow and very pale brown loam.

Typically, the surface layer of the Rockton soils is black loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 9 inches thick. It is brown, friable and firm sandy clay loam and clay loam. Fractured limestone bedrock is at a depth of about 24 inches.

Typically, the surface layer of the Winneshiek soils is very dark brown silt loam about 8 inches thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, friable clay loam and sandy clay loam, and the lower part is brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 33 inches.

The most extensive minor soils in this association are the Bolan, Dinsdale, Emeline, Klinger, and Racine. Bolan soils are well drained and are on gently sloping ridges and side slopes. Dinsdale soils are on broad, nearly level ridge crests and on gently sloping ridge crests and side slopes. Emeline soils are on moderately sloping ridge crests and moderately sloping to very steep side slopes. Klinger soils are on nearly level or very gently sloping ridge crests and in waterways. Racine soils are on nearly level to moderately sloping ridge crests and side slopes.

Many areas of this association are used intensively for row crops. In the steeper and the moderately deep areas, corn, soybeans, and small grain are grown in rotation with legumes for hay and pasture. The steepest areas adjacent to stream valleys generally are wooded. The soils in this association are well suited, suited, moderately suited, or unsuited to row crops. Available water capacity ranges from high to very low.

The main management concerns are water erosion and the limited available water capacity of many of the soils. A system of conservation tillage that leaves crop residue on the surface, contour farming, grassed waterways, and terraces help to prevent excessive soil loss. Leaving crop residue on the surface also slows the drying out of the surface soil and conserves soil moisture.

6. Jacwin-Limecreek-Mottland Association

Nearly level to strongly sloping, well drained to somewhat poorly drained soils formed in silty and loamy sediments and material weathered from the underlying shale and limestone bedrock; on uplands

This association consists of soils on broad, nearly level to gently sloping upland divides and moderately sloping side slopes. The development of drainageways varies from low gradient waterways high in the uplands to well developed drainageways in the lower landscape positions. Slopes generally range from 0 to 14 percent.

This association makes up about 1 percent of the county. It is about 40 percent Jacwin and similar soils, 35 percent Limecreek soils, 20 percent Mottland soils, and 5 percent minor soils.

Limecreek soils are moderately well drained and are on nearly level and gently sloping ridge crests and gently sloping and moderately sloping side slopes. Jacwin soils are somewhat poorly drained. They are in waterways and on foot slopes in the nearly level upland swales. Mottland soils are well drained and are moderately sloping or strongly sloping. They are on convex side slopes. Jacwin soils are moderately deep, and Limecreek and Mottland soils are deep.

Typically, the surface layer of the Jacwin soils is black silty clay loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 18 inches thick. The upper part is dark grayish brown, friable silty clay loam, and the lower part is olive gray, very firm silty clay. Gray and pale olive shale bedrock is at a depth of about 34 inches. It has a texture of silty clay.

Typically, the surface layer of the Limecreek soils is black silty clay loam about 7 inches thick. The subsurface layer is very dark brown silty clay loam about 6 inches thick. The subsoil is mottled brown, friable silty clay loam and clay loam about 12 inches thick. The substratum to a depth of about 60 inches is light yellowish brown silty clay loam and loam.

Typically, the surface layer of the Mottland soils is dark grayish brown and very dark grayish brown, calcareous loam about 6 inches thick. Below this is light olive brown, calcareous loam about 5 inches thick. The

substratum to a depth of about 60 inches is light yellowish brown and olive yellow, calcareous loam and silty clay loam.

The most extensive minor soils in this association are the Calamine, Clyde, Ostrander, and Ripon soils. Calamine soils are poorly drained and are in nearly level or very gently sloping swales, in drainageways, and on footslopes. Clyde soils formed in glacial till. They are in waterways. Ostrander and Ripon soils are well drained and are on broad, nearly level to gently sloping ridge crests and on gently sloping side slopes.

Many areas of this association are used intensively for row crops. In the most sloping areas, corn, soybeans, and small grain are grown in rotation with legumes for hay and pasture. The steepest areas adjacent to streams frequently have a permanent vegetative cover. The soils in this association are well suited, suited, moderately suited, or unsuited to row crops. Available water capacity is high in these soils.

The main management concerns are controlling water erosion, improving drainage, and maintaining good tilth and fertility. Draining some of the soils in this association is more difficult than in other associations, and applying erosion-control measures also may be difficult. Spacing the tile drainage lines in areas of the Jacwin soils closer together than is typical helps to overcome the wetness. Tile drainage lines, however, do not function well in Jacwin soils, and in some areas installing a drainage system may not be possible. Topsoil should be returned to areas that are exposed during construction; otherwise, reestablishing vegetation will be difficult. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive erosion and maintain tilth. The major soils have a calcareous surface layer and are alkaline. Applications of fertilizer and herbicide may be needed.

7. Aureola-Norville-Rocksan Association

Nearly level to moderately steep, well drained, moderately well drained, and poorly drained soils formed in loamy sediments and the underlying cretaceous sandstone and fluvial shale bedrock; on uplands and in benchlike areas

This association consists of soils on flats, gently sloping or moderately sloping ridge crests, and gently sloping to strongly sloping side slopes. Slopes range from 0 to 16 percent.

This association makes up about 2 percent of the county. It is about 34 percent Norville and similar soils, 22 percent Aureola soils, 10 percent Rocksan soils, and 34 percent minor soils.

Aureola soils are well drained and are underlain by calcareous sandstone. They are on nearly level flats, gently sloping or moderately steep ridge crests, and gently sloping to strongly sloping side slopes. Norville soils are moderately well drained and are underlain by red shale. They are on nearly level ridge crests and gently sloping side slopes. Rocksan soils are poorly drained and are nearly level. They are underlain by calcareous sandstone and are in swales and on flats in the uplands and benchlike areas.

Typically, the surface layer of the Aureola soils is very dark brown loam about 9 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 5 inches thick. The subsoil is friable and about 19 inches thick. The upper part is dark brown loam, the next part is yellowish brown loam, and the lower part is yellowish brown sandy loam. The substratum is calcareous, brownish yellow and olive yellow loamy fine sand.

Typically, the surface layer of the Norville soils is black silty clay loam about 9 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 21 inches thick. The upper part is brown, friable silty clay loam, and the lower part is red, very firm silty clay. The substratum to a depth of about 60 inches is red, very firm and firm silty clay and loam.

Typically, the surface layer of the Rocksan soils is black silty clay loam about 9 inches thick. The subsurface layer is black silty clay loam about 8 inches thick. The subsoil is about 8 inches thick. The upper part is olive gray, friable loam, and the lower part is light olive brown, friable sandy loam. The substratum to a depth of 60 inches is calcareous, brownish yellow and light yellowish brown loamy fine sand and calcareous, reddish brown and pale olive silty clay.

The most extensive minor soils in this association are the Floyd, Jacwin, and Kenyon soils. Floyd soils are somewhat poorly drained and are in very gently sloping waterways and on the lower side slopes. Jacwin soils are somewhat poorly drained and are on very gently sloping ridge crests and side slopes. Kenyon soils are moderately well drained and are on gently sloping ridge crests and side slopes.

The nearly level to gently sloping areas of this association are used intensively for corn and soybeans. In the more sloping areas, corn and soybeans are grown in rotation with small grain and grasses and legumes for hay and pasture. The steepest areas generally have a permanent vegetative cover. The soils in this association are well suited, suited, moderately suited, or unsuited to row crops. Available water capacity is high or moderate.

The main management concerns are erosion, wetness, a high content of lime in the Rocksan soils, and eroded areas of the Aureola soils. Installing

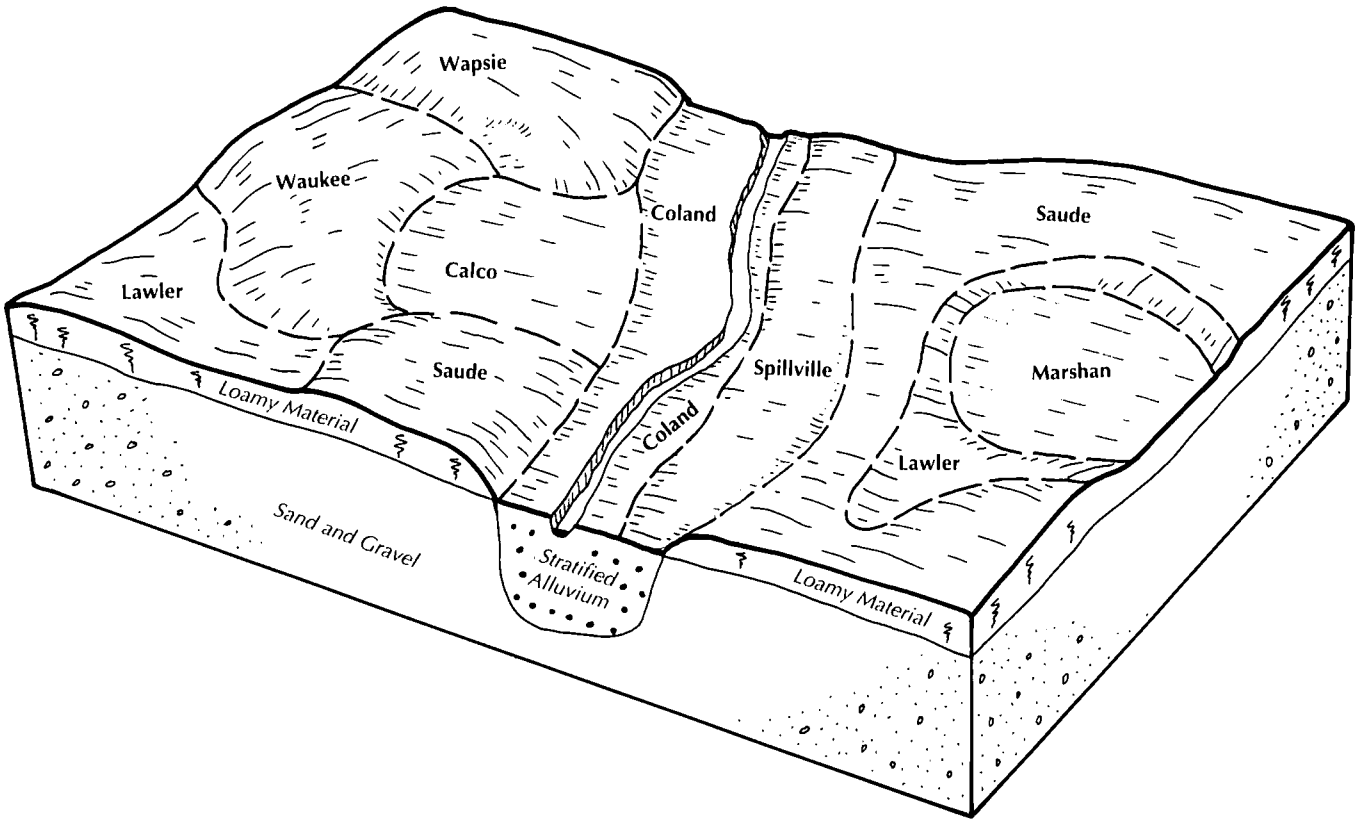

Figure 5.—Pattern of soils and parent material in the Saude-Coland-Lawler association.

subsurface tile drains helps to remove excess water. Applications of fertilizer and herbicide may be needed. Applying a system of conservation tillage that leaves crop residue on the surface and other conservation measures helps to prevent excessive soil loss.

8. Saude-Coland-Lawler Association

Nearly level to moderately sloping, well drained, somewhat poorly drained, and poorly drained soils formed in loamy or silty alluvium and loamy sediments underlain by sand or gravel; on bottom land and alluvial terraces

This association consists of soils on wide alluvial terraces and on flood plains. Abandoned channels are common in many areas of the flood plains. The old stream channels, which are partially filled with alluvial sediments, often impound water after periods of rainfall. Slopes range from 0 to 5 percent.

This association makes up about 11 percent of the county. It is about 30 percent Saude soils, 12 percent Lawler soils, 10 percent Coland soils, and 48 percent soils of minor extent (fig. 5).

Saude soils are well drained and are underlain by sand and gravel. They are on nearly level ridge crests and on gently sloping or moderately sloping side slopes. Coland soils are poorly drained. They are on very gentle slopes and in gently sloping drainageways. Lawler soils are somewhat poorly drained and are underlain by sand and gravel. They are on nearly level ridge crests.

Typically, the surface layer of the Saude soils is black loam about 9 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 8 inches thick. The subsoil is about 17 inches thick. The upper part is brown, friable loam, the next part is brown, friable sandy loam, and the lower part is brown, very friable gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown sand.

Typically, the surface layer of the Coland soils is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 34 inches thick. The substratum to a depth of 60 inches is olive gray clay loam and olive, mottled loam.

Typically, the surface layer of the Lawler soils is black loam about 8 inches thick. The subsurface layer is

black and very dark grayish brown loam about 11 inches thick. The subsoil is mottled and about 19 inches thick. The upper part is dark grayish brown, friable sandy clay loam, and the lower part is dark grayish brown and grayish brown, very friable sandy loam. The substratum to a depth of about 60 inches is grayish brown, brown, and light olive brown loamy sand and sand.

The most extensive minor soils in this association are the Calco, Marshan, Spillville, Wapsie, and Waukee soils. Marshan, Wapsie, and Waukee soils are on terraces. Calco and Spillville soils are on bottom land. Calco soils are poorly drained and calcareous. Marshan soils are poorly drained and are on the lower flats. Spillville soils are moderately well drained. Wapsie and Waukee soils are well drained and are on nearly level flats and gently sloping ridge crests and side slopes.

Areas of this association vary in their intensity of use. Most areas on terraces are used intensively for corn and soybeans and for small grain and grasses and legumes for hay and pasture. Some areas on bottom land that are not flooded as frequently as other areas are cropped almost continuously with corn. The areas that are flooded more frequently are typically used as permanent pasture or woodland that is pastured. Available water capacity ranges from high to very low. Most of the sand and gravel pits in the county are in areas of this association.

The main management concerns in areas on terraces are drought, soil blowing, water erosion, the wetness of the Lawler and Marshan soils, and fertility. Many of these areas are irrigated. Generally, soils on terraces have a limited available water capacity. A system of conservation tillage that leaves crop residue on the surface helps to control soil blowing and prevent excessive erosion. Leaving crop residue on the surface also slows the drying out of the surface soil and conserves soil moisture.

The main management concerns in areas on bottom land are the wetness and the flooding. Installing surface drains helps to remove excess water. Some areas, however, are only slightly higher in elevation than the adjacent streams, and suitable tile outlets may not be available.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kenyon loam, 2 to 5 percent slopes, is a phase of the Kenyon series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Clyde-Floyd complex, 1 to 4 percent slopes, is an example.

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

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

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

Soil Descriptions

27—Terril loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is in the lower landscape positions on uplands. In many of the areas, limestone bedrock is at a depth of 4 to 12 feet. Areas typically range from 2 to 20 acres in size, but a few are much larger. The areas are irregularly shaped.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is about 28 inches of very dark brown and very dark grayish brown loam and silt loam. The subsoil extends to a depth of about 60 inches or more. The upper part is brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. In places the subsurface layer is 8 to 16 inches thick.

Included with this soil in mapping are small areas of soils that have sandstone bedrock or hard limestone bedrock at a depth of 40 to 60 inches. Also included are small areas of soils that have stratified loamy sand and sand within a depth of 36 inches. These soils are in landscape positions similar to those of the Terril soil. They make up about 10 percent of the unit.

Permeability of this Terril soil is moderate, and runoff

is slow. Available water capacity is high. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorous and potassium.

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

The land capability classification is I.

27B—Terril loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on upland foot slopes and convex alluvial fans. Slopes generally are short. Areas range from 2 to 10 acres in size, but a few are somewhat larger. The areas are irregularly shaped or are long and narrow.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is about 28 inches of very dark brown and very dark grayish brown loam and silt loam. The subsoil extends to a depth of about 60 inches or more. The upper part is brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. In places the subsurface layer is 8 to 16 inches thick.

Included with this soil in mapping are small areas of soils that have stratified loamy sand and sand within a depth of 36 inches. Also included are small areas of soils that have sandstone bedrock or hard limestone bedrock at a depth of 40 to 60 inches. These soils are in landscape positions similar to those of the Terril soil. They make up about 10 percent of the unit.

Permeability of this Terril soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for pasture. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. In places contour farming and terracing are difficult because slopes are short and irregular. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for windbreaks or ornamental plantings, erosion is a moderate hazard before the trees and shrubs are established. It can be controlled, however, by a permanent plant cover or surface mulch.

The land capability classification is IIe.

41B—Sparta loamy fine sand, 2 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on convex slopes on ridges and dunes in the uplands. Areas range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is black loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown loamy fine sand about 10 inches thick. The subsoil is about 18 inches of brown and dark yellowish brown, very friable loamy fine sand and sand. The substratum to a depth of about 60 inches is dark yellowish brown and brown fine sand and sand. In some places the surface layer is very dark brown and dark brown fine sandy loam. In other places the surface soil is less than 10 inches thick.

Permeability is rapid, and runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or used for pasture. This soil is poorly suited to corn, soybeans, and small grain, mainly because the soil is droughty and low in fertility. Plants respond poorly to applications of fertilizer. If cultivated crops are grown, soil blowing and water erosion are hazards. The sandy windblown material damages seedlings on this soil and on the adjacent soils. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is poorly suited to terracing. Tilth generally is good.

A cover of pasture plants or hay is effective in controlling erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture in good condition.

Only a few areas are used as woodland. This soil is moderately well suited to trees. The seedling mortality rate is severe. As a result, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Supplemental water may be needed because the soil is droughty. Competing vegetation can be controlled by careful site preparation or by spraying, cutting, or girdling.

The land capability classification is IVs.

63C—Chelsea loamy fine sand, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on ridges and side slopes in

the uplands. Areas range from about 3 to 12 acres in size and generally are long and narrow or irregularly shaped.

Typically, the surface layer is dark brown loamy fine sand about 3 inches thick. The subsurface layer is 24 inches thick. The upper part is dark yellowish brown, friable loamy fine sand, the next part is brown, very friable loamy fine sand, and the lower part is brown, loose loamy fine sand. Below this to a depth of about 60 inches is yellowish brown and brownish yellow, loose loamy fine sand and loamy sand having bands of brown sandy loam 0.5 inch to 2 inches thick. In places loam or sandy loam glacial till is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of soils that have a surface layer of sandy loam. These soils have a slightly higher content of organic matter than the Chelsea soil. They also have a higher available water capacity and are less susceptible to soil blowing. They are in landscape positions similar to those of the Chelsea soil. They make up about 10 percent of the unit.

Permeability of this Chelsea soil is rapid, and runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 0.5 to 1.5 percent. The subsurface layer generally has a very low supply of available phosphorus and a low supply of available potassium. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. It seldom crusts after hard rains or puddles if tilled when wet.

Many areas are cultivated. Many small areas of this soil are cropped along with large areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing is a hazard. Initially, it occurs on round, convex shoulder slopes. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the coarse textured material is difficult. Droughtiness is a severe limitation in most years unless rainfall is timely. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and west-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

The land capability classification is IVs.

83—Kenyon loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flats and ridge crests in the uplands. Areas typically range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 32 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown and light olive brown, mottled, friable and firm loam. The substratum to a depth of about 60 inches is light olive brown loam. In some places the upper part of the subsoil is dark grayish brown. In other places the lower part of the subsoil and the substratum are friable or very firm. In some areas the surface layer is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil has a very low supply of available phosphorous and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

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

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

83B—Kenyon loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, convex ridgetops and side slopes in the uplands. Areas typically range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 4 inches thick. The subsoil is about 32 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown and light olive brown, mottled, friable and firm loam. The substratum to a depth of about 60 inches is light olive brown loam. In some places the upper part of the subsoil is dark grayish brown. In other places the lower part of the subsoil and the substratum are friable or very firm. In

some areas the surface layer is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

83C—Kenyon loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on short side slopes in the uplands. Areas typically range from 2 to 15 acres in size. They generally are somewhat narrow, irregularly shaped bands.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 4 inches thick. The subsoil is about 32 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown and light olive brown, mottled, friable and firm loam. The substratum to a depth of about 60 inches is light olive brown loam. In places the surface layer is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans and is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate or severe hazard. Terraces, a system of conservation tillage that leaves crop residue on the surface, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

83C2—Kenyon loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short side slopes in the uplands. Areas typically range from 2 to more than 20 acres in size. They generally are somewhat narrow, irregularly shaped bands.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. It is mixed with streaks and pockets of brown subsoil material. The subsoil is about 32 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown and light olive brown, firm loam. The substratum to a depth of about 60 inches is light olive brown loam. In places the surface layer is black. In some small areas, the soil is severely eroded and the surface layer is brown.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans and is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. Terraces and a system of conservation tillage that leaves crop residue on the surface help to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. If terraces are built, cuts should not expose the less productive underlying glacial till. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

More nitrogen generally is needed on this soil than on the less eroded Kenyon soils. Also, more intensive management is needed to maintain productivity and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

84—Clyde silty clay loam, 0 to 3 percent slopes. This nearly level, poorly drained soil is in drainageways and the lower concave areas on uplands. Areas generally range from 5 to 100 acres in size, but some are much larger. The areas are elongated and irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 13 inches thick. The subsoil is about 24 inches thick. The upper part is olive gray, mottled, friable loam, the next part is grayish brown, mottled, friable sandy loam, and the lower part is mottled grayish brown and light olive brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In places the subsurface layer is thicker and darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd and Schley soils. These soils are upslope from the Clyde soil. They make up about 5 percent of the unit. Also included are small areas of Marshan and Maxfield soils. Marshan soils are underlain by sand and gravel. Maxfield soils have a lower content of sand in the upper 20 to 40 inches than the Clyde soil. Marshan and Maxfield soils make about 10 percent of the unit.

Permeability of this Clyde soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. It also receives runoff from soils higher on the landscape. The content of organic matter in the surface layer is about 6 to 9 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. If drained and protected against runoff from the higher elevations, this soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Glacial stones and boulders are common in many unimproved, undrained areas. They should be removed before tile drains are installed and the soil is cultivated. Installing the tile is difficult in some areas because of the very friable, water-bearing sandy sediments. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

96—Turlin loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains and low terraces. It is subject to flooding. Areas generally range from about 5 to 20 acres in size, but a few are larger.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and very dark grayish brown loam about 27 inches thick. The subsoil is about 14 inches thick. The upper part is dark grayish brown, friable loam, and the lower part is dark grayish brown, very friable sandy loam. The substratum to a depth of about 60 inches is brown loamy sand. In some small areas the soil is poorly drained.

Included with this soil in mapping are small areas of soils that have a thinner surface layer and a sandy layer at a depth of about 3 feet. These soils make up about 10 percent of the unit.

Permeability of this Turlin soil is moderate in the upper part of the profile and rapid in the lower part. Runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4.5 to 5.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Some areas are used for pasture or hay. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and

restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

110B—Lamont fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex slopes in the uplands. Areas range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 13 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is brown, very friable sandy loam, and the lower part is dark yellowish brown and yellowish brown, loose and very friable loamy sand that has dark brown sandy loam lamellae. In places loam glacial till is at a depth of about 4 feet.

Included with this soil in mapping are small areas of soils that have a surface layer of loamy sand. These soils have a slightly lower content of organic matter than the Lamont soil. Also, they have a lower available water capacity and are more susceptible to soil blowing. They are in landscape positions similar to those of the Lamont soil. They make up about 5 percent of the unit.

Permeability of this Lamont soil is moderately rapid, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 0.5 to 1.5 percent. The surface layer has a low supply of available phosphorus and a very low supply of available potassium.

Some areas are cultivated. Many small areas of this soil are cropped along with large areas of adjacent soils that are well suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing is a hazard. Initially, it occurs on round, convex shoulder slopes. The sandy windblown material sometimes damages newly seeded crops on this soil and on adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is so close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and west-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture in good condition.

This soil is moderately suited to trees. Some areas support native hardwoods. The seedling mortality rate, plant competition, and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIIe.

110C—Lamont fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex slopes on ridges and side slopes in the uplands. Areas range from 3 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 10 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is brown, very friable fine sandy loam, and the lower part is dark yellowish brown and yellowish brown, very friable and loose loamy sand that has dark brown sandy loam lamellae. In places the surface layer is brown sandy loam.

Included with this soil in mapping are small areas of soils that have a surface layer of loamy sand. These soils are more droughty than the Lamont soil and have a lower content of organic matter in the surface layer. They make up about 10 percent of the unit.

Permeability of this Lamont soil is moderately rapid. Runoff is medium in cultivated areas. Available water capacity is moderate. The content of organic matter in the surface layer is about 0.5 to 1.5 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Many areas are pastured or wooded. Other areas are cultivated. Even though it is droughty, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Soil blowing and water erosion are hazards if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface helps to control soil blowing and water erosion and conserves moisture. In places farming on the contour is beneficial. Terraces can be difficult to construct and maintain because of the poor stability of the soil. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay is effective in

controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support native hardwoods. This soil is moderately well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

135—Coland clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom land and low benches. It is subject to flooding. Areas range from 10 to 50 acres in size and are long and narrow.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 34 inches thick. The upper part of the substratum is olive gray clay loam, and the lower part to a depth of about 60 inches is olive, mottled loam. In some places the surface layer is silty clay loam. In other places the soil is loam throughout.

Included with this soil in mapping are small areas of the moderately well drained Hanlon soils that have a surface layer of sandy loam. These soils have a lower content of organic matter than the Coland soil. They also have a lower available water capacity and generally are at the slightly higher elevations. They make up about 5 percent of the unit.

Permeability of this Coland soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 7 percent. The substratum generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some areas that are not protected from flooding or that are isolated by a meandering stream are used for pasture. If the soil is adequately drained and if flooding is controlled, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Special care generally is needed to maintain good tilth in the surface layer. Chisel plowing increases the infiltration rate by making the surface more pervious to water. Cultivating when the soil is too wet causes surface compaction and results in the formation of clods. Returning crop residue to the soil or regularly adding other organic material helps to control soil blowing and prevent surface crusting and increases the rate of water infiltration. Water-tolerant grasses and legumes are the best pasture plants.

The seasonal high water table and the flooding are the main limitations if this soil is used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate the wetness and the flooding should be selected for planting.

The land capability classification is IIw.

151—Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is on alluvial benches and in the larger drainageways on uplands. Areas range from about 6 to more than 40 acres in size and are irregularly shaped.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black and very dark gray clay loam about 13 inches thick. The subsoil is olive gray, friable loam about 6 inches thick. The substratum to a depth of about 60 inches is grayish brown and yellowish brown coarse sand containing 5 to 15 percent gravel. In places the subsoil extends to a depth of about 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Lawler soils. These soils are in the higher areas. They make up about 5 to 10 percent of the unit.

Permeability of this Marshan soil is moderate in the subsoil and rapid in the substratum. Runoff is slow. Available water capacity is low. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Measures that help to control the runoff from higher elevations also are needed. Establishing adequate drainage outlets and installing drainage tile are difficult in some areas because of the loose, water-bearing sand and gravel. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

152—Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is on alluvial benches and in the larger drainageways on uplands. Areas range from 5 to more than 80 acres in size. They are irregularly shaped.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black and very dark gray clay loam about 13 inches thick. The subsoil is about 15 inches thick. The upper part is olive gray and grayish brown, friable loam, and the lower part is grayish brown, very friable sandy loam. The substratum to a depth of about 60 inches is grayish brown and yellowish brown sand and coarse sand containing 5 to 15 percent gravel. In places the subsoil extends to a depth of only about 28 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Lawler soils. These soils are in the slightly higher areas. They make up about 5 to 10 percent of the unit.

Permeability of this Marshan soil is moderate in the subsoil and rapid in the substratum. Runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Measures that help to control the runoff from higher elevations also are needed. Establishing adequate drainage outlets and installing drainage tile are difficult in some areas because of the loose, water-bearing sand and gravel. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

171—Bassett loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on uplands. Areas typically range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil is about 35 inches thick. The upper part is brown and yellowish brown, friable loam, the next part is yellowish brown, firm loam, and the lower part is mottled yellowish brown and grayish brown, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown loam. In some places the surface layer is black. In other places the upper part of the subsoil is dark grayish brown.

Included with this soil in mapping are small areas of Donnan soils, which have clayey material at a depth of 2 to 4 feet. These soils are on the higher part of the landscape. They are very slowly permeable in the lower part of the profile. Because permeability is slower than that in the Bassett soil, the susceptibility to hillside seepage and the wetness are increased. The increased wetness can interfere with the timeliness of fieldwork. These soils make up less than 5 percent of the unit.

Permeability of this Bassett soil is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. If the soil is cultivated, the surface layer tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is I.

171B—Bassett loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on uplands. Areas typically range from 2 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is about 34 inches thick. The upper part is brown and yellowish brown, friable loam, the next part is yellowish brown, firm loam, and the lower part is mottled yellowish brown and grayish brown, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown loam. In some places the subsurface layer is dark brown. In other places the upper part of the subsoil is dark grayish brown.

Included with this soil in mapping are small areas of Donnan soils, which have clayey material at a depth of 2 to 4 feet. These soils are on the lower part of the landscape. They are very slowly permeable in the lower part of the profile. Because permeability is slower than that in the Bassett soil, the susceptibility to hillside seepage and the wetness are increased. The increased wetness can interfere with the timeliness of fieldwork. These soils make up less than 5 percent of the unit.

Permeability of this Bassett soil is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. If the soil is cultivated, the surface layer tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIe.

171C—Bassett loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on convex side slopes in the uplands. Areas typically range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable loam, the next part is yellowish brown, friable loam, and the lower part is mottled yellowish brown and grayish brown, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, calcareous loam. In some places the surface layer is very dark brown. In some small areas, the soil is moderately eroded and the surface layer is brown.

Included with this soil in mapping are small areas of Donnan soils, which have clayey material at a depth of 2 to 4 feet. These soils are on the lower part of the landscape. They are very slowly permeable in the lower part of the profile. Because permeability is slower than that in the Bassett soil, the susceptibility to hillside seepage and the wetness are increased. The increased wetness can interfere with the timeliness of fieldwork. These soils make up less than 5 percent of the unit.

Permeability of this Bassett soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. If the soil is cultivated, the surface layer tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss (fig. 6). Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Intensive management is needed to maintain productivity and tilth.

A cover of pasture plants or hay is effective in

Figure 6.—Terraces in an area of Bassett loam, 5 to 9 percent slopes.

controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIIe.

171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex side slopes in the uplands. Areas typically range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. It is mixed with streaks and pockets of brown and yellowish brown subsoil material. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable loam, the next part is yellowish brown, friable loam, and the lower part is mottled yellowish brown and grayish brown, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, calcareous loam. In some places the surface layer is very dark brown. In some small areas, the soil is severely eroded and the surface layer is brown.

Included with this soil in mapping are small areas of Donnan soils, which have clayey material at a depth of 2 to 4 feet. These soils are on the lower part of the landscape. They are very slowly permeable in the lower part of the profile. Because permeability is slower than that in the Bassett soil, the susceptibility to hillside seepage and the wetness are increased. The increased

wetness can interfere with the timeliness of fieldwork. These soils make up less than 5 percent of the unit.

Permeability of this Bassett soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. If the soil is cultivated, the surface layer tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Intensive management is needed to maintain productivity and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIIe.

171D2—Bassett loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Areas typically range from 2 to 15 acres in size and are elongated to irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. It is mixed with streaks and pockets of brown and yellowish brown subsoil material. The subsoil is about 30 inches thick. The upper part is brown and yellowish brown, friable loam, the next part is yellowish brown, friable loam, and the lower part is mottled yellowish brown and grayish brown, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, calcareous loam. In some places the surface layer is very dark brown. In other places the lower part of the subsoil and the substratum are friable.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. If the soil is cultivated, the surface layer tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Intensive management is needed to maintain productivity and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIIe.

174—Bolan loam, 0 to 2 percent slopes. This nearly level, well drained soil is on very low mounds and in dunelike areas in the uplands. Areas range from 2 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 12 inches thick. The subsoil is about 24 inches thick. The upper part is brown, friable loam, the next part is yellowish brown, very friable fine sandy loam, and the lower part is light yellowish brown, very friable loamy

sand. The substratum to a depth of about 60 inches is light yellowish brown, yellowish brown, and light olive brown sand and loamy sand. It is mottled in the lower part. In some places, the surface layer is fine sandy loam and the soil is more droughty. In other places the surface layer is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is slow. Available water capacity is moderate. The content of organic matter in the surface layer is 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty, however, because of the moderate available water capacity. Soil blowing is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control soil blowing. Good tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Soil blowing is a hazard, however, if overgrazing reduces the extent of the protective plant cover. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIs.

174B—Bolan loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on very low mounds and in dunelike areas in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 12 inches thick. The subsoil is about 21 inches thick. The upper part is brown, friable loam, the next part is yellowish brown, very friable fine sandy loam, and the lower part is light yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is light yellowish brown, yellowish brown, and light olive brown sand and loamy sand. In some places the surface layer is fine sandy loam and is slightly droughty. In other places the surface layer is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty, however, because of the moderate available water capacity. Soil blowing is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control soil blowing. Good tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Soil blowing is a hazard, however, if overgrazing reduces the extent of the protective plant cover. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

174B2—Bolan loam, 2 to 5 percent slopes, moderately eroded. This gently sloping, well drained soil is on very low mounds and in dunelike areas in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 7 inches thick. It is mixed with some streaks and pockets of brown subsoil material. The subsoil is about 21 inches thick. The upper part is brown, friable loam, the next part is yellowish brown, very friable fine sandy loam, and the lower part is light yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is light yellowish brown, yellowish brown, and light olive brown sand and loamy sand. In some places the surface layer is fine sandy loam and is slightly droughty. In other places the surface layer is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty, however, because of the moderate available water capacity. Soil blowing is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control soil blowing. Good tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Soil blowing is a hazard, however, if overgrazing reduces the extent of the protective plant

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

The land capability classification is IIe.

174C2—Bolan loam, 5 to 9 percent slopes, moderately eroded. This gently sloping, well drained soil is on very low mounds and in dunelike areas in the uplands. Areas range from 5 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 7 inches thick. It is mixed with some streaks and pockets of brown subsoil material. The subsoil is about 20 inches thick. The upper part is brown, friable loam, the next part is yellowish brown, very friable fine sandy loam, and the lower part is light yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is light yellowish brown, yellowish brown, and light olive brown sand and loamy sand. In some places the surface layer is fine sandy loam and is slightly droughty. In other places the surface layer is thinner and has a lower content of organic matter.

Permeability is moderate, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately suited to corn and soybeans and is well suited to small grain and to grasses and legumes for hay and pasture. It is somewhat droughty because of the moderate available water capacity. Soil blowing is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control soil blowing. Good tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Soil blowing is a hazard, however, if overgrazing reduces the extent of the protective plant cover. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

175B—Dickinson fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex slopes on ridges and dunes in the uplands. Areas typically range from 2 to 20 acres in size. The larger areas typically are long and narrow. The small areas generally are more oval in shape.

Typically, the surface layer is black fine sandy loam about 9 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 15 inches thick. The subsoil is about 30 inches thick. The upper part is brown, very friable sandy loam, and the lower part is dark yellowish brown, very friable loamy sand. The upper part of the substratum is dark yellowish brown sand. The lower part to a depth of about 60 inches is mottled brown and yellowish brown sand. In some places the surface layer is dark brown loam. In other places loamy glacial till is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of soils that have a surface layer of loamy fine sand. These soils make up about 5 percent of the unit.

Permeability of this Dickinson soil is moderately rapid, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The surface layer generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for pasture or hay. Many small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Soil blowing is a hazard in areas where cultivated crops are grown. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is so close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

If this soil is used for pasture, overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during excessively wet or dry periods help to keep the pasture in good condition.

The land capability classification is IIIe.

175C—Dickinson fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex slopes on ridges and dunes in the uplands.

Areas typically range from 3 to 12 acres in size. The larger areas are long and narrow. The small areas generally are more oval in shape.

Typically, the surface layer is black fine sandy loam about 9 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 27 inches thick. The upper part is brown, very friable sandy loam, and the lower part is dark yellowish brown, very friable loamy sand. The upper part of the substratum is dark yellowish brown sand. The lower part to a depth of about 60 inches is mottled brown and yellowish brown sand. In some places loamy glacial till is at a depth of 40 to 60 inches. In other places the surface layer is dark brown.

Permeability is moderately rapid, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or used for pasture or hay. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing and water erosion are hazards. Stripcropping, a system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, or a combination of these practices help to prevent excessive soil loss. Terraces can be difficult to construct and maintain because of the poor stability of the soil. The soil is droughty in periods of below normal rainfall. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture, improves fertility, and helps to maintain tilth.

If this soil is used for pasture, overgrazing causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture in good condition.

The land capability classification is IIIe.

177—Saude loam, 0 to 2 percent slopes. This nearly level, well drained soil is on alluvial terraces. Areas range from 2 to 80 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 8 inches thick. The subsoil is about 17 inches thick. The upper part is brown, friable loam, the next part is brown, friable sandy loam, and the lower part is brown, very friable gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown sand. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Lawler soils. These soils are lower on the landscape than the Saude soil. They make up about 10 percent of the unit.

Permeability of this Saude soil is moderate in the subsoil and very rapid in the substratum. Runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

177B—Saude loam, 2 to 5 percent slopes. This gently sloping, well drained soil is dominantly on alluvial terraces. In places it is in the uplands. Areas range from 2 to 10 acres in size. They are irregularly shaped and somewhat elongated.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 8 inches thick. The subsoil is about 14 inches thick. The upper part is brown, friable loam, the next part is dark yellowish brown, very friable loam, and the lower part is dark yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand and gravelly sand. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of soils that have a surface layer of gravelly loamy sand. These soils have a lower content of organic matter than the Saude soil and have a lower available water capacity. They are in landscape positions similar to those of the Saude soil. They make up less than 5 percent of the unit.

Permeability of this Saude soil is moderate in the subsoil and very rapid in the substratum. Runoff is

medium. Available water capacity is low. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorous and potassium. The surface layer is friable. Tilth is good in the surface layer.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because the coarse textured material is so close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

177C—Saude loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on alluvial terraces and on ridge crests and side slopes in the uplands. Areas typically range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 12 inches thick. The upper part is brown, friable loam and sandy loam, and the lower part is yellowish brown, very friable gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly sand. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of soils that have a surface layer of gravelly loamy sand. These soils have a lower content of organic matter than the Saude soil. They also have a lower available water capacity. They are in landscape positions similar to those of the Saude soil. They make up less than 5 percent of the unit.

Permeability of this Saude soil is moderate in the subsoil and very rapid in the substratum. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorous and potassium. The surface layer is friable. Tilth is good in the surface layer.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because the coarse textured material is so close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

178—Waukee loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces and in outwash areas. Areas range from 4 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and very dark grayish brown loam about 10 inches thick. The subsoil is about 17 inches of brown, dark yellowish brown, and yellowish brown, friable and very friable loam and sandy loam. The substratum to a depth of about 60 inches is yellowish brown loamy sand and sand. The surface layer is somewhat thicker in waterways and on foot slopes. In some small places the surface layer is lighter in color. In other places sand and gravel are at a depth of less than 30 inches. In some lower lying areas, the upper part of the subsoil is dark grayish brown.

Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is slow. Available water capacity is moderate. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty,

however, because of the moderate available water capacity. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

178B—Waukee loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream terraces and in outwash areas. Areas range from 4 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and very dark grayish brown loam about 8 inches thick. The subsoil is about 17 inches of brown, dark yellowish brown, and yellowish brown, friable and very friable loam and sandy loam. The substratum to a depth of about 60 inches is yellowish brown loamy sand and sand. In the more sloping areas, the surface layer is somewhat thinner and sand and gravel are at a depth of less than 30 inches. In some lower lying areas, the upper part of the subsoil is dark grayish brown.

Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty, however, because of the moderate available water capacity. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the underlying coarse textured material. Droughtiness is a limitation during periods of below normal rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

184—Klinger silty clay loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on slightly convex ridgetops and side slopes in the uplands. Areas range from about 5 to more than 100 acres in size. They are irregularly shaped.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is silty clay loam about 9 inches thick. It is black in the upper part and very dark grayish brown in the lower part. The subsoil is about 37 inches thick. The upper part is dark grayish brown, friable silty clay loam, the next part is yellowish brown, firm loam, and the lower part is yellowish brown and brownish yellow, firm clay loam that is mottled in the lower 6 inches. The substratum to a depth of about 60 inches is yellowish brown loam. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of the poorly drained Maxfield soils in small depressions. These soils make up about 5 percent of the unit.

Permeability of this Klinger soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion can be a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. A tile drainage system is needed in some areas to help overcome the wetness and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of

grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

194—Norville silty clay loam, 0 to 2 percent slopes. This gently sloping, moderately well drained soil is on ridges and side slopes in the uplands. Areas range from 3 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown silty clay loam about 8 inches thick. The subsurface layer is brown silt loam about 7 inches thick. The subsoil is about 29 inches thick. The upper part is strong brown, friable silty clay loam and red, firm clay loam, and the lower part is dark red, firm clay. The substratum to a depth of about 60 is yellowish red clay loam. In places the surface layer is loam or silty clay loam.

Permeability is moderate in the upper part of the profile and slow in the lower part. Runoff is slow or medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorous and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table may develop when the water reaches the less permeable horizons.

Most areas are cultivated. Some are used for pasture or hay. This soil is moderately suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is not well suited to terracing because of the moderate depth to clayey material. If terraces are built, cuts should not expose the clayey material. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

194B—Norville silty clay loam, 2 to 5 percent slopes. This very gently sloping and gently sloping, moderately well drained soil is on ridges and in nearly level areas in the uplands. Areas range from about 2 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 21 inches thick. The upper part is brown, friable silty clay loam, and the lower part is red, very firm silty clay. The substratum to a depth of about 60 inches is red, very firm and firm silty clay and loam. In some places the surface layer is silt loam or loam. In other places weakly cemented, calcareous sandstone bedrock is at a depth of more than 40 inches.

Included with this soil in mapping are small areas of soils that are 15 inches deep over limestone bedrock and small areas of the somewhat poorly drained Jacwin soils. Jacwin soils are in waterways. They are lower on the landscape than the Norville soil. Included soils make up about 5 percent of the unit.

Permeability of this Norville soil is moderate in the upper part of the profile and slow in the lower part. Runoff is slow or medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorous and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table may develop when the water reaches the less permeable horizons.

Most areas are cultivated. Some are used for pasture or hay. This soil is moderately suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is not well suited to terracing because of the moderate depth to clayey material. If terraces are built, cuts should not expose the clayey material. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

194C3—Norville silt loam, 5 to 9 percent slopes, severely eroded. This gently sloping and moderately sloping, moderately well drained soil is on ridges and side slopes in the uplands. Areas range from 2 to 10 acres in size. They are long and narrow or oval.

Typically, the surface layer is mixed reddish brown and very dark grayish brown silt loam about 9 inches thick. The subsoil is firm silty clay about 17 inches thick. The upper part is red, and the lower part is dark red. The upper 24 inches of the substratum is red silty clay with thin interbedded layers of yellowish red, calcareous sandstone. The lower part to a depth of about 60 inches is yellow clay loam. In places the surface layer is loam or silty clay loam.

Permeability is slow, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. The soil is not suitable for terracing because of the shallow, clayey subsoil. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IVe.

198—Floyd loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on upland ridgetops and on high terraces along streams. Areas range from 2 to 60 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and very dark gray clay loam about 11 inches thick. The subsoil is about 25 inches thick. It is friable and mottled. The upper part is olive brown loam, the next part is light olive brown sandy clay loam, and the lower part is grayish brown and light olive brown loam. The substratum to a depth of about 60 inches is light olive brown, mottled loam. In some places the surface layer is thinner and lighter colored. In other places, the subsoil is loam throughout and the soil is shallower to firm till.

Permeability is moderate, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Measures that help to control the runoff from higher elevations are needed in some areas. Glacial stones and boulders are common in many unimproved, undrained areas. They should be removed before tile drains are installed and the soil is cultivated. Installing tile is difficult in some areas because of the very friable, water-bearing erosional sediments over glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

198B—Floyd loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on concave slopes and on side slopes along upland drainageways. Areas range from 2 to 60 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and very dark gray clay loam about 11 inches thick. The subsoil is about 25 inches thick. It is friable and mottled. The upper part is olive brown loam, the next part is light olive brown sandy clay loam, and the lower part is grayish brown and light olive brown loam. The substratum to a depth of about 60 inches is light olive brown, mottled loam. In some places the surface layer is thinner and lighter colored. In other places, the subsoil is loam throughout and the soil is shallower to firm till.

Included with this soil in mapping are small areas of the poorly drained Clyde soils in drainageways. These

soils make up about 5 to 10 percent of the unit.

Permeability of this Floyd soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Measures that help to control the runoff from higher elevations are needed in some areas. Glacial stones and boulders are common in many unimproved, undrained areas. They should be removed before tile drains are installed and the soil is cultivated. Installing tile is difficult in some areas because of the very friable, water-bearing erosional sediments over glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

201B—Coland-Terril complex, 1 to 5 percent slopes. These gently sloping, poorly drained and moderately well drained soils are on narrow flood plains and on foot slopes in the uplands. The Coland soil is along drainageways, and the Terril soil is on the foot slopes. The Coland soil is subject to flooding. Areas range from 5 to 20 acres in size and generally are long and narrow. The Coland soil makes up about 50 percent of the map unit, and the Terril soil makes up 40 to 50 percent. These soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the surface layer of the Coland soil is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 25 inches thick. The upper part of the substratum is black, friable clay loam, the next part is olive gray clay loam, and the lower part to a depth of about 60 inches is olive loam.

Typically, the surface layer of the Terril soil is very dark brown loam about 8 inches thick. The subsurface layer is about 23 inches of very dark brown loam and silt loam. The upper part of the subsoil is very dark grayish brown, friable loam, the next part is brown, friable loam, and the lower part to a depth of about 60 inches is yellowish brown, very friable sandy loam.

Included with these soils in mapping are small areas of soils that have slopes of more than 5 percent and small areas of soils that have limestone bedrock at a depth of 40 to 60 inches. These soils make up as much as 10 percent of the unit.

Permeability of these Coland and Terril soils is moderate, and runoff is medium. Available water capacity is high. The Coland soil has a seasonal high water table. The Coland and Terril soils receive runoff and seepage from adjacent slopes. The content of organic matter is about 5 to 7 percent in the surface layer of the Coland soil and 3 to 4 percent in the surface layer of the Terril soil. The substratum of the Coland soil generally has a medium supply of available phosphorus and a very low supply of available potassium. The subsoil of the Terril soil generally has a very low supply of available phosphorus and potassium.

Many areas are used for pasture. Some are cultivated. If drained, these soils are suited to corn, soybeans, and small grain and to grasses and legumes for hay. Installing drainage tile in areas of the Coland soil helps to overcome the wetness and improves the timeliness of fieldwork. If these soils are used for cultivated crops, gully erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent gullies. Interceptor tile helps to remove the excess seepage from adjacent slopes. Gully erosion is also a hazard in areas where runoff concentrates. Diversions help to intercept the runoff. Avoiding tillage when the soils are wet and returning crop residue to the soils help to maintain good tilth. Overgrazing or grazing when the soils are too wet causes surface compaction and poor tilth.

The land capability classification is IIw.

213—Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes. This nearly level, well drained soil is on uplands. Areas range from 2 to 15 acres is size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 11 inches thick. The subsoil is about 16 inches of brown, friable and firm sandy clay loam and clay loam. Fractured limestone bedrock is at a depth of about 36 inches. In some places the limestone fragments have grayish brown weathering rinds. In other places the depth to bedrock is 20 to 30 inches.

Included with this soil in mapping are small areas of

soils that are more than 36 inches deep over bedrock. These soils make up less than 10 percent of the unit.

Permeability of this Rockton soil is moderate, and runoff is slow. Available water capacity is moderate. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation during periods of below normal rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

213B—Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands and on escarpments. Areas range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 17 inches of brown, friable and firm sandy clay loam and clay loam. Fractured limestone bedrock is at a depth of about 35 inches. In some places the limestone fragments have grayish brown weathering rinds. In other places the depth to bedrock is 20 to 30 inches.

Included with this soil in mapping are small areas of soils that are more than 35 inches deep over bedrock. These soils make up less than 10 percent of the unit.

Permeability of this Rockton soil is moderate, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss and conserve moisture during periods of low rainfall. If terraces are built, cuts should not expose the underlying bedrock. Droughtiness is a limitation during periods of below normal rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

214—Rockton loam, 20 to 30 inches to limestone, 0 to 2 percent slopes. This nearly level, well drained soil is on uplands. Areas range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 9 inches of brown, friable and firm sandy clay loam and clay loam. Fractured limestone bedrock is at a depth of about 26 inches. In some small places the limestone fragments have grayish brown weathering rinds. In other places the depth to bedrock is 30 to 40 inches.

Permeability is moderate, and runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

214B—Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands and in the higher part of benchlike areas. Areas range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9

inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 9 inches of brown, friable and firm sandy clay loam and clay loam. Fractured limestone bedrock is at a depth of about 24 inches. In some small places the depth to bedrock is 30 to 40 inches.

Included with this soil in mapping are small areas where limestone bedrock is at or near the surface. These areas are on the lower part of side slopes. They make up less than 5 percent of the unit.

Permeability of this Rockton soil is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for pasture. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is subject to erosion and is droughty in years of average or below average rainfall. The root zone is limited by the depth to bedrock. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is not well suited to terracing because of the limited depth to bedrock. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

214C—Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes. This moderately sloping, well drained soil is on ridge crests and side slopes in the uplands. Areas typically range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 9 inches thick. The subsoil is brown, friable loam about 5 inches thick. Shattered limestone bedrock is at a depth of about 23 inches. In places the depth to bedrock is 30 to 40 inches.

Included with this soil in mapping are small areas where limestone bedrock is near the surface or is exposed. These areas are near the base of side slopes. They make up about 3 to 8 percent of the unit.

Permeablilty of this Rockton soil is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Many areas are used for pasture. Some are cultivated. This soil is moderately suited to corn, soybeans, and small grain and is suited to grasses and legumes for hay and pasture. It is subject to erosion and is droughty in years of average or below average rainfall. The bedrock in the included areas hinders fieldwork. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is not well suited to contour farming or terracing because slopes generally are short and irregular and the bedrock is only 20 to 30 inches from the surface. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The pasture can be easily overstocked, however, because the available water capacity is low. Overgrazing causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Tree growth may be limited, however, because the available water capacity is low and root penetration may be restricted by the hard bedrock. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

214C2—Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on ridge crests and side slopes in the uplands. Areas typically range from 3 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 8 inches thick. It is mixed with streaks and pockets of brown subsoil material. The subsoil is brown, friable loam about 15 inches thick. Shattered limestone bedrock is at a depth of about 23 inches. In places the depth to bedrock is 30 to 40 inches.

Included with this soil in mapping are small areas where limestone bedrock is near the surface or is exposed. These areas are at the base of side slopes. They make up about 3 to 8 percent of the unit.

Permeability of this Rockton soil is moderate, and runoff is medium. Available water capacity is low. The

content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Many areas are used for pasture. Some are cultivated. This soil is moderately suited to corn, soybeans, and small grain and is suited to grasses and legumes for hay and pasture. It is subject to erosion and is droughty in years of average or below average rainfall. The bedrock in the included areas hinders fieldwork. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is not well suited to contour farming or terracing because slopes generally are short and irregular and the bedrock is only 20 to 30 inches from the surface. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The pasture can be easily overstocked, however, because the available water capacity is low. Overgrazing causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Tree growth may be limited, however, because the available water capacity is low and root penetration may be restricted by the hard bedrock. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

216B—Ripon silt loam, 20 to 30 inches to limestone, 1 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 3 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is about 14 inches thick. The upper part is brown, friable silt loam, and the lower part is dark yellowish brown, friable loam. Fractured limestone bedrock is at a depth of about 27 inches. In some small areas the depth to bedrock is more than 30 inches.

Included with this soil in mapping are small areas where limestone bedrock is at or near the surface. Tilling is difficult in these areas. Inclusions make up less than 5 percent of the unit.

Permeability of this Ripon soil is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is, however, subject to erosion and is droughty in years of average or below average rainfall. The root zone is limited by the depth to bedrock. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is not well suited to terracing because of the limited depth to bedrock. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material increases the rate of water infiltration and helps to prevent surface crusting.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

217B—Ripon silt loam, 30 to 40 inches to limestone, 1 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part is brown, friable silt loam, and the lower part is dark yellowish brown loam. Fractured limestone bedrock is at a depth of about 35 inches. In some small areas the depth to bedrock is 20 to 30 inches.

Included with this soil in mapping are small areas of soils that are more than 35 inches deep over bedrock. These soils make up less than 10 percent of the unit.

Permeability of this Ripon soil is moderate, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. The surface layer generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are

grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss and conserve moisture during periods of low rainfall. If terraces are built, cuts should not expose the underlying bedrock. Droughtiness is a limitation during periods of below normal rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

221B—Palms muck, 0 to 5 percent slopes. This nearly level to gently sloping, very poorly drained soil is in seepy areas on hillsides and in depressions in drainageways. The seepy areas are kept saturated by spring water unless the soil is adequately drained. Ponding is a limitation in the lower landscape positions. Areas range from 5 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is black sapric material about 14 inches thick. The subsurface layer is black sapric material about 29 inches thick. The upper part of the substratum is very dark gray and dark gray silt loam. The lower part to a depth of about 60 inches is olive gray sandy loam. In places the substratum is black silt loam.

Included with this soil in mapping are areas of soils that cannot be drained as easily as the Palms soil because the muck deposits are deeper. The tile lines can settle and be difficult to maintain in these areas. These soils make up less than 15 percent of the unit.

Permeability of this Palms soil is moderately rapid to moderately slow in the organic material and moderately slow in the substratum. Runoff is very slow or ponded. Available water capacity is very high. The soil has a seasonal high water table near or above the surface. The content of organic matter in the surface layer is more than 20 percent. The substratum generally has a very low supply of available phosphorus and potassium.

Most of the acreage of this soil is used as pasture or is idle land. A few areas are cultivated. If drained, the soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table and the seepage are the main management concerns. The seepy areas on slopes are difficult to drain. Interceptor tile is needed to adequately drain these areas. In many places the adjacent soils in the higher landscape positions have a sandy substratum. Drainage tile should be installed in the substratum of the Palms soil. If the tile is installed in the surface layer or subsurface layer, the organic material will settle and shrink. As a result, the tile is displaced and does not function properly. In some areas locating an adequate outlet is difficult. Tilth generally is poor in the surface layer.

In undrained areas, this soil is poorly suited to pasture and the acreage generally is idle land because the spongy surface layer cannot withstand grazing. If the soil is drained and used as pasture, stocking or grazing should be restricted during wet periods. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is poorly suited to trees because of the seasonal high water table and the ponding. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are severe. Operating logging equipment is difficult because of the spongy surface layer. Ordinary logging equipment should be operated only during dry periods or during winter when the ground is frozen. Seedlings do not survive well. As a result, they should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is IIIw.

225—Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on alluvial terraces. Areas range from 2 to more than 30 acres in size. They are irregularly shaped.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black and very dark grayish brown loam about 9 inches thick. The subsoil is about 12 inches thick. The upper part is dark grayish brown, mottled, friable sandy clay loam, and the lower part is mottled dark grayish brown and grayish brown, very friable sandy loam. The substratum to a depth of about 60 inches is light olive brown sand. The subsurface layer is somewhat thicker in soils that are adjacent to swales and waterways.

Permeability is moderate in the subsoil and very rapid in the substratum. Runoff is slow. Available water capacity is low. This soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a

limitation in most years unless rainfall is timely. The water table is moderately high during spring but drops rapidly during the growing season. In some areas a tile drainage system is beneficial during wet periods, but installing the tile is difficult because of the loose, water-bearing sand and gravel. If cultivated crops are grown, erosion is a hazard in areas that are plowed in the fall and are not protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in improving soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

226—Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on alluvial terraces. Areas range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black and very dark grayish brown loam about 11 inches thick. The subsoil is about 19 inches thick. It is mottled. The upper part is dark grayish brown, friable sandy clay loam, and the lower part is dark grayish brown and grayish brown, very friable sandy loam. The substratum to a depth of about 60 inches is grayish brown, brown, and light olive brown loamy sand and sand. The subsurface layer is somewhat thicker in soils that are adjacent to swales and waterways.

Included with this soil in mapping are small areas of the poorly drained Marshan soils in waterways and slight depressions. These soils make up less than 5 percent of the unit.

Permeability of this Lawler soil is moderate in the subsoil and very rapid in the substratum. Runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation during periods of below normal rainfall. Fieldwork is more timely in areas that have been plowed in the fall. Unless these plowed areas are protected, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in improving soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

284—Flagler sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on alluvial terraces. Areas range from 2 to 80 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown sandy loam about 12 inches thick. The subsoil is about 20 inches thick. The upper part is brown and dark yellowish brown, friable and very friable sandy loam, and the lower part is dark yellowish brown, very friable loamy sand that contains some fine gravel. The substratum to a depth of about 60 inches is yellowish brown gravelly sand.

Included with this soil in mapping are small areas of soils that have a surface layer of loam. These soils have a higher available water capacity than the Flagler soil. They make up less than 10 percent of the unit.

Permeability of this Flagler soil is moderately rapid in the upper part of the profile and very rapid in the lower part. Runoff is slow. Available water capacity is low. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay or pasture. Many small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Soil blowing also is a hazard during most years. Some areas are irrigated. More areas could be irrigated because they are nearly level and commonly are near an adequate water supply. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent

excessive soil loss and conserve moisture during periods of low humidity and high-velocity winds. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil improves fertility and increases the rate of water infiltration and the available water capacity.

If this soil is used for pasture, overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture in good condition.

The land capability classification is IIIs.

284B—Flagler sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat excessively drained soil is dominantly on alluvial terraces. In a few places it is in the uplands. Areas range from 2 to 20 acres in size. They generally are long and narrow, but some are irregularly shaped.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown sandy loam about 10 inches thick. The subsoil is about 19 inches thick. The upper part is brown, friable sandy loam, the next part is dark yellowish brown, very friable sandy loam, and the lower part is dark yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown gravelly sand. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of soils that have a surface layer of gravelly loamy sand. These soils have a lower available water capacity than the Flagler soil. They are in landscape positions similar to those of the Flagler soil. They make up less than 5 percent of the unit.

Permeability of this Flagler soil is moderately rapid in the upper part of the profile and very rapid in the lower part. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Many small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn and soybeans and is suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing is a hazard. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is so close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south and west-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration and the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture in good condition.

The land capability classification is IIIe.

284C—Flagler sandy loam, 5 to 9 percent slopes. This moderately sloping, somewhat excessively drained soil is dominantly on alluvial terraces. In places it is in the uplands. Areas range from 3 to 10 acres in size. They generally are long and narrow, but some are irregularly shaped.

Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown sandy loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown, friable sandy loam, and the lower part is yellowish brown, very friable loamy sand that contains some fine gravel. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of soils that have a surface layer of gravelly loamy sand. These soils have a lower available water capacity than the Flagler soil. They are in landscape positions similar to those of the Flagler soil. They make up less than 5 percent of the unit.

Permeability of this Flagler soil is moderately rapid in the upper part of the profile and very rapid in the lower part. Runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Many small areas of this soil are cropped along with large areas of adjacent soils that are better suited to crops. This soil is moderately

suited to corn and soybeans and is suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing is a hazard. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is so close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and west-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration and the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture in good condition.

The land capability classification is IIIe.

285B—Burkhardt sandy loam, 2 to 5 percent slopes. This nearly level to gently sloping, excessively drained soil is on stream terraces and on ridge crests and side slopes in the uplands. Areas range from 2 to 10 acres in size and generally are irregularly shaped.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part is dark brown, friable sandy loam, and the lower part is brown, very friable loamy sand. The substratum to a depth of about 60 inches is brown sand that contains 5 to 15 percent gravel. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are a few areas of soils that have outcrops of gravelly sand. These soils have a lower available water capacity than the Burkhardt soil. They are in landscape positions similar to those of the Burkhardt soil. They make up less than 5 percent of the unit.

Permeability of this Burkhardt soil is moderately rapid in the upper part of the profile and very rapid in the lower part. Runoff is slow. Available water capacity is very low. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium.

Many areas are cultivated. Many small areas of this soil are cropped along with large areas of adjacent soils that are better suited to crops. This droughty soil is poorly suited to corn and soybeans and is moderately suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing is a hazard. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the moderately coarse textured material is so close to the surface. Small areas of this soil are occasionally terraced along with adjacent areas of suitable soils. If terraces are built, cuts should be covered with topsoil so that the coarse textured material in the terrace channels is not exposed. Droughtiness is a limitation in most years unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and west-facing slopes. Because of the low available water capacity, a lower density of plants than normal should be maintained. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, increases the rate of water infiltration and the available water capacity, and helps to control erosion.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing increases the hazard of erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIs.

285C—Burkhardt sandy loam, 5 to 9 percent slopes. This moderately sloping, excessively drained soil is on ridges and side slopes on stream terraces and uplands. Areas range from 3 to 15 acres in size. They typically are narrow, but a few are irregularly shaped.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsoil is about 12 inches thick. It contains some fine gravel. The upper part is dark brown, friable sandy loam, and the lower part is brown, very friable loamy sand. The substratum to a depth of about 60 inches is brown sand that contains 5 to 15 percent fine gravel.

Permeability is moderately rapid in the upper part of

the profile and very rapid in the lower part. Runoff is medium. Available water capacity is very low. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Many areas are cultivated. Some are used as permanent pasture. Many small areas of this soil are cropped along with large areas of adjacent soils that are better suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. It is very droughty and is subject to soil blowing and water erosion. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss and conserve moisture. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is so close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and west-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to control erosion, and increases the rate of water infiltration and the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing increases the hazard of erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIs.

285F—Burkhardt sandy loam, 14 to 30 percent slopes. This moderately steep to very steep, excessively drained soil is on narrow escarpments along stream terraces. Areas range from 3 to 12 acres in size and typically are long and narrow.

Typically, the surface layer is very dark brown sandy loam about 7 inches thick. The subsoil is about 10 inches thick. It contains some fine gravel. The upper part is dark brown, friable sandy loam, and the lower part is brown, very friable loamy sand. The substratum to a depth of about 60 inches is brown loose sand that contains 5 to 15 percent fine gravel.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Runoff is medium or rapid. Available water capacity is very low. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Some areas are cultivated. Most are used as permanent pasture. Many small areas of this soil are cropped along with large areas of adjacent soils that are better suited to crops. This soil is not suited to corn and soybeans. It is moderately suited or poorly suited to hay and pasture. It is very droughty and is subject to soil blowing and water erosion. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss and conserve moisture. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is so close to the surface. If terraces are built, cuts should not expose the coarse textured material in terrace channels. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and west-facing slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to control erosion.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing increases the hazard of erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is VIIe.

303—Pinicon silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on glacial uplands. Areas range from 2 to more than 100 acres in size. They are irregularly shaped.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is about 9 inches of light olive brown and light brownish gray, mottled silt loam and loam. The subsoil is mottled light brownish gray and strong brown loam about 34 inches thick. The upper part is friable, and the lower part is firm. The substratum to a depth of about 60 inches is mottled light yellowish brown and strong brown loam. In places the surface layer is very dark gray.

Included with this soil in mapping are small areas of soils having a surface layer that is darker than that of the Pinicon soil and friable material at a depth of 2 to 4 feet. These soils are in the lower landscape positions. They make up less than 10 percent of the unit.

Permeability of this Pinicon soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. In most areas a tile drainage system is needed to help overcome the wetness and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is only moderately suited to trees because it has a seasonal high water table and remains wet for long periods after rainfall. A drainage system is needed to reduce the seedling mortality rate. Special equipment is needed because the equipment limitation is moderate.

The land capability classification is IIw.

377—Dinsdale silty clay loam, 0 to 2 percent slopes. This nearly level, well drained soil is on low ridges and flats in the uplands. Areas range from 2 to more than 100 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 45 inches thick. The upper part is brown, friable silty clay loam, the next part is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is light olive brown and olive clay loam. In places the upper part of the subsoil is dark grayish brown.

Permeability is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons.

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

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

377B—Dinsdale silty clay loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 2 to more than 50 acres in size. They are irregularly shaped.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 40 inches thick. The upper part is brown, friable silty clay loam, the next part is yellowish brown, friable silty clay loam, and the lower part is brown, yellowish brown, and light olive brown, firm loam. The substratum to a depth of about 60 inches is light olive brown and olive clay loam. In some places the surface layer is thinner and light colored. In other places the upper part of the subsoil is very dark grayish brown.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A

system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

382—Maxfield silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad upland divides and in broad, shallow drainageways on uplands. Areas range from 2 to more than 200 acres in size. They are irregularly shaped.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black and very dark gray silty clay loam about 10 inches thick. The subsoil is about 29 inches thick. It is mottled and firm. The upper part is olive gray and olive silty clay loam, and the lower part is yellowish brown clay loam. The substratum to a depth of about 60 inches is yellowish brown loam.

Included with this soil in mapping are small areas of Clyde soils along waterways. These soils have more stratification in the solum than the Maxfield soil. They make up about 5 percent of the unit.

Permeability of this Maxfield soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 6 to 8 percent. The shrink-swell potential is high in the upper part of the profile. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Soil blowing is a hazard in areas that are plowed in the fall and are not protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

391B—Clyde-Floyd complex, 1 to 4 percent slopes. These very gently sloping, poorly drained and somewhat poorly drained soils are on the lower side slopes in the uplands and in drainageways. In most places, the Clyde soil is in the center of the drainageways on slopes of less than 3 percent and the Floyd soil is in a band bordering the drainageways on slopes of 1 to 4 percent. Areas generally range from 4 to 20 acres in size, but a few are much larger. The areas are long and narrow. The Clyde soil makes up about 60 percent of the map unit, and the Floyd soil makes up 40 percent. These soils occur as areas so intricately mixed or so small in size that separating them in mapping is not practical.

Typically, the surface layer of the Clyde soil is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 13 inches thick. The subsoil is about 22 inches thick. It is mottled and friable. The upper part is olive gray loam, and the lower part is olive gray and olive sandy loam and loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In some places the subsurface layer is 28 or more inches thick. In other places the substratum and the lower portion of the subsoil are coarser textured.

Typically, the surface layer of the Floyd soil is black loam about 9 inches thick. The subsurface layer is black and very dark gray clay loam about 11 inches thick. The subsoil is about 25 inches thick. It is mottled. The upper part is olive brown, friable loam, the next part is light olive brown, very friable sandy clay loam, and the lower part is grayish brown and light olive brown, friable loam. The substratum to a depth of about 60 inches is light olive brown, mottled loam. In places the surface layer and subsurface layer are thicker and darker.

Included with these soils in mapping are small areas of Schley soils. Schley soils are more acid than the Clyde and Floyd soils and have a lower content of organic matter. They are on concave side slopes. They make up about 10 percent of the unit.

Permeability of these Clyde and Floyd soils is moderate, and runoff is slow. Available water capacity is high. These soils have a seasonal high water table.

They receive runoff and seepage from adjacent slopes. The content of organic matter is about 6 to 9 percent in the surface layer of the Clyde soil and 5 to 6 percent in the surface layer of the Floyd soil. The subsoil of these soils generally has a very low supply of available phosphorus and potassium.

Most areas of these soils are drained by tile and are cultivated. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system helps to overcome the wetness and helps to ensure that the soils are properly aerated and have a deep root zone available to plants. Tile drains work well if good outlets are available. Good tilth generally is easily maintained. Returning crop residue to the soils and avoiding tillage when the soils are wet help to maintain good tilth.

If these soils are used for pasture, overgrazing or grazing when the soils are too wet causes surface compaction and poor tilth.

The land capability classification is IIw.

394—Ostrander loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad ridge crests in the higher part of uplands and in benchlike positions in the lower part. Areas typically range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark brown and dark brown loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown and dark yellowish brown, friable loam, the next part is yellowish brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow and very pale brown loam. In places the lower part of the subsoil is firm loam.

Included with this soil in mapping are small areas of Rockton and Saude soils. These soils are in landscape positions similar to those of the Ostrander soil. Rockton soils are underlain by hard, bedded limestone. They make up less than 5 percent of the unit. Saude soils are underlain by sand and gravel. They make up about 5 to 10 percent of the unit.

Permeability of this Ostrander soil is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Tilth is good, but the surface layer tends to crust after hard rains and to puddle if tilled when wet.

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

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

394B—Ostrander loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridge crests and side slopes in the uplands and in benchlike positions in the lower part of the uplands. Areas typically range from 2 to 20 acres in size, but a few are much larger. The areas are irregularly shaped.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is very dark brown and dark brown loam about 7 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown and dark yellowish brown, friable loam, the next part is yellowish brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow and very pale brown loam. In places the lower part of the subsoil is firm loam.

Included with this soil in mapping are small areas of Dinsdale, Rockton, and Saude soils. These soils are in landscape positions similar to those of the Ostrander soil. Dinsdale soils have a lower content of sand in the upper 20 to 40 inches than the Ostrander soil. Rockton soils are underlain by hard, bedded limestone. Saude soils are underlain by sand and gravel. Each of these soils makes up less than 10 percent of the unit.

Permeability of this Ostrander soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Tilth is good, but the surface layer tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

394C—Ostrander loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on short, convex ridge crests and side slopes in the uplands. Areas typically range from 2 to 15 acres in size and are elongated.

Typically, the surface layer is very dark brown loam about 9 inches thick. The subsurface layer is dark brown loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is brown, friable loam, the next part is yellowish brown and dark yellowish brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow and very pale brown loam. In places the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Saude soils. These soils are in landscape positions similar to those of the Ostrander soil. They are underlain by sand and gravel. They make up less than 10 percent of the unit.

Permeability of this Ostrander soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Tilth is good, but the surface layer tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans and is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate or severe hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial material. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

394C2—Ostrander loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on short, convex ridge crests and side slopes in the uplands. Areas typically range from 2 to 10 acres in size. They are commonly narrow and irregularly shaped.

Typically, the surface layer is very dark brown loam about 7 inches thick. It is mixed with streaks and pockets of brown subsoil material. The subsoil is about 25 inches thick. The upper part is brown, friable loam, the next part is yellowish brown and dark yellowish brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow and very pale brown loam. In places the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of soils that are underlain by sand and gravel. These soils are in landscape positions similar to those of the Ostrander soil. They make up less than 10 percent of the unit.

Permeability of this Ostrander soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2.2 to 3.2 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Tilth is good, but the surface layer tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn and soybeans and is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a moderate or severe hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial material. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

398—Tripoli silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on broad upland divides and along broad drainageways in the uplands. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is about 7 inches of black and very dark gray silty clay loam and clay loam. The subsoil is about 23 inches thick. It is mottled. The upper part is grayish brown, friable clay loam, the next part is yellowish brown, friable loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places in waterways, the soil has a substratum of sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Readlyn soils on the slightly higher parts of the landscape. These soils have a lower content of organic matter than the Tripoli soil and are more acid in the subsoil. They make up about 10 percent of the unit.

Permeability of this Tripoli soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 6 to 7 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

399—Readlyn loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on broad divides or at the slightly concave head of drainageways in the uplands. Areas range from 2 to several hundred acres in size. They are irregularly shaped.

Typically, the surface layer is black loam about 10 inches thick. The subsurface layer is very dark grayish brown clay loam about 7 inches thick. The subsoil is about 29 inches thick. It is mottled. The upper part is very dark grayish brown, dark grayish brown, and light olive brown, friable clay loam, and the lower part is light olive brown and light brownish gray, firm loam. The substratum to a depth of about 60 inches is light olive brown and light brownish gray, calcareous loam. In some places the surface layer is thinner and has a lower content of organic matter. In other places it has a lower content of sand and is silt loam or silty clay loam.

Included with this soil in mapping are small areas of the poorly drained Tripoli soils in small depressions. These soils have a higher content of organic matter than the Readlyn soil. Also, they contain more clay in the surface layer. They make up about 6 to 8 percent of the unit.

Permeability of this Readlyn soil is moderate, and runoff is slow or medium. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 4.5 to 5.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A tile drainage system is needed in some areas to help overcome the wetness and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

399B—Readlyn loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on broad divides and at the slightly concave head of drainageways in the uplands. Areas typically range from

2 to 15 acres in size. They are irregularly shaped.

Typically, the surface layer is black loam about 10 inches thick. The subsurface layer is very dark brown loam about 6 inches thick. The subsoil is about 27 inches thick. It is mottled. The upper part is very dark grayish brown, dark grayish brown, and light olive brown, friable clay loam, and the lower part is light olive brown and light brownish gray, firm loam. The substratum to a depth of about 60 inches is light olive brown and light brownish gray, calcareous loam. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd soils. These soils are downslope from the Readlyn soil. They are more stratified in the subsoil than the Readlyn soil. They make up less than 5 percent of the unit.

Permeability of this Readlyn soil is moderate, and runoff is medium. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 4.5 to 5.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for pasture or hay. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A tile drainage system is needed in some areas to help overcome the wetness and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

407B—Schley silt loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on glaciated uplands. Areas range from about 3 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 35 inches thick. It is mottled. The upper part is grayish brown and dark yellowish brown, friable silty clay loam and loam, the next part is light brownish gray and yellowish brown, very friable sandy loam, and the lower part is yellowish brown and strong brown, firm loam. The substratum to a depth of about 60 inches is mottled, yellowish brown loam.

Included with this soil in mapping are small areas of Donnan soils, which have clayey material at a depth of 2 to 4 feet. These soils are very slowly permeable in the lower part. When they are at the base of side slopes, they tend to be excessively wet and seepy for extended periods. They are in landscape positions similar to those of the Schley soil. They make up about 2 to 5 percent of the unit.

Permeability of this Schley soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Gully erosion is a hazard in areas where runoff concentrates. Measures that help to control the runoff from the higher elevations are needed. Grassed waterways help to prevent gully erosion. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Glacial stones and boulders are common in many unimproved areas. They should be removed before tile drains are installed and the soil is cultivated. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, reduces the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support native hardwoods. This soil is only moderately suited to trees because it has a seasonal high water table and remains wet for long periods after rainfall. A drainage system is needed to reduce the seedling mortality rate.

The land capability classification in IIw.

408B—Olin sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from about 3 to 12 acres in size and are irregularly shaped.

Typically, the surface layer is black sandy loam about 9 inches thick. The subsurface layer is very dark brown and dark brown sandy loam about 12 inches thick. The subsoil is 24 inches thick. The upper part is brown, very friable sandy loam, the next part is yellowish brown, firm loam, and the lower part is light olive brown, firm clay loam. The substratum to a depth of about 60 inches is light olive brown, firm clay loam. In places the surface layer is dark brown. In some small areas the sandy loam material extends to a greater depth.

Permeability is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 1.5 to 2.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable or very friable but tends to crust after hard rains and to puddle if tilled when wet. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons.

Most areas are cultivated. Some are used for pasture or hay. Most areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in some years unless rainfall is timely. Soil blowing is a hazard in areas where cultivated crops are grown. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil is not well suited to terracing because ridging the moderately coarse textured material is difficult and because the less productive underlying glacial till is so close to the surface. If terraces are built, cuts should not expose the less productive glacial till in terrace channels. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

If this soil is used for pasture, overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during excessively wet and dry periods help to keep the pasture in good condition.

The land capability classification is IIe.

412C—Emeline loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, somewhat excessively drained soil is on ridges and short side slopes in the uplands and on stream terraces. Areas range from 2 to 10 acres in size. They are irregularly shaped and somewhat elongated.

Typically, the surface layer is black loam about 8 inches thick. The subsoil is about 4 inches of brown, friable clay loam. Fractured limestone bedrock is at a depth of about 12 inches. In places the depth to bedrock is 12 to 20 inches.

Included with this soil in mapping are small areas where fractured limestone bedrock is near or at the surface. These areas are difficult to till. Operating equipment in these areas is hazardous. Inclusions generally make up less than 10 percent of the unit.

Permeability of this Emeline soil is moderate, and runoff is medium or rapid. Available water capacity is very low. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are in pasture. Some small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is unsuited to cultivated crops because of the severe hazard of erosion. It is better suited to grasses and legumes for hay and pasture. Droughtiness is a severe limitation.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees, but some areas support native hardwoods. Plant competition is moderate. It can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IVs.

412E—Emeline loam, 9 to 18 percent slopes. This strongly sloping and moderately steep, somewhat excessively drained soil typically is on escarpments in the uplands and on stream benches. Areas range from about 2 to 15 acres in size and are somewhat elongated.

Typically, the surface layer is black loam about 7 inches thick. The subsoil is brown, friable clay loam about 3 inches thick. Fractured limestone bedrock is at a depth of about 10 inches. In places the depth to bedrock is 10 to 20 inches.

Included with this soil in mapping are small areas where fractured limestone bedrock is near or at the surface. These areas are difficult to till. Operating equipment in these areas is hazardous. Inclusions generally make up about 5 to 15 percent of the unit.

Permeability of this Emeline soil is moderate, and runoff is rapid. Available water capacity is very low. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are in pasture. Some small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is unsuited to cultivated crops because of the severe hazard of erosion. It is better suited to grasses and legumes for pasture. Droughtiness is a severe limitation.

A cover of pasture plants is effective in controlling erosion. Reestablishing vegetation for improved pasture is difficult without damaging equipment and causing excessive soil loss. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees, but some areas support native hardwoods. Plant competition is moderate. It can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is VIs.

412G—Emeline loam, 18 to 40 percent slopes. This steep and very steep, somewhat excessively drained soil typically is on escarpments in the uplands and on stream benches. Areas range from about 2 to 35 acres in size and generally are elongated.

Typically, the surface layer is black loam about 6 inches thick. The subsoil is brown, friable clay loam about 3 inches thick. Fractured limestone bedrock is at a depth of about 9 inches. In places the depth to bedrock is 9 to 20 inches.

Included with this soil in mapping are areas where fractured limestone bedrock is near or at the surface. These included areas make up about 5 percent of the unit.

Permeability of this Emeline soil is moderate, and runoff is very rapid. Available water capacity is very low. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

This soil is unsuited to cultivated crops and has limited value as pasture because of the slope, the depth to bedrock, and the hazard of erosion. It is better suited to trees and wildlife habitat.

This soil is poorly suited to trees. The seedling mortality rate is severe because of the slope and the depth to bedrock. The bedrock is fractured, however, and tree roots can penetrate the rock crevices. Ordinary planting and harvesting equipment cannot be used because of the slope.

The land capability classification is VIIs.

444B—Jacwin silty clay loam, 1 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on uplands and on high stream benches bordering the uplands. Areas range from 4 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 18 inches thick. The upper part is dark grayish brown, friable silty clay loam, and the lower part is olive gray, very firm silty clay. Gray and pale olive shale bedrock is at a depth of about 34 inches. It has a texture of silty clay. In places the surface layer is clay loam.

Included with this soil in mapping are areas of soils that are 40 inches or more deep over clayey shale and small areas of soils that are less than 20 inches deep over shale. These soils may be difficult to drain. They make up about 5 to 10 percent of the unit.

Permeability of this Jacwin soil is moderate in the upper part of the profile and very slow in the lower part. Runoff is slow or medium. Available water capacity is moderate. The soil has a perched seasonal high water table. The content of organic matter in the surface layer is about 4.5 to 5.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. A few are used as permanent pasture. If drained and protected against water erosion, this soil is suited to corn and soybeans. Draining the soil is difficult because it receives runoff and seepage from the soils upslope. This excess water should be intercepted before it seeps into the root zone of those soils. When installing a drainage system, the tile drains should not be positioned too deeply in the

clayey material that weathered from shale bedrock and the backfill material should be porous. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. A combination of drainage tile and terraces is needed in some areas. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in fairly good condition.

The land capability classification is IIe.

457—Du Page loam, 0 to 2 percent slopes. This nearly level, moderately well drained, calcareous soil is on bottom land. It is subject to flooding from adjacent streams and waterways. Areas typically range from 5 to 70 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black, friable loam about 36 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown loam.

Included with this soil in mapping are areas of soils that have a higher content of sand than the Du Page soil. These soils typically are adjacent to streams and waterways. Also included are poorly drained soils in the lower landscape positions. Included soils make up 10 to 15 percent of the unit.

Permeability of this Du Page soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 6 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The soil is mildly alkaline or moderately alkaline and does not need lime. An excess of lime reduces the effects of fertilizer and herbicides on crops.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Flooding is a hazard in cultivated areas. It results in some crop loss. Tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. The high content of lime in the soil adversely affects the availability of plant nutrients. In some areas where soybeans are grown, applications of iron compounds are needed.

Overgrazing or grazing when the soil is too wet causes surface compaction and results in deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The wetness and the excess amount of lime are the main limitations if this soil is used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate these limitations should be selected for planting.

The land capability classification is IIw.

471—Oran loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on uplands. Areas range from 2 to more than 100 acres in size. They are irregularly shaped.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is mottled loam about 32 inches thick. The upper part is dark grayish brown and friable, and the lower part is yellowish brown and firm. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

Included with this soil in mapping are small areas of Donnan soils, which have clayey material at a depth of 2 to 4 feet. These soils are on the upper part of the landscape. They are very slowly permeable in the lower part of the profile. They make up less than 5 percent of the unit.

Permeability of this Oran soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A tile drainage system is needed in some areas to help overcome the wetness and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is only moderately suited to trees because it has a seasonal high water table and remains wet for long periods after rainfall. A drainage system is needed

to reduce the seedling mortality rate. Special equipment is needed because the equipment limitation is moderate.

The land capability classification is I.

471B—Oran loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is in the uplands. Areas range from 2 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is mottled loam about 30 inches thick. The upper part is dark grayish brown and friable, and the lower part is yellowish brown and firm. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In places the subsurface layer and the upper part of the subsoil are browner.

Included with this soil in mapping are small areas of soils that have clayey material at a depth of 2 to 4 feet. These soils are on the lower part of the landscape. They are more slowly permeable than the Oran soil. They make up less than 5 percent of the unit.

Permeability of this Oran soil is moderate, and runoff is medium. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. A tile drainage system is needed in some areas to help overcome the wetness and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is only moderately suited to trees because it has a seasonal high water table and remains wet for long periods after rainfall. A drainage system is needed to reduce the seedling mortality rate. Special equipment is needed because the equipment limitation is moderate.

The land capability classification is IIe.

482—Racine loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad ridge crests in the higher part of the uplands and in benchlike positions in the lower part. Areas typically range from 2 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 8 inches thick. The subsoil to a depth of about 60 inches is friable. The upper part is brown and dark yellowish brown loam, the next part is yellowish brown clay loam, and the lower part is light olive brown, mottled loam. In some places the surface layer is black. In other places the lower part of the subsoil is firm loam.

Included with this soil in mapping are small areas of Wapsie and Winneshiek soils. These soils are in landscape positions similar to those of the Racine soil. Wapsie soils are underlain by sand and gravel. They make up about 5 percent of the unit. Winneshiek soils are underlain by hard, bedded limestone. They make up less than 5 percent of the unit.

Permeability of this Racine soil is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

482B—Racine loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridge crests and side slopes in the uplands and in benchlike positions in the lower part of the uplands. Areas typically range from 2 to 20 acres in size, but a few are

much larger. The areas are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil to a depth about 60 inches is friable. The upper part is brown and dark yellowish brown loam, the next part is yellowish brown sandy clay loam, and the lower part is light olive brown, mottled loam. In some places the surface layer is black. In other places the lower part of the subsoil is firm loam.

Included with this soil in mapping are small areas of Wapsie soils. These soils are in landscape positions similar to those of the Racine soil. They are underlain by sand and gravel. They make up about 5 percent of the unit. Also included are small areas of the somewhat poorly drained Schley soils. Schley soils are downslope along waterways. They make up less than 5 percent of the unit.

Permeability of this Racine soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial material. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying.

The land capability classification is IIe.

482C—Racine loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex ridge crests and side slopes in the uplands and in benchlike positions in the lower part of the uplands. Areas typically range from 2 to 10 acres in size, but a few are larger. The areas are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil to a depth of about 60 inches is friable. The upper part is brown and dark yellowish brown loam, the next part is yellowish brown sandy clay loam, and the lower part is light olive brown, mottled loam. In some places the surface layer is black. In other places the lower part of the subsoil is firm loam. In some areas the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of soils that are underlain by sand and gravel. These soils are in landscape positions similar to those of the Racine soil. Also included are small areas of somewhat poorly drained soils downslope along waterways. Included soils make up about 5 to 10 percent of the unit.

Permeability of this Racine soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. If the soil is cultivated, the surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIIe.

482C2—Racine loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex ridge crests and side slopes in the uplands and in benchlike positions in the lower part

of the uplands. Areas typically range from 2 to 10 acres in size, but a few are larger. The areas are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. It is mixed with streaks and pockets of brown and yellowish brown subsoil material. The subsoil to a depth of about 60 inches is friable. The upper part is brown and dark yellowish brown loam, the next part is yellowish brown sandy clay loam, and the lower part is light olive brown, mottled loam. In some places the surface layer is very dark brown. In other places the lower part of the subsoil is firm loam.

Included with this soil in mapping are small areas of soils that are underlain by sand and gravel. These soils are in landscape positions similar to those of the Racine soil. Also included are small areas of somewhat poorly drained soils downslope along waterways. Included soils make up about 5 to 10 percent of the unit.

Permeability of this Racine soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorus and potassium. If the soil is cultivated, the surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIIe.

485—Spillville loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains and in drainageways on uplands. It is subject to flooding. Areas typically range from 10 to 80 acres in size. They are irregularly shaped or long and narrow.

Typically, the surface layer is black loam about 12 inches thick. The subsurface layer is black and very dark grayish brown, friable loam about 35 inches thick. The substratum to a depth of about 60 inches is dark brown loam.

Included with this soil in mapping are small areas of soils that have a surface layer of sandy loam. These soils have a lower content of organic matter than the Spillville soil. They also have a lower available water capacity. They are in landscape positions similar to those of the Spillville soil or on slightly higher mounds. Also included are small areas of poorly drained soils in slight depressions. Included soils make up about 10 percent of the unit.

Permeability of this Spillville soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Some areas are used for pasture or hay. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

491B—Renova silt loam, 1 to 5 percent slopes. This gently sloping, well drained soil is on convex ridge crests and side slopes in the uplands and in benchlike positions in the lower part of the uplands. Areas typically range from 3 to 30 acres in size, but a few are much larger. The areas are irregularly shaped.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer is brown and yellowish brown loam about 6 inches thick. The subsoil is about 31 inches thick. It is friable. The upper part is yellowish brown sandy clay loam and loam, and the lower part is mottled grayish brown and light yellowish brown loam. The substratum to a depth of about 60 inches is mottled grayish brown and light yellowish brown loam. In some places the surface layer is loam. In other places the lower part of the subsoil is

firm loam. In some areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of soils that are underlain by sand and other areas of soils that are underlain by hard, bedded limestone. These soils are in landscape positions similar to those of the Renova soil. Each of the soils makes up less than 5 percent of the unit.

Permeability of this Racine soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial material. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIe.

507—Canisteo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained, calcareous soil typically is in waterways and shallow swales on uplands. Areas range from 3 to 60 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer also is black silty clay loam about 8 inches thick. The subsoil is about 24 inches thick. The upper part is dark olive gray and olive gray, friable silty clay loam and silt loam, and the lower part is olive gray, friable loam. The upper part of the substratum is olive gray sandy loam. The lower part to a depth of about 60 inches is olive gray loam.

Permeability is moderate, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter in the surface layer is about 6 to 7 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The soil is alkaline and does not need lime. An excess of lime reduces the effects of fertilizer and herbicides on crops.

Most areas are cultivated. If drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Tile drains remove excess subsurface water. Special care generally is needed to maintain good tilth in the surface layer. Cultivating when the soil is too wet causes surface compaction and results in the formation of clods. Chisel plowing increases the infiltration rate by making the surface more pervious to water. Returning crop residue to the soil or regularly adding other organic material helps to control soil blowing and prevent surface crusting and increases the rate of water infiltration. The high content of lime in the soil adversely affects the availability of plant nutrients. In some areas where soybeans are grown, applications of iron compounds are needed.

The wetness and the excess amount of lime are the main limitations if this soil is used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate these limitations should be selected for planting.

The land capability classification is IIw.

535—Shellwood sandy loam, 0 to 3 percent slopes. This nearly level, moderately well drained, calcareous soil is on natural levees and nearly level bottom land. It is subject to flooding. Areas range from 2 to 20 acres in size.

Typically, the surface layer is black sandy loam about 9 inches thick. The subsurface layer is sandy loam about 47 inches thick. The upper part is black, and the lower part is very dark gray. The substratum to a depth of about 60 inches is very dark brown sandy loam.

Included with this soil in mapping are areas of coarser textured soils along streambanks and in the slightly higher positions on the landscape. These coarser textured soils make up about 10 percent of the unit. Also included are small areas of Du Page soils in the slightly lower positions on the landscape. Du Page soils are loamy in texture. They make up less than 5 percent of the unit.

Permeability of this Shellwood soil is moderately rapid, and runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table.

The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorous and potassium. The soil is mildly alkaline or moderately alkaline and does not need lime. An excess of lime reduces the effects of fertilizer and herbicides on crops. The soil is somewhat droughty during extended dry periods. Tilth is good.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Most areas are suited to intensive row cropping if they are adequately protected from flooding. Most of the flooding occurs before corn is planted. Levees and dikes can provide flood protection. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. The high content of lime in the soil adversely affects the availability of plant nutrients.

Care should be taken so that pastures are not overstocked since the available water capacity is moderate. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The flooding and the excess amount of lime are the main limitations if this soil is used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate these limitations should be selected for planting.

The land capability classification is IIs.

536—Hanlon fine sandy loam, 0 to 3 percent slopes. This nearly level, moderately well drained soil is on natural levees and nearly level bottom land. It is subject to flooding. Areas range from 2 to 20 acres in size.

Typically, the surface layer is black fine sandy loam about 12 inches thick. The subsurface layer is very friable fine sandy loam about 36 inches thick. The upper part is very dark brown, the next part is very dark grayish brown, and the lower part is dark brown. The substratum to a depth of about 60 inches is brown sand.

Included with this soil in mapping are areas of coarser textured soils along streambanks and in the slightly higher positions on the landscape. These coarser textured soils make up about 10 percent of the unit. Also included are small areas of Spillville soils in the slightly lower positions on the landscape. Spillville soils are loamy in texture. They make up less than 5 percent of the unit.

Permeability of this Hanlon soil is moderately rapid, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorous and potassium. The soil is somewhat droughty during extended dry periods. Tilth is good.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Most areas are suited to intensive row cropping if they are adequately protected from flooding. Most of the flooding occurs before corn is planted. Levees and dikes can provide flood protection. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Care should be taken so that pastures are not overstocked since the available water capacity is moderate. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIs.

537—Du Page-Calco complex, 0 to 2 percent slopes. These deep, nearly level, moderately well drained and poorly drained, calcareous soils are on flood plains bordering streams. They are subject to flooding. Many areas have shallow bayous and swales that frequently pond water or remain wet after flooding. Areas typically range from about 5 to 50 acres in size and are irregularly shaped. The Du Page soil makes up about 50 percent of the map unit, and the Calco soil makes up 50 percent. The soils that make up this map unit are so closely intermingled that it is not practical to separate them in mapping.

Typically, the surface layer of the Du Page soil is black loam about 8 inches thick. The subsurface layer is black, friable loam about 36 inches thick. The substratum to a depth of about 60 inches is very dark brown loam.

Typically, the surface layer of the Calco soil is black silty clay loam about 9 inches thick. The subsurface layer is black silty clay loam about 39 inches thick. The substratum to a depth of about 60 inches is very dark gray and dark gray silty clay loam. In places the soil is loam throughout.

Permeability of the Du Page and Calco soils is moderate, and runoff is slow. Available water capacity is high. The Calco soil has a seasonal high water table at the surface or within a depth of 3 feet, and the Du Page soil has one at a depth of 4 to 6 feet. The content of organic matter is about 4 to 6 percent in the surface layer of the Du Page soil and 5 to 7 percent in the surface layer of the Calco soil. The subsoil of the Du Page soil generally has a very low supply of available phosphorus and potassium. The subsoil of the Calco soil has a medium supply of available phosphorus and

a very low supply of available potassium. The high content of lime in these soils adversely affects the availability of plant nutrients.

Most areas are cultivated. If these soils are drained and protected from flooding, they are suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Draining some areas is difficult because suitable outlets are not available. Many areas benefit if a surface drainage system is installed. Plant species that can tolerate the flooding may need to be selected for planting.

The wetness and the excess amount of lime are the main limitations if these soils are used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate these limitations should be selected for planting.

The land capability classification is IIIw.

551—Calamine silty clay loam, 0 to 3 percent slopes. This nearly level, poorly drained soil is on foot slopes below outcrops of arenaceous limestone, in drainageways, and in broad, nearly level areas in swales on uplands. Areas of the soil range from 10 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer also is black silty clay loam about 10 inches thick. The subsoil is about 12 inches thick. The upper part is olive gray, mottled, friable and firm silty clay loam, and the lower part is mottled olive gray and olive yellow, very firm silty clay. The substratum is mottled olive and gray, very firm silty clay. Brownish yellow and greenish gray shale bedrock is at a depth of 54 inches. The bedrock has a texture of clay. In places shale bedrock is at a depth of 10 inches.

Included with this soil in mapping are areas where the soils have a calcareous surface layer. The calcareous material reduces the effect of herbicides and fertilizers on crops. These soils are in landscape positions similar to those of the Calamine soil. They make up less than 10 percent of the unit.

Permeability of this Calamine soil is moderate in the upper part of the subsoil and very slow in the lower part and in the substratum. Runoff is slow. Available water capacity is moderate or high. The soil has a perched seasonal high water table. It receives seepage and runoff from soils higher on the landscape. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium. The soil is mildly alkaline and does not need lime. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. If drained, this soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed but cannot be installed easily. Tiling is difficult because the depth to bedrock varies from area to area. When installing a drainage system, the tile drains should not be positioned too deeply in the clayey material that weathered from shale bedrock and the backfill material should be porous. Tilth generally is poor in the surface layer.

Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the likelihood of puddling. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in fairly good condition.

This soil is poorly suited to trees because it has a seasonal high water table and remains wet for long periods after rainfall. The bedrock restricts root penetration at a depth of about 4.5 feet. The equipment limitation, the seedling mortality rate, and the hazard of windthrow are severe. Ordinary logging equipment should be operated only during dry periods or during the winter when the ground is frozen. Special high flotation equipment can be used for harvesting the trees or managing the woodland during wet periods. Because they do not survive well, seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is IIIw.

559—Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained, calcareous soil is on stream terraces and in alluvial areas on uplands. Areas of the soil typically range from 4 to 100 acres in size and generally are elongated.

Typically, the surface layer is black clay loam about 9 inches thick. The subsurface layer is black and very dark gray, mottled clay loam about 13 inches thick. The subsoil is about 16 inches thick. The upper part is dark gray, mottled, friable clay loam, and the lower part is olive gray, mottled, friable loam. The substratum to a depth of about 60 inches is mixed yellowish brown, brownish yellow, and light yellowish brown coarse sand. In some places the depth to sand and gravel is less than 32 inches. In other places it is 40 to 48 inches.

Permeability is moderate in the upper part of the subsoil and rapid in the lower part and in the substratum. Runoff is slow. Available water capacity is moderate. This soil is droughty during prolonged dry seasons. It has a seasonal high water table. The content of organic matter in the surface layer is about 5.5 to 6.5 percent. The surface layer becomes cloddy and puddles if the soil is tilled when wet. The subsoil

has a very low supply of available phosphorous and potassium. The soil is alkaline and does not need lime. An excess of lime reduces the effects of fertilizer and herbicides on crops.

Most areas are cultivated. If drained, this soil is well suited to corn, soybeans, and other cultivated crops; to small grain; and to grasses and legumes for hay and pasture. Undrained areas are well suited to wetland wildlife habitat and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. The high content of lime in the soil adversely affects the availability of plant nutrients. In some areas where soybeans are grown, applications of iron compounds may be needed.

The wetness and the excess amount of lime limit crop production. A drainage system is needed for optimum production. Installation of subsurface drainage lines is difficult in some areas because of the loose, water-bearing sand. If large areas are plowed in the fall, soil blowing is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil blowing.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The wetness and the excess amount of lime are the main limitations if this soil is used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate these limitations should be selected for planting.

The land capability classification is IIw.

595—Harpster silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained, calcareous soil is in drainageways and on broad flats in the uplands. Areas typically range from 5 to 20 acres, but a few long, narrow areas are much larger.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is about 11 inches of very dark gray silty clay loam and mottled silt loam. The subsoil is about 20 inches of olive gray and olive, mottled, friable silt loam and loam. The upper part of the substratum is light olive brown, mottled sandy loam. The lower part to a depth of about 60 inches is olive, mottled loam. In a few small places, reaction is neutral in the surface layer.

Permeability is moderate, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter in the surface layer is about 4.5 to 5.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The soil is alkaline and does not need lime. An excess of lime reduces the effects of fertilizer and herbicides on crops.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Soil blowing is a hazard in areas that are plowed in the fall and are not protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. The high content of lime in the soil adversely affects the availability of plant nutrients. In some areas where soybeans are grown, applications of iron compounds may be needed.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The wetness and the excess amount of lime are the main limitations if this soil is used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate these limitations should be selected for planting.

The land capability classification is IIw.

612C2—Mottland loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained, calcareous soil is on convex side slopes in the uplands. Areas range from 5 to 10 acres in size and are elongated.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. It is mixed with streaks and pockets of light olive brown substratum material. The substratum to a depth of about 60 inches is light olive brown, light yellowish brown, and olive yellow loam and silty clay loam. In places the surface layer is very dark brown or very dark grayish brown.

Included with this soil in mapping are areas of soils that have a surface layer of channery loam. These soils generally are on side slopes. Also included are small areas of soils that have earthy shaly limestone at a depth of more than 20 inches. These soils are near the base of side slopes. Included soils make up less than 10 percent of the unit.

Permeability of this Mottland soil is moderate, and runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is about

1.7 to 2.7 percent. The substratum generally has a very low supply of available phosphorus and potassium. The soil is alkaline and does not need lime. If the soil is cultivated, the surface layer tends to crust after hard rains and to puddle if tilled when wet.

Many areas are cultivated. Some are used for pasture. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The high content of lime in the soil reduces the availability of phosphorus and potassium to plants. If the soil is cultivated, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. If terraces are built, covering the cuts with topsoil helps to ensure the growth of plants. Tilth generally is poor or fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. The reduced content of organic matter that results from erosion and the calcareous nature of the soil should be considered when determining the application rate of herbicides.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

612D2—Mottland loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained, calcareous soil is on convex side slopes in the uplands. Areas range from 5 to 10 acres in size and are elongated.

Typically, the surface layer is dark grayish brown and very dark grayish brown, calcareous loam about 6 inches thick. It is mixed with streaks and pockets of light olive brown substratum material. The substratum to a depth of about 60 inches is light olive brown, light yellowish brown, and olive yellow, calcareous loam and silty clay loam. In places the surface layer is very dark brown or very dark grayish brown.

Included with this soil in mapping are areas of soils that have a surface layer of channery loam. These soils generally are on side slopes. Also included are small areas of soils that are 20 inches or more deep over arenaceous limestone. These soils are near the base of side slopes. Included soils make up less than 10 percent of the unit.

Permeability of this Mottland soil is moderate, and runoff is rapid. Available water capacity is high. The content of organic matter in the surface layer is about 1.7 to 2.7 percent. The substratum generally has a very low supply of available phosphorus and potassium.

Some areas are cultivated. Many are used for pasture. This soil is poorly suited to corn, soybeans, and other cultivated crops. The high content of lime in the soil reduces the availability of phosphorus and potassium to plants. If the soil is cultivated, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. If terraces are built, covering the cuts with topsoil helps to ensure the growth of plants. Tilth generally is poor or fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. The reduced content of organic matter that results from erosion and the calcareous nature of the soil should be considered when determining the application rate of herbicides.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IVe.

616—Aureola loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad ridge crests in the uplands and in benchlike positions in the lower part of the uplands. Areas typically range from about 3 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 9 inches thick. The subsurface layer is very dark brown loam about 5 inches thick. The subsoil is about 19 inches thick. It is friable. The upper part is dark brown loam, the next part is yellowish brown loam, and the lower part is yellowish brown sandy loam. The substratum to a depth of about 60 inches is brownish yellow and olive yellow loamy fine sand. In places the upper part of the subsoil is dark grayish brown.

Included with this soil in mapping are small areas of soils that have sandstone at a depth of 40 to 60 inches and small areas of soils that have reddish silty clay below a depth of 40 inches. These soils make up less than 10 percent of the unit.

Permeability of this Aureola soil is moderate in the solum and rapid in the substratum. Runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer

is friable. Tilth is good in the surface layer.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty, however, because of the moderate available water capacity. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of the grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

616B—Aureola loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridge crests and side slopes in the uplands and in benchlike positions in the lower part of the uplands. Areas typically range from about 3 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 9 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 5 inches thick. The subsoil is about 19 inches thick. It is friable. The upper part is dark brown loam, the next part is yellowish brown loam, and the lower part is yellowish brown fine sandy loam. The substratum to a depth of about 60 inches is brownish yellow and olive yellow loamy fine sand. In places the surface layer is dark brown.

Included with this soil in mapping are small areas where sandstone is at or near the surface. The soils in these areas are calcareous and have excess lime in the surface layer. They are in landscape positions similar to those of the Aureola soil. Also included are small areas of soils that have reddish silty clay below a depth of 40 inches. Inclusions make up less than 10 percent of the unit.

Permeability of this Aureola soil is moderate in the solum and rapid in the substratum. Runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable. Tilth is good in the surface layer.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is somewhat droughty, however, because of the moderate available water capacity. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the underlying sandy material. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

616C2—Aureola sandy loam, 5 to 9 percent slopes, moderately eroded. This gently sloping and moderately sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 3 to 15 acres in size and are elongated.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. It is mixed with streaks and pockets of yellowish brown subsoil material. The subsoil is about 15 inches thick. It is yellowish brown, friable loam and fine sandy loam. The substratum to a depth of about 60 inches is brownish yellow loamy fine sand.

Included with this soil in mapping are areas of soils that have a surface layer of channery fine sandy loam and small areas of soils that are 7 to 20 inches deep over sandstone bedrock. These soils make up less than 15 percent of the unit.

Permeability of this Aureola soil is moderate in the solum and rapid in the substratum. Runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 1 to 2 percent. The substratum generally has a very low supply of available phosphorus and potassium. The soil is alkaline and does not need lime.

Many areas are cultivated. Some are used for pasture. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is highly susceptible to erosion if cultivated, and it is droughty. The erosion adversely affects crops because the layer of topsoil becomes even thinner. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Some small areas are terraced along with areas of other deeper soils. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

A cover of pasture plants is effective in controlling

erosion. Overgrazing increases the runoff rate and the hazard of erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

616D2—Aureola sandy loam, 9 to 16 percent slopes, moderately eroded. This strongly sloping and moderately steep, well drained soil is on convex side slopes in the uplands. Areas range from about 5 to 20 acres in size and are elongated.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. It is mixed with streaks and pockets of yellowish brown subsoil material. The subsoil is about 15 inches thick. It is yellowish brown, friable loam and fine sandy loam. The substratum to a depth of about 60 inches is brownish yellow loamy fine sand.

Included with this soil in mapping are areas of soils that have a surface layer of channery fine sandy loam and small areas of soils that are 7 to 20 inches deep over sandstone bedrock. These soils make up less than 15 percent of the unit.

Permeability of this Aureola soil is moderate in the solum and rapid in the substratum. Runoff is rapid in cultivated areas. Available water capacity is moderate. The content of organic matter in the surface layer is about 1 to 2 percent. The substratum generally has a very low supply of available phosphorus and potassium. The soil is alkaline and does not need lime.

Many areas are used for pasture. Some are cultivated. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is highly susceptible to erosion if cultivated, and it is droughty. The erosion adversely affects crops because the layer of topsoil becomes even thinner. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

A cover of pasture plants is effective in controlling erosion. Overgrazing increases the runoff rate and the hazard of erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is VIe.

631—Limecreek silty clay loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on uplands. Areas range from about 2 to 12 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark brown silty clay loam about 7 inches thick. The subsoil is about 14 inches of mottled, brown, friable silty clay loam and clay loam. The substratum to a depth of about 60 inches or more is light yellowish brown silty clay loam and loam. In places the upper part of the subsoil is dark grayish brown.

Permeability is moderate, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 6 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. A tile drainage system is needed in some areas to help overcome the wetness and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

631B—Limecreek silty clay loam, 2 to 5 percent slopes. This gently sloping, deep, moderately well drained soil is on ridges and side slopes in the uplands. Areas range from about 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is very dark brown silty clay loam about 6 inches thick. The subsoil is about 12 inches of mottled, brown, friable silty clay loam and clay loam. The substratum to a depth of about 60 inches or more is light yellowish brown silty clay loam and loam. In places the upper part of the subsoil is dark grayish brown.

Included with this soil in mapping are small areas where weathered fossiliferous siltstone and shaly limestone material is at or near the surface. The soils in these areas are calcareous and have a high content of lime in the surface layer. They are in landscape positions similar to those of the Limecreek soil. They make up about 5 percent of the unit.

Permeability of this Limecreek soil is moderate, and

runoff is medium. Available water capacity is low. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard and the wetness may limit crop production. A tile drainage system is beneficial. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying material. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

631C—Limecreek silty clay loam, 5 to 9 percent slopes. This moderately sloping, deep, moderately well drained soil is on ridges and side slopes in the uplands. Areas range from about 2 to 8 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 5 inches thick. The subsoil is about 12 inches of mottled, brown, friable silty clay loam and clay loam. The substratum to a depth of about 60 inches or more is light yellowish brown silty clay loam and loam. In places the upper part of the subsoil is dark brown.

Included with this soil in mapping are small areas of Mottland soils. These soils are in landscape positions similar to those of the Limecreek soil. They are deeper to the residuum derived from fossiliferous siltstone and shaly limestone. They make up about 5 percent of the unit.

Permeability of this Limecreek soil is moderate, and runoff is medium. Available water capacity is low. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 4 to 5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Tilth is good, but the surface layer tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying material. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

651—Faxon silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in benchlike positions in the lower part of the uplands and on benches that overlie the Shell Rock Formation. It is subject to flooding. Areas range from about 3 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 10 inches thick. The subsoil is olive gray and olive, friable clay loam about 7 inches thick. Hard, fractured limestone bedrock is at a depth of about 25 inches. In some places the surface layer is calcareous. In other places the subsoil is dark grayish brown.

Permeability is moderate in the subsoil. It varies in the underlying bedrock depending on the amount of interbedding of shale in the Shell Rock Formation. Runoff is slow. Available water capacity is low or moderate. This soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. When drained, this soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Installing a drainage system is very difficult because of the moderate depth to bedrock. Measures

that help to control the runoff from higher elevations are needed.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIw.

662B—Mt. Carroll silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 3 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The subsoil is yellowish brown, friable silt loam about 36 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam. In some places the surface layer is thicker and darker. In other places it is thinner and light colored.

Permeability is moderate, and runoff is medium. Available water capacity is very high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIe.

697—Rocksan silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained, calcareous soil typically is in swales and flats in the uplands and in benchlike areas adjacent to the major drainageways. Areas range from 3 to more than 100 acres in size. They are irregularly shaped.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black silty clay loam about 8 inches thick. The subsoil is about 8 inches thick. It is mottled and friable. The upper part is olive gray loam, and the lower part is light olive brown sandy loam. The substratum to a depth of about 60 inches is brownish yellow and light yellowish brown loamy fine sand and mottled reddish brown and pale olive silty clay.

Included with this soil in mapping are small areas of soils that have sandstone at a depth of 40 to 60 inches and small areas of soils that have reddish silty clay at a depth of 30 to 50 inches. Included soils make up about 5 to 10 percent of the unit.

Permeability of this Rocksan soil is moderate in the subsoil and rapid in the substratum. Runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 6 percent. The subsoil has a very low supply of available phosphorous and potassium. The soil is alkaline and does not need lime. An excess of lime reduces the effects of fertilizer and herbicides on crops.

Most areas are cultivated. If drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Tile drains remove excess subsurface water. Draining some areas is difficult because suitable outlets are not available. Special care generally is needed to maintain good tilth in the surface layer. Cultivating when the soil is too wet causes compaction and results in the formation of clods. Chisel plowing increases the infiltration rate by making the surface more pervious to water. Returning crop residue to the soil or regularly adding other organic material helps to control soil blowing and prevent surface crusting and increases the infiltration rate. The high content of lime in the soil adversely affects the availability of plant nutrients. In some areas where soybeans are grown, applications of iron compounds may be needed.

The wetness and the excess amount of lime are the main limitations if this soil is used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate these limitations should be selected for planting.

The land capability classification is IIw.

713—Winneshiek silt loam, 30 to 40 inches to limestone, 0 to 2 percent slopes. This nearly level, well drained soil is on broad ridges in the uplands and on stream benches. Areas typically range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 24 inches thick. The upper part is brown, friable clay loam and sandy clay loam, and the lower part is brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 37 inches. In some places the depth to bedrock is less than 30 inches. In other places it is more than 40 inches.

Included with this soil in mapping are small areas of Racine soils. These soils are not underlain by limestone bedrock. They are in landscape positions similar to those of the Winneshiek soil. They make up about 5 to 10 percent of the unit.

Permeability of this Winneshiek soil is moderate, and runoff is slow. Available water capacity is moderate. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is, however, subject to droughtiness in years of below average rainfall. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture and increases the rate of water infiltration.

Overgrazing pasture plants causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Tree growth may be limited, however, because the available water capacity is moderate and root penetration may be restricted by the hard bedrock. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIs.

713B—Winneshiek silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas typically range from 5 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, friable clay loam and sandy clay loam, and the lower part is brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 33 inches. In some places the depth to bedrock is less than 30 inches. In other places it is more than 40 inches.

Included with this soil in mapping are small areas where limestone bedrock is near the surface or is exposed. These areas are near the base of side slopes. They make up less than 5 percent of the unit. Also included are small areas of Racine soils, which are not underlain by limestone bedrock. These soils are in landscape positions similar to those of the Winneshiek soil. They make up about 5 percent of the unit.

Permeability of this Winneshiek soil is moderate, and runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is, however, subject to erosion and is droughty in years of below average rainfall. The bedrock in the included areas hinders fieldwork. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The bedrock should be considered when terraces are designed and constructed. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture and increases the rate of water infiltration.

Overgrazing pasture plants causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Tree growth may be limited, however, because the available water capacity is moderate and root penetration may be restricted by the hard bedrock. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIe.

714B—Winneshiek silt loam, 20 to 30 inches to limestone, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas typically range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about

11 inches thick. The upper part is brown, friable clay loam and sandy clay loam, and the lower part is brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 24 inches. In some places the depth to bedrock is less than 20 inches. In other places it is more than 30 inches.

Included with this soil in mapping are small areas where limestone bedrock is near the surface or is exposed. These areas are near the base of side slopes. Inclusions make up less than 5 percent of the unit.

Permeability of this Winneshiek soil is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is, however, subject to erosion and is very droughty in years of below average rainfall. The bedrock in the included areas hinders fieldwork. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is not well suited to terracing because of the depth to bedrock. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The pasture can be easily overstocked, however, because the available water capacity is low. Overgrazing causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Tree growth may be limited, however, because the available water capacity is low and root penetration may be restricted by the bedrock. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIe.

714C—Winneshiek silt loam, 20 to 30 inches to limestone, 5 to 9 percent slopes. This moderately sloping, well drained soil is on ridges and side slopes in the uplands. Areas typically range from 5 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is about 11 inches thick. The upper part is brown, friable clay loam and sandy clay loam, and the lower part is brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 22 inches. In some places the surface layer is very dark brown loam. In other places the depth to bedrock is less than 20 inches.

Included with this soil in mapping are small areas where limestone bedrock is near the surface or is exposed. These areas are near the base of side slopes. They make up about 3 to 8 percent of the unit.

Permeability of this Winneshiek soil is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are used for pasture. Some are cultivated. This soil is moderately suited to corn, soybeans, and small grain and is suited to grasses and legumes for hay and pasture. It is subject to erosion and is very droughty in years of below average rainfall. The bedrock in the included areas hinders fieldwork. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is not well suited to contour farming or terracing because slopes generally are short and irregular and the bedrock is only 20 to 30 inches from the surface. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The pasture can be easily overstocked, however, because the available water capacity is low. Overgrazing causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Tree growth may be limited, however, because the available water capacity is low and root penetration may be restricted by the hard bedrock. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

725—Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on alluvial terraces. Areas range from 5 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray loam about 9 inches thick. The subsurface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 21 inches thick. The upper part is brown, mottled,

friable clay loam, the next part is brown, mottled, friable sandy clay loam, and the lower part is light olive brown, very friable loamy sand. The substratum to a depth of about 60 inches is multicolored sand and gravelly sand.

Included with this soil in mapping are small areas of the poorly drained Marshan soils in slight depressions. Tillage commonly is delayed in this unit unless these soils are drained. These soils make up about 5 percent of the unit.

Permeability of this Hayfield soil is moderate in the subsoil and rapid in the substratum. Runoff is slow. Available water capacity is low. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. The water table is moderately high during spring but drops rapidly during the growing season. In some areas a tile drainage system is beneficial during wet periods, but installing the tile is difficult because of the loose, water-bearing sand and gravel. If cultivated crops are grown, soil blowing is a hazard in the areas that are plowed in the fall and are not protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. A few small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIs.

726—Hayfield loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on alluvial terraces. Areas range from 5 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray loam about 9 inches thick. The subsurface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 29 inches thick. The upper part is brown, mottled, friable clay loam, the next part is brown, mottled, friable sandy clay loam, and the lower part is light olive brown, very friable loamy sand. The substratum to a depth of about 60 inches is multicolored sand and gravelly sand.

Included with this soil in mapping are small areas of the poorly drained Marshan soils in slight depressions. Tillage commonly is delayed in this unit unless these soils are drained. These soils make up about 5 percent of the unit.

Permeability of this Hayfield soil is moderate in the subsoil and rapid in the substratum. Runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation during periods of below normal rainfall. The water table is moderately high during spring but drops rapidly during the growing season. In some areas a tile drainage system is beneficial during wet periods, but installing the tile is difficult because of the loose, water-bearing sand and gravel. If cultivated crops are grown, soil blowing is a hazard in the areas that are plowed in the fall and are not protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. A few small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIs.

733—Calco silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained, calcareous soil is on flats and in swales on bottom land. It is subject to

flooding. Areas range from 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black silty clay loam about 39 inches thick. The substratum to a depth of about 60 inches is very dark gray silty clay loam. In places the surface layer is covered with about 12 inches of recently deposited silt loam.

Permeability is moderate, and runoff is slow. Available water capacity is very high. This soil has a seasonal high water table. The content of organic matter in the surface layer is about 5 to 7 percent. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The soil is alkaline and does not need lime. An excess of lime reduces the effects of fertilizer and herbicides on crops.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce wetness and provide good aeration and a deep root zone for plants. Tile drains work well if they are properly installed and if an adequate outlet is available. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration. The high content of lime in the soil adversely affects the availability of plant nutrients. In some areas where soybeans are grown, applications of iron compounds may be needed.

If this soil is used for pasture, only the species that can tolerate the excess amount of lime should be selected for planting. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces forage production.

The wetness and the excess amount of lime are the main limitations if this soil is used for the trees and shrubs grown as windbreaks or ornamental plantings. Only the species that can tolerate these limitations should be selected for planting.

The land capability classification is IIw.

761—Franklin silt loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on divides and slightly convex side slopes in the uplands. Areas range from 5 to 150 acres in size and are irregularly shaped.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is grayish brown, mottled, friable silty clay loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam.

Included with this soil in mapping are small areas of Donnan soils, which have clayey material at a depth of 2 to 4 feet. These soils are in landscape positions similar to those of the Franklin soil. They are very slowly permeable in the lower part of the profile. They make up less than 5 percent of the unit.

Permeability of this Franklin soil is moderate, and runoff is slow. Available water capacity is high. The soil has a seasonal high water table. Water moves more rapidly through the upper horizons, which are more permeable, than through the lower horizons, which are less permeable. As a result, a temporary perched water table develops when the water reaches the less permeable horizons. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. A few small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is I.

771—Waubeek silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on low ridges and flats in the uplands. Areas range from 2 to more than 10 acres in size. They are irregularly shaped.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The subsoil is about 32 inches thick. The upper part is

brown, friable silty clay loam and silt loam, and the lower part is brown, friable and firm loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places the upper part of the subsoil is dark grayish brown. In other places it has a higher content of sand.

Permeability is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is I.

771B—Waubeek silt loam, 2 to 5 percent slopes. This nearly level, well drained soil is on ridges and flats in the uplands. Areas range from 2 to more than 10 acres in size. They are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The subsoil is about 32 inches thick. The upper part is brown, friable silty clay loam and silt loam, and the lower part is brown, friable and firm loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places the surface layer is thinner and light colored. In other places the upper part of the subsoil is higher in content of sand.

Permeability is moderate, and runoff is slow. Available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. If terraces are built, cuts should not expose the less productive underlying glacial material. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Some small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIe.

776C—Lilah sandy loam, 3 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on uplands and alluvial terraces. Areas range from 2 to 15 acres in size and generally are long and narrow.

Typically, the surface layer is very dark gray sandy loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is dark brown and dark yellowish brown, very friable gravelly sandy loam and gravelly loamy sand, and the lower part is yellowish brown and dark yellowish brown, very friable gravelly sand. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown sand containing about 10 percent gravel. In some places the surface layer is loamy sand. In other places it is brown sandy loam.

Permeability is very rapid, and runoff is slow. Available water capacity is very low. The content of organic matter in the surface layer is about 1 to 2 percent. The surface layer generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Some areas are cultivated. Some small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small

grain and to grasses and legumes for hay and pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. Soil blowing is a hazard if cultivated crops are grown. The sandy windblown material sometimes damages newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration and the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the plant cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture in good condition.

This soil is moderately suited to trees. A few small areas support native hardwoods. The seedling mortality rate is severe because of the droughtiness. Supplemental water is needed in some areas. The hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IVs.

777—Wapsie loam, 0 to 2 percent slopes. This nearly level, well drained soil is on alluvial terraces. Areas range from 2 to more than 100 acres in size. They are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 7 inches thick. The subsoil is about 14 inches thick. The upper part is brown, friable loam and sandy clay loam, and the lower part is dark yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown loamy sand and gravelly sand.

Included with this soil in mapping are small areas of soils that have a surface layer of loamy sand or gravelly loamy sand. These soils have a lower content of organic matter and a lower available water capacity than the Wapsie soil. They are on the slightly higher mounds. They make up about 5 percent of the unit.

Permeability of this Wapsie soil is moderate in the upper part of the profile and very rapid in the substratum. Runoff is slow. Available water capacity is low or moderate. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Soil blowing is a hazard in areas that are plowed in the fall and are not protected. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is moderately suited to trees. A few areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIs.

777B—Wapsie loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on alluvial terraces. Areas range from 5 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil is about 13 inches thick. The upper part is brown, friable loam and sandy clay loam, and the lower part is dark yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown loamy sand and gravelly sand.

Included with this soil in mapping are small areas of soils that have a surface layer of sandy loam. These soils are more droughty than the Wapsie soil. They are near the edge of benches. They make up less than 5 percent of the unit.

Permeability of this Wapsie soil is moderate in the upper part of the profile and very rapid in the lower part. Runoff is medium. Available water capacity is low or moderate. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated. Some are used for pasture or woodland. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, soil blowing and water erosion are hazards. The soil is droughty, especially in years of average or below average rainfall. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves moisture. Contour farming is difficult because the slopes generally are short and irregular. The soil is not well suited to terracing because of the coarse textured material in the substratum. Good tilth generally can be easily maintained. Returning crop residue to the soil conserves moisture.

A cover of pasture plants or hay helps to control erosion. The pasture can be easily overstocked, however, because the available water capacity is low or moderate. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is moderately well suited to trees. Tree growth may be limited, however, because the available water capacity is low or moderate and root penetration may be restricted by the gravelly sand in the substratum. Seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIe.

777C—Wapsie loam, 5 to 9 percent slopes. This moderately sloping, well drained soil typically is on alluvial terraces. In some areas it is in the uplands. Areas typically range from 3 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 12 inches thick. The upper part is brown, friable loam and sandy clay loam, and the lower part is dark yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown loamy sand and gravelly sand. In places the surface layer is lighter colored.

Included with this soil in mapping are small areas of soils that have a surface layer of sandy loam. These soils are more droughty than the Wapsie soil. They are near the edge of benches. They make up less than 5 percent of the unit.

Permeability of this Wapsie soil is moderate in the upper part of the profile and very rapid in the lower part. Runoff is medium. Available water capacity is low or moderate. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated. Some are used for pasture or woodland. This soil is moderately suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a hazard. The soil is droughty, especially in years of average or below average rainfall. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves moisture. Contour farming is difficult because the slopes generally are short and irregular. The soil is not well suited to terracing because of the coarse textured material in the substratum. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture, improves fertility, and helps to maintain good tilth.

A cover of pasture plants or hay helps to control erosion. The pasture can be easily overstocked, however, because the available water capacity is low or moderate. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is moderately well suited to trees. Tree growth may be limited, however, because the available water capacity is low or moderate and root penetration may be restricted by the gravelly sand in the substratum. Seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

781B—Lourdes loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on slightly convex ridge crests and side slopes in the uplands. Areas range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is about 41 inches thick. The upper part is brown, friable loam, the next part is yellowish brown, firm clay loam, and the lower part is mottled yellowish brown and grayish brown, very firm clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, calcareous clay loam. In some places the subsurface layer is about 8 inches thick. In other places yellowish brown subsoil material is mixed into the surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Riceville soils. These soils

are in the lower landscape positions. They make up less than 5 percent of the unit.

Permeability of this Lourdes soil is moderately slow, and runoff is medium. Available water capacity is high. The soil has a perched seasonal high water table. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Root development is somewhat restricted below a depth of about 2 feet by the compact clay loam glacial till.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated areas. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. Good tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

The hazard of erosion and the wetness are the major management concerns. Overcoming these limitations is difficult because the practices needed to do so conflict to some extent. This soil is well suited to contour farming and terracing because the slopes are uniform. Contour farming and terracing, which help to control erosion, also slow the movement of surface water. As a result, more water infiltrates the soil. The additional water increases the need for a drainage system, especially during wet periods. A combination of terracing and tiling may be needed. If the soil is terraced, the amount of subsoil that is exposed should be kept to a minimum because of the low fertility and unfavorable tilth of the subsoil.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases the runoff rate, and results in deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

781C—Lourdes loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on convex ridge crests and side slopes in the uplands. Areas range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 2 inches thick. The subsoil is about 33 inches thick. The upper part is brown, friable loam, the next part is yellowish brown, firm clay loam, and the lower part is mottled yellowish brown and grayish brown, very firm clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, calcareous clay loam. In some places the subsurface layer is about 8 inches thick. In other places yellowish brown subsoil material is mixed into the surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Riceville soils. These soils are in the lower landscape positions. They make up less than 5 percent of the unit.

Permeability of this Lourdes soil is moderately slow, and runoff is medium. Available water capacity is high. The soil has a perched seasonal high water table. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Root development is somewhat restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated areas. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. Good tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

The hazard of erosion and the wetness are the major management concerns. Overcoming these limitations is difficult because the practices needed to do so conflict to some extent. This soil is well suited to contour farming and terracing because the slopes are uniform. Contour farming and terracing, which help to control erosion, also slow the movement of surface water. As a result, more water infiltrates the soil. The additional water increases the need for a drainage system, especially during wet periods. A combination of terracing and tiling may be needed. If the soil is terraced, the amount of subsoil that is exposed should be kept to a minimum because of the low fertility and unfavorable tilth of the subsoil.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases the runoff rate, and results in deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

781C2—Lourdes loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex ridge crests

and side slopes in the uplands. Areas range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. It is mixed with streaks and pockets of yellowish brown subsoil material. The subsoil is about 30 inches thick. The upper part is yellowish brown, firm clay loam, and the lower part is mottled yellowish brown and grayish brown, very firm clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, calcareous clay loam. In places the surface layer is black loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Riceville soils. These soils are in the lower landscape positions. They make up less than 5 percent of the unit.

Permeability of this Lourdes soil is moderately slow, and runoff is medium. Available water capacity is high. The soil has a perched seasonal high water table. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Root development is somewhat restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated areas. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. Good tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

The hazard of erosion and the wetness are the major management concerns. Overcoming these limitations is difficult because the practices needed to do so conflict to some extent. This soil is well suited to contour farming and terracing because the slopes are uniform. Contour farming and terracing, which help to control erosion, also slow the movement of surface water. As a result, more water infiltrates the soil. The additional water increases the need for a drainage system, especially during wet periods. A combination of terracing and tiling may be needed. If the soil is terraced, the amount of subsoil that is exposed should be kept to a minimum because of the low fertility and unfavorable tilth of the subsoil.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases the runoff rate, and results in deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

782—Donnan loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained and moderately well drained soil is on broad ridge crests and high flats in the uplands. Areas range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil to a depth of about 60 inches is mottled. The upper part is dark grayish brown and light olive brown, friable clay loam, the next part is light olive brown, grayish brown, and light brownish gray, mottled, friable loam and clay loam, and the lower part is very dark gray and dark gray, very firm silty clay.

Included with this soil in mapping are small areas of Oran soils. These soils are in landscape positions similar to those of the Donnan soil. Also included are areas of Floyd and Schley soils along waterways. These soils have less clay in the subsoil than the Donnan soil. Included soils make up less than 10 percent of the unit.

Permeability of this Donnan soil is moderate in the upper part of the profile and very slow in the lower part. Runoff is slow. Available water capacity is high. The soil has a perched seasonal high water table. The shrink-swell potential is moderate or high in the lower part of the profile. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Many small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to legumes for hay. It is better suited to grasses and legumes for pasture. The wetness is a limitation. Tile drainage systems should be designed so that they intercept water. Because of the very slow permeability in the clayey part of the subsoil, installing tile is difficult and all areas of this soil cannot be drained satisfactorily. Tile lines generally should be spaced more closely together in this soil than in more permeable soils. If possible, tile drains should be installed above the clayey part of the subsoil. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent surface crusting.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too

wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is moderately suited to trees. A few small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate is slight.

The land capability classification is IIw.

782B—Donnan loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained and moderately well drained soil is on ridges and side slopes in the uplands. Areas range from 2 to 15 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsoil to a depth of about 60 inches is mottled. The upper part is dark grayish brown and light olive brown, friable clay loam, the next part is light olive brown, grayish brown, and light brownish gray, friable loam and clay loam, and the lower part is very dark gray and dark gray, very firm silty clay.

Included with this soil in mapping are small areas of Oran soils on ridges and side slopes and areas of Floyd and Schley soils along waterways. These soils have less clay in the subsoil than the Donnan soil. They make up less than 10 percent of the unit.

Permeability of this Donnan soil is moderate in the upper part of the profile and very slow in the lower part. Runoff is slow. Available water capacity is high. The soil has a perched seasonal high water table. The shrink-swell potential is moderate or high in the lower part of the profile. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Many small areas of this soil are cropped along with larger areas of adjacent soils that are better suited to crops. This soil is moderately suited to corn, soybeans, and small grain and to legumes for hay. It is better suited to grasses and legumes for pasture. If cultivated crops are grown, erosion is a hazard unless the surface is protected by a plant cover. The wetness is an additional limitation. Measures that help to control erosion tend to increase the wetness because they retard the movement of surface water. As a result, a combination of terraces and a tile drainage system is needed. In areas where a perched water table and seepage on side slopes are the major problems, the tile drainage system should be designed so that it intercepts water. Because of the very slow permeability in the clayey part of the subsoil, installing tile is difficult and all areas of this soil cannot be drained satisfactorily. If possible, tile drains should be installed above the clayey part of the subsoil. If terraces are built, cuts should not expose the less productive, clayey part of the subsoil. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent surface crusting.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is moderately suited to trees. A few small areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. The seedling mortality rate is slight. In areas where the trees are planted or harvested, the hazard of erosion also is slight.

The land capability classification is IIe.

783B—Cresco loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, convex ridge crests and side slopes in the uplands. Areas range from 2 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black and very dark grayish brown loam about 8 inches thick. The subsoil is about 24 inches thick. The upper part is brown, friable clay loam, and the lower part is light olive brown, mottled, very firm clay loam. The substratum to a depth of about 60 inches is grayish brown, mottled, calcareous clay loam. In places the surface layer is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd and Protivin soils along waterways. These soils are in the less sloping areas. They make up 5 to 8 percent of the unit.

Permeability of this Cresco soil is moderate in the loamy overburden and moderately slow in the underlying glacial till. Runoff is medium. Available water capacity is high. The soil has a perched seasonal high water table. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Root development is somewhat restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas are cultivated. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. A combination of terracing and tiling or a conservation tillage system and tiling may be needed to help control erosion and reduce wetness. If terraces are built, cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

783C—Cresco loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on short, slightly convex side slopes in the uplands. Areas range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 24 inches thick. The upper part is brown and yellowish brown, friable clay loam, and the lower part is yellowish brown, mottled, very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd and Protivin soils along waterways. These soils are in the less sloping areas. They make up 2 to 5 percent of the unit.

Permeability of this Cresco soil is moderate in the loamy overburden and moderately slow in the underlying glacial till. Runoff is medium. Available water capacity is high. The soil has a perched seasonal high water table. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Root development is somewhat restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated areas. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

The hazard of erosion and the wetness are the major management concerns. Overcoming these limitations is difficult because the practices needed to do so conflict to some extent. This soil is well suited to contour farming and terracing because the slopes are uniform. Contour farming and terracing, which help to control erosion, also slow the movement of surface water. As a result, more water infiltrates the soil. The additional water increases the need for a drainage system. A combination of terracing and tiling may be needed. If the soil is terraced, exposure of subsoil should be held to a minimum because of the low fertility and unfavorable tilth of the subsoil.

A cover of pasture plants or hayland helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, increases the runoff rate, and results in deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

784B—Riceville silt loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on uplands. Areas range from 2 to more than 40 acres in size. They are irregularly shaped.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 46 inches thick. The upper part is dark grayish brown, mottled, friable clay loam, and the lower part is mottled light olive brown, yellowish brown, and gray, firm and very firm clay loam. The substratum to a depth of about 60 inches is mottled gray and yellowish brown clay loam. In some places the upper part of the subsoil is brown or yellowish brown. In other places the surface layer and subsurface layer are black clay loam or loam.

Included with this soil in mapping are small areas of the poorly drained Clyde and Jameston soils along waterways. These soils make up about 5 to 10 percent of the unit.

Permeability of this Riceville soil is moderate in the upper part of the profile and moderately slow in the lower part. Runoff is medium. Available water capacity is high. The soil has a seasonal high water table. The

content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. A combination of terraces and drainage tile is needed in some areas to help control erosion and reduce wetness. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

789—Oakton loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low mounds or dunelike uplands. Areas range from 2 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is very dark gray loam about 9 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is 34 inches thick. The upper part is grayish brown and olive brown, friable loam, the next part is mottled, light olive brown, very friable fine sandy loam, and the lower part is mottled, light olive brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is light olive brown sand. In some areas the surface layer is darker and thicker. In other small areas the subsoil is brown.

Permeability is moderate in the subsoil and rapid in the substratum. Runoff is slow. Available water capacity is moderate. This soil has a seasonal high water table. The content of organic matter in the surface layer is about 3 to 4 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in years of below average rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

Overgrazing or grazing when the soil is too wet causes surface compaction and results in deterioration of tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. A few small areas support native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed. Competing vegetation can be controlled by careful site preparation or by spraying, cutting, or girdling. No hazards or limitations affect planting and harvesting.

The land capability classification is IIs.

797—Jameston silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in swales and drainageways in the uplands. Areas typically range from 2 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black silty clay loam and very dark gray and dark olive gray, mottled silty clay loam about 12 inches thick. The subsoil is about 33 inches thick. The upper part is olive gray and olive, mottled, friable silty clay loam, the next part is mottled olive gray, yellowish brown, and light olive brown, very firm clay loam, and the lower part is mottled olive gray, yellowish brown, and light olive brown, very firm, calcareous clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous clay loam. In some places the lower part of the subsoil and the substratum are firm and have a lower content of clay. In other places they are friable or firm, are stratified, and have a lower content of clay.

Permeability is slow, and runoff is slow. Available water capacity is high. This soil has a seasonal high water table. It also receives runoff from adjacent slopes. The content of organic matter in the surface layer is about 7 to 8 percent. The subsoil generally has a very low supply of available phosphorus and potassium. Root development is somewhat restricted below a depth of about 2 feet by the compact, clay loam glacial till.

Most areas are cultivated. This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally is easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. Drainage systems should be designed to intercept laterally moving water from soils that are upslope. Because of the slow

permeability in the subsoil, proper depth and spacing of the tile are very important.

Undrained areas are better suited to pasture than to other uses. If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction, increases the runoff rate, and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

798B—Protivin clay loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on uplands. Areas range from 2 to more than 100 acres in size. They are irregularly shaped.

Typically, the surface layer is black clay loam about 7 inches thick. The subsurface layer is black and very dark grayish brown clay loam and loam about 10 inches thick. The subsoil is about 25 inches thick. The upper part is dark grayish brown, friable loam, the next part is mottled dark gray and strong brown, very firm clay loam, and the lower part is mottled gray and light olive brown, calcareous, very firm clay loam. The substratum to a depth of about 60 inches is mottled olive and olive brown, calcareous clay loam. In places the upper part of the subsoil is brown or dark brown.

Included with this soil in mapping are small areas of the poorly drained Clyde and Jameston soils along waterways. These soils make up about 5 to 10 percent of the unit.

Permeability of this Protivin soil is moderate in the upper part of the profile and moderately slow in the lower part. Runoff is medium. Available water capacity is high. The soil has a seasonal high water table. The content of organic matter in the surface layer is about 5.5 to 6.5 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. A combination of terraces and drainage tile is needed in some areas to help control erosion and reduce wetness. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Undrained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

806B—Whalan silt loam, 1 to 5 percent slopes. This gently sloping, well drained soil is on uplands. Areas typically range from about 3 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 18 inches thick. The upper part is yellowish brown, friable silt loam, the next part is yellowish brown, firm clay loam, and the lower part is mottled strong brown and grayish brown, firm clay. Fractured limestone bedrock is at a depth of about 29 inches.

Included with this soil in mapping are small areas where limestone bedrock is near the surface or is exposed. These areas make up less than 5 percent of the unit.

Permeability of this Whalan soil is moderate, and runoff is medium. Available water capacity is low. The content of organic matter in the surface layer is about 2 to 3 percent. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. This soil is moderately suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and contour farming help to prevent excessive soil loss. The soil is poorly suited to terracing because the limestone bedrock is so close to the surface. If terraces are built, cuts should not expose the bedrock in terrace channels. Droughtiness is a limitation in most years unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is moderately well suited to trees. Some areas support native hardwoods. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling.

The seedling mortality rate and the hazards and limitations that affect planting and harvesting are slight.

The land capability classification is IIe.

936—Coland-Spillville complex, 0 to 2 percent slopes. These deep, nearly level, poorly drained and moderately well drained soils are on flood plains bordering streams. They are subject to flooding. Many areas have shallow bayous and swales that frequently pond water or remain wet after flooding. Areas typically range from about 5 to 50 acres in size and are irregularly shaped. The Coland soil makes up about 50 percent of the map unit, and the Spillville soil makes up 50 percent. These soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the surface layer of the Coland soil is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 25 inches thick. The substratum to a depth of about 60 inches is black clay loam grading to olive loam with increasing depth. In some places the surface layer is silty clay loam. In other places the soil is loam throughout.

Typically, the surface layer of the Spillville soil is black loam about 12 inches thick. The subsurface layer is black and very dark grayish brown, friable loam about 35 inches thick. The substratum to a depth of about 60 inches is dark brown loam.

Permeability of these Coland and Spillville soils is moderate, and runoff is slow. Available water capacity is high. The Coland soil has a seasonal high water table at a depth of 1 to 3 feet. The Spillville soil has a seasonal high water table at a depth of 3 to 5 feet. The content of organic matter is about 5 to 7 percent in the surface layer of the Coland soil and 4 to 5 percent in the surface layer of the Spillville soil. The subsoil of the Coland soil generally has a medium supply of available phosphorus and a very low supply of available potassium. The subsoil of the Spillville soil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. If these soils are drained and protected from flooding, they are suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Locating adequate tile outlets is difficult in some areas. A surface drainage system is needed in many areas. Plant species that can tolerate the flooding may need to be selected for planting.

The land capability classification is IIw.

976—Raddle silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces on the west side of the Shell Rock River. Areas range from 10 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is black, very dark brown, and dark brown silt loam about 16 inches thick. The subsoil to a depth of about 60 inches is brown and yellowish brown, friable silt loam. In some places the subsurface layer is thinner. In other places the substratum is sandy loam or loamy sand and is at a depth of 50 to 60 inches.

Permeability is moderate, and runoff is slow. Available water capacity is very high. The content of organic matter in the surface layer is about 3.5 to 4.5 percent. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable but tends to crust after hard rains and to puddle if tilled when wet.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to intensive cropping of corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

If this soil is used for pasture, overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

1537—Du Page-Shellwood-Calco complex, channeled, 0 to 3 percent slopes. These deep, nearly level, moderately well drained and poorly drained, calcareous soils are on flood plains bordering streams. They are subject to flooding. Most areas of these soils are dissected by old stream channels. The channels are continually wet because water stands in low areas after flooding. Areas typically range from about 5 to more than 100 acres in size. They are long and narrow. Generally, the Du Page soil makes up about 40 percent of the map unit, the Shellwood soil makes up 35 percent, and the Calco soil makes up 25 percent. In places as much as 10 percent of the unit is calcareous overwash and sandbars. The soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the surface layer of the Du Page soil is black loam about 8 inches thick. The subsurface layer is black, friable loam about 21 inches thick. The subsoil is black loam about 15 inches thick. The substratum to a depth of about 60 inches is very dark brown loam.

Typically, the surface layer of the Shellwood soil is black sandy loam about 9 inches thick. The subsurface layer is black sandy loam about 47 inches thick. The subsoil to a depth of about 60 inches is very dark brown sandy loam.

Typically, the surface layer of the Calco soil is black silty clay loam about 9 inches thick. The subsurface layer is black silty clay loam about 39 inches thick. The substratum to a depth of about 60 inches is very dark gray silty clay loam. In places the soil is loam throughout.

Permeability of these soils is moderate, and runoff is slow. Available water capacity is high in the Du Page and Calco soils and moderate in the Shellwood soil. The Du Page and Shellwood soils have a seasonal high water table at a depth of 3 to 5 feet. The Calco soil has a seasonal high water table at the surface or within a depth of 3 feet. The content of organic matter is about 4 to 6 percent in the surface layer of the Du Page soil, 2 to 3 percent in the surface layer of the Shellwood soil, and 5 to 7 percent in the surface layer of the Calco soil. The subsoil of the Du Page and Shellwood soils generally has a very low supply of available phosphorus and potassium. The subsoil of the Calco soil generally has a medium supply of available phosphorus and a very low supply of available potassium. The high content of lime in all of the soils adversely affects the availability of plant nutrients.

Nearly all areas are in permanent pasture or are used as woodland. These soils generally are not suited to cultivated crops. In some of the higher areas, the soils can be protected from flooding by dikes. These areas can then be leveled to fill in old stream channels and used for cultivated crops. Most areas are best used for permanent pasture or as wildlife habitat.

The land capability classification is Vw.

1936—Spillville-Hanlon-Coland complex, channeled, 0 to 3 percent slopes. These deep, nearly level, moderately well drained and poorly drained soils are on flood plains bordering streams (fig. 7). They are subject to flooding. Most areas of these soils are dissected by old stream channels. The channels are continually wet because water stands in low areas after flooding. Areas typically range from about 5 to more than 100 acres in size. They are long and narrow. Generally, the Spillville soil makes up about 40 percent of the map unit, the Hanlon soil makes up 35 percent, and the Coland soil makes up 25 percent. In places, particularly along the Little Cedar River, as much as 10 percent of the unit is sandbars. The soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the surface layer of the Spillville soil is black loam about 12 inches thick. The subsurface layer is black and very dark grayish brown, friable loam about 35 inches thick. The substratum to a depth of about 60 inches is dark brown loam.

Typically, the surface layer of the Hanlon soil is black fine sandy loam about 12 inches thick. The subsurface layer is fine sandy loam and loamy fine sand about 36 inches thick. The upper part is very dark brown, the next part is very dark grayish brown, and the lower part is dark brown. The subsoil to a depth of about 60 inches is brown sand.

Typically, the surface layer of the Coland soil is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 25 inches thick. The substratum to a depth of about 60 inches is black clay loam grading to olive loam. In some places the surface layer is silty clay loam. In other places the soil is loam throughout.

Permeability of these soils is moderate, and runoff is slow. Available water capacity is high. The Spillville and Hanlon soils have a seasonal high water table at a depth of 3 to 5 feet. The Coland soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 4 to 5 percent in the surface layer of the Spillville soil, 2 to 3 percent in the surface layer of the Hanlon soil, and 5 to 7 percent in the surface layer of the Coland soil. The subsoil of the Spillville and Hanlon soils generally has a very low supply of available phosphorus and potassium. The subsoil of the Coland soil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Nearly all areas are in permanent pasture or are used as woodland. These soils generally are not suited to cultivated crops. In some of the higher areas, the soils can be protected from flooding by dikes. These areas can then be leveled to fill in old stream channels and used for cultivated crops. Most areas are best used for permanent pasture or as wildlife habitat.

The land capability classification is Vw.

4000—Urban land. This map unit is on nearly level to gently sloping uplands and terraces in urban and industrial areas. The areas range from 4 to 100 acres in size and are rectangular or irregularly shaped.

This map unit is covered by streets, parking lots, buildings, shopping centers, and other structures that obscure or alter the soils so that identification of the soil series is not feasible. In many areas the structures are built on cut or fill material that ranges from 2 to 4 feet or more in thickness. Most areas are drained by sewer systems, gutters, and drainage tile.

No land capability classification is assigned.

5010—Pits, sand and gravel. This map unit dominantly is on stream benches, but in some areas it is in the uplands. Many of the pits are no longer being mined. Areas range from less than 1 acre to more than

Figure 7.—An area of Spillville-Hanlon-Coland complex, channeled, 0 to 3 percent slopes, bordering a stream.

40 acres in size. They generally are square or rectangular.

Typically, available water capacity is low or very low in the soil material. As a result, the material tends to be droughty during much of the growing season. In most areas it has a seasonal high water table. Low areas are ponded during wet periods. Stones and cobbles are common on the surface.

Most of the inactive pits support a few weeds and small trees. Some have been used as refuse dumps. The pits can be developed for wildlife or recreational uses. The trees and shrubs that can withstand the droughtiness should be selected for planting.

No land capability classification is assigned.

5030—Pits, limestone quarry. This map unit consists of pits from which limestone bedrock has been quarried, primarily for use in road construction and as agricultural lime. The pits are often 30 feet or more deep and are surrounded by piles of spoil 15 feet or more high. Areas range from a few acres to 40 acres in size. They are irregularly shaped. Some areas contain water from a few feet to many feet deep and have steep sides.

The spoil surrounding the pits varies in texture but generally is loamy and contains varying amounts of limestone fragments. It is derived from glacial till, eolian material, or a mixture of glacial till and eolian material. In some areas it has been leveled and smoothed, but in

other areas it is very uneven. In the level areas grasses or trees grow reasonably well.

The quarries are well suited to wildlife habitat. Those containing water could support fish. Because of the steepness of the sides and the variable depth of the water, however, they could be dangerous as sites for recreation and wildlife habitat. Onsite investigation is needed to determine the hazard.

No land capability classification is assigned.

5040—Orthents, loamy. These nearly level to strongly sloping soils are used as borrow areas for construction. In some places the original soil material has been removed to a depth of 5 to 20 feet or more. In other places 4 to 10 inches of topsoil has been redistributed, commonly in an uneven pattern. The soils range from excessively drained to somewhat poorly drained, depending on the kind of material from which the soils were derived and the extent to which the borrow area is restored. Areas typically range from 2 to 10 acres in size and are irregularly shaped.

Typically, the upper 60 inches of these soils is yellowish brown, friable and firm loam. In many areas cobbles and pebbles are common on the surface. In some places the soil material is sandy loam. In other places the soil material at the surface is very dark gray or dark brown.

Included with these soils in mapping are small areas of sand. Also included are a few areas formerly used as dumps or landfills that have been covered.

Permeability varies in the Orthents, depending on the texture and density of the soil material. Runoff is slow to rapid. Available water capacity is moderate or low. The soil material that was once buried 5 to 20 feet or more beneath the surface has less pore space and a higher density than the original surface layer. It has not been appreciably affected by the processes of soil formation, such as freezing and thawing. The content of organic matter is very low unless the topsoil has been redistributed throughout the area. As a result, preparing a good seedbed is difficult and drought is a hazard. In most areas these soils have a very low supply of available phosphorus and potassium.

These soils are better suited to small grain and to grasses and legumes for hay and pasture than to row crops. They are suited to row crops only in some areas where the topsoil has been redistributed. Corn and soybeans are grown in these areas. If cultivated crops are grown, erosion is a moderate or severe hazard in the more sloping areas. A system of conservation tillage that disturbs the soil as little as possible and leaves crop residue on the surface helps to control erosion and stabilize the soils.

No land capability classification is assigned to these soils.

5060—Pits, clay. This map unit consists of pits from which shale has been mined for use in brick and tile manufacturing. The only area in Floyd County where shale has been mined is in the area just west of Rockford.

Clay is no longer being mined, and the pits have been abandoned. Vegetation is growing with varied success on the mine spoil. The larger, deeper pits contain permanent ponds.

No land capability classification is assigned.

Prime Farmland

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

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

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

About 292,947 acres in Floyd County, or 91 percent of the total acreage, meets the soil requirements for prime farmland. Nearly all of this prime farmland is used for crops. The crops grown on this land, mainly corn

and soybeans, account for most of the county's total agricultural income each year.

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

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

Some soils that have a seasonal high water table qualify as prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help 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 woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

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

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

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

Crops and Pasture

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

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

In 1985, about 265,000 acres, or 82 percent of the total land area, was farmed in Floyd County. This acreage did not include pasture or agricultural land that was enrolled in the government set-aside program. Of the 265,000 acres, about 247,000 acres was planted to corn and soybeans. Most of the remaining acreage was planted to oats or grass-legume hay. Most of the soils in permanent pasture are not used as cropland because they are too wet or steep or because they have outcroppings of limestone bedrock that make them unsuited to cultivated crops.

Good land use should be based on the properties and capabilities of the soils. The paragraphs that follow describe the management concerns in the areas of the county used for crops and pasture.

Water erosion is a major concern on more than 6 percent of the cropland and pasture in the county. The hazard of erosion is influenced by the slope of the land, the texture and structure of the soil, rainfall, the amount and type of plant cover, and tillage practices. The major soils in the county on which erosion-control practices are needed are the Bassett, Lourdes, Kenyon, Ostrander, and Racine soils.

The loss of soil through erosion is damaging for several reasons. Erosion results in the loss of organic matter, nutrients, and water in the soils; the formation of gullies on side slopes; deterioration of soil tilth; and pollution of streams. Loss of the surface layer through erosion decreases productivity because the subsoil is mixed into the plow layer in some soils, such as the Bassett, Kenyon, and Lourdes soils, and because the

rooting depth is reduced in others, such as the Emeline, Rockton, Wapsie, Whalan, and Winneshiek soils. Erosion also reduces the productivity of droughty soils, such as the Burkhardt, Chelsea, Dickinson, Flagler, Lilah, and Sparta soils.

Erosion can cause pollution of streams and lakes by sediments and chemicals. By controlling erosion, water quality of streams and lakes can be improved for municipal and recreational uses and for fish and wildlife.

Preparing a good seedbed and tilling are difficult in many areas of eroded soils because the original friable surface layer is eroded away and the less fertile subsoil is exposed. The moderately eroded Bassett and Lourdes soils become hard and cloddy if worked when wet.

Measures that control erosion provide a protective cover, which reduces the runoff rate and increases the rate of water infiltration. A cropping system that keeps a plant cover on the surface for extended periods can hold soil losses to an amount that does not reduce the productive capacity of the soil. On livestock farms where some of the acreage is used as hayland or pasture, including legumes and grasses in the cropping sequence reduces the susceptibility to erosion on sloping land and improves tilth for the following crop. The legumes also provide additional nitrogen.

A system of conservation tillage that leaves crop residue on the surface is effective in controlling erosion. Following are examples of conservation tillage systems. No-tillage is a system in which the seedbed is prepared and the seed planted in one operation. The surface is disturbed only in the immediate area of the planted seed row. A protective cover of crop residue is left on at least 90 percent of the surface. Strip tillage, or till plant, also is a system in which the seedbed is prepared and the seed planted in one operation. Tillage is limited to a strip not wider than one-third of the row width. A protective cover is left on two-thirds of the surface after planting. Both the no-tillage and strip tillage, or till plant, systems can be adapted to most of the soils in the county. Chisel disk, or rotary tillage, is a system in which the soil is loosened throughout the field and part of the crop residue is incorporated into the soil. Preparing the seedbed and planting may be one or several operations. Conservation tillage is effective only if the amount of crop residue left on the surface after planting is enough to control erosion.

Terraces reduce the length of slope and help to control runoff and erosion. They are most adaptable and practical on well drained and moderately well drained soils that have long, smooth slopes and are gently sloping or moderately sloping. The gently sloping Dinsdale, Mt. Carroll, and Waubeek soils are well suited to terracing.

Controlling erosion is difficult in areas of the Bassett, Cresco, Kenyon, and Lourdes soils because the loamy material in the upper part of these soils is more rapidly permeable than the glacial till in the lower part of the subsoil and in the substratum. Water tends to move more rapidly through the upper part and accumulates at the point where the loamy material comes in contact with the glacial till. As a result, hillside seepage can occur during wet periods. A combination of terracing and tiling is likely to be most successful in controlling erosion. Grade stabilization structures and grassed waterways help to control gullying in watercourses.

When terraces are built in areas of soils having a subsoil of glacial till, such as the Bassett, Cresco, Kenyon, and Lourdes soils, care should be taken not to expose the glacial till because of its low fertility and unfavorable tilth. Similar care should be taken when building terraces on soils that have sand and gravel or limestone fragments in the subsoil or substratum.

Contour farming helps to control erosion in some areas in the county. It is best suited to soils that have fairly smooth, uniform slopes, such as the Dinsdale, Mt. Carroll, and Waubeek soils.

Soil blowing is a hazard on the sandy Burkhardt, Chelsea, Dickinson, Flagler, Lamont, Lilah, Olin, and Sparta soils. It can damage these soils and the crops growing on them in a few hours if winds are strong and the soil is dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils.

Information about erosion-control measures for each soil is contained in the "Technical Guide," which is available at the local office of the Natural Resources Conservation Service.

Soil drainage is a management problem in some areas of the county. Some soils on uplands are naturally wet and poorly drained. Examples are the Clyde, Maxfield, and Tripoli soils. Coland and Marshan soils are on stream benches and bottom land and are poorly drained. Most poorly drained and somewhat poorly drained soils are more productive if a tile drainage system is installed. The somewhat poorly drained Floyd, Franklin, Klinger, Lawler, Oran, Protivin, and Readlyn soils benefit from a drainage system in most years. If the soil is drained, fieldwork is less likely to be delayed by the wetness, a better air-to-soil ratio is maintained, and root growth is improved.

Many of the soils in the county are naturally acid. Applications of ground limestone are needed to raise the pH level for the optimum growth of crops that grow well only on neutral or slightly acid soils. Alfalfa is an example of such a crop. Poorly drained soils generally do not require addition of lime because they are neutral

or slightly acid. Calamine, Calco, Canisteo, Du Page, Harpster, Mottland, Rocksan, Shellwood, and Talcot soils, which are limited in extent in the county but important locally, are calcareous. Care should be taken if agricultural chemicals are applied to these soils.

The available potash level is naturally low or very low in the subsoil of all of the soils in Floyd County. Available phosphorus is medium in the subsoil of the Lamont and Mt. Carroll soils and low or very low in the subsoil of most of the other soils.

Additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can provide assistance in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils that have good tilth generally are high in content of organic matter, have granular structure, and are porous.

Many of the soils in the county have a dark surface layer that is high in content of organic matter. Soils that are low in content of organic matter generally have weaker structure. During periods of intense rainfall, a crust forms on the surface of these soils. This crusting reduces the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve soil structure and help to prevent crusting. The organic matter content of the surface layer ranges from less than 1 percent in the Chelsea and Lamont soils to more than 25 percent in the Palms soils. The predominant percentage of organic matter in soils in areas of cropland is 3 to 8 percent.

Fall plowing generally should be avoided on the soils in the county because it increases the susceptibility to water erosion during periods of snowmelt and heavy rainfall. It also increases the hazard of soil blowing because the soils are not protected by cover crops.

The soils in the county are suited to climatically adapted legumes, cool-season grasses, and warm-season grasses grown for pasture or hay. Most of the permanent pastures support bluegrass or bromegrass. Other cool-season grasses that grow well in the county are orchardgrass, tall fescue, timothy, and reed canarygrass. Alfalfa is the most common legume grown for hay. It also is used in mixtures with orchardgrass, bromegrass, or timothy for hay and pasture. Birdsfoot trefoil is used in mixtures with bluegrass, orchardgrass, or timothy.

The soils are suited to many climatically adapted field crops that are not commonly grown in the county. Grain sorghum, sunflowers, potatoes, sugar beets, sweet corn, popcorn, pumpkins, canning peas, canning beans, and navy beans can be grown if economic conditions are favorable. The forage production of alfalfa and brome is very high if they are planted along with red clover and orchardgrass. Oats is the most common close-growing crop. Rye, barley, buckwheat, wheat, and flax also can be grown.

Information and suggestions for growing specialty crops can be obtained from the local office of the Cooperative Extension Service or of the Natural Resources Conservation Service.

Yields per Acre

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

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

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

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

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

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(17)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are

used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production. There are no class VIII soils in the survey area.

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

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

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

Corn Suitability Rating

Corn suitability ratings provide a relative ranking of all of the soils mapped in the State of Iowa based on the potential of the soils to be used for intensive production of row crops. The corn suitability rating is an index that can be used to rate the potential production of one soil against another soil over a period of time. The average weather conditions and the frequency of use of the soil for row crop production are considered in the corn suitability rating. Ratings range from 100 for soils that have no physical limitations, occur on minimal slopes, and can be continuously row cropped to as low as 5 for soils that have severe limitations when used for row crops. The criteria used to determine the ratings listed in table 6 are that the soil is properly managed, is not irrigated, has been drained where needed, is not affected by frequent flooding, and has not been leveled or terraced. The reasons why the weighted corn suitability rating for a given field can be modified include if the field includes sandy spots, outcrops of rock or gravel, and drainageways that cannot be crossed with machinery and the boundary of the field. Even though predicted average yields change with time, the corn suitability ratings are expected to remain relatively constant in relation to one another over time.

The corn suitability ratings in Floyd County range from 95 for map unit 377, Dinsdale silty clay loam, 0 to 2 percent slopes, to 5 for map unit 412E, Emeline loam, 9 to 18 percent slopes. Ratings are not assigned to miscellaneous areas or urban land in the county because the properties and use of these units vary. The corn suitability ratings are listed in the yields table.

Woodland Management and Productivity

At one time, trees covered about 63,000 acres of the county, or nearly 20 percent of the total acreage. They were valued by the early settlers as sources of building material and fuel. The settlers harvested the best trees and left the less desirable ones. Gradually, the less desirable trees dominated the woodland. From the time of the early settlers to the present, the woodland has been cleared for agricultural uses. As a result, only about 9,000 acres, or 3 percent of the county, currently is wooded. Most of the woodland soils are in areas where the forests once flourished. They include the Bassett, Chelsea, Lamont, Lourdes, Pinicon, Racine, Renova, Wapsie, Waubeek, Whalan, and Winneshiek soils.

The major forested areas in the county are along the Cedar, Little Cedar, Shell Rock, and Winnebago Rivers and Flood Creek. In many areas the soils adjacent to these watercourses are unsuited to cultivated crops and poorly suited to pasture because they are too steep or are too shallow to limestone bedrock. The woodland in these areas is extremely important because the cover of trees helps to control erosion.

Good woodland management is critical in these areas and in other wooded areas in the county because it keeps the woodland productive. It includes planting, weeding, thinning, and pruning and measures that protect the woodland from livestock and fire. Good harvesting techniques help to sustain productivity. In even-aged stands, seed block and shelterwood are suitable harvesting methods. In stands that are not even aged, the best technique generally is selective cutting. High grading should be avoided in all stands because it leaves only the undesirable and poorly formed trees for regeneration of the stand.

Woodland management depends on the present condition of the woodland and the kinds of trees to be grown. The objective of woodland management is to attain sustained production by cutting only the amount of wood that the stand produces in a given period of time. These cuttings can be made every 5 to 10 years.

The factors that affect the use of soils for woodland are somewhat different and less restrictive than those that affect the use of soils for cropland. This soil survey can help woodland owners identify the soils that are most likely to be productive as woodland. Some factors that affect woodland management are described in the following paragraphs.

Soil moisture.—The growth of trees is directly related to the available water capacity of the soil. The available water capacity is affected mainly by the slope, depth of the soil, permeability, and drainage. A lack of sufficient moisture is a limiting factor in Chelsea, Emeline, Lamont, Wapsie, Whalan, and Winneshiek soils.

Aspect, or direction of the slope.—The exposure of a soil to sunlight affects the tree species that grow on a site and the rate of growth. Soils on south- and west-facing slopes tend to be warmer and drier than soils on north- and east-facing slopes. Examples of the warmer, drier soils are the Bassett, Racine, and Renova soils.

Soil reaction.—The rate of growth and the suitability of tree species are somewhat affected by soil reaction. Most pines grow better on soils that tend to be more acid, and hardwoods grow better on soils that tend to be neutral in reaction. Pines grow better than hardwoods on the sandy, eroded or depleted soils in the county because the soils tend to be medium acid or strongly acid in the subsurface layer and the subsoil.

The local office of the Natural Resources Conservation Service can help woodland managers determine which soils are suited to trees, the best land use for wooded areas, and the kinds of management needed. State foresters can assist in developing plans for managing new or existing stands.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *N*, snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and N.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of

use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *productivity class*. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow (fig. 8). 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.

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

Figure 8.—A farmstead windbreak.

Resources Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for 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.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

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

Picnic areas are subject to heavy foot traffic (fig. 9). Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

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

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

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

Wildlife Habitat

Floyd County has a wide variety of wildlife. The major game species are white-tailed deer, ring-necked pheasant, Hungarian partridge, and squirrel. Smallmouth bass, catfish, northern pike, bullhead, sunfish, and rough fish inhabit the rivers and streams. Some farm ponds are stocked with channel catfish, bluegill, crappie, and largemouth bass.

At one time woodland wildlife habitat was excellent in the county. Clearing of the woodland for agricultural uses and overharvesting of trees, however, have drastically reduced the acreage of prime woodland wildlife habitat. Most of the remaining woodland wildlife habitat is in areas adjacent to the larger rivers and their tributaries. White-tailed deer, squirrel, and many song birds depend on woodland wildlife habitat for food and protection. Many areas may be suitable as habitat for wild turkey, which would need to be stocked in the county. Woodland wildlife habitat can be improved by fencing out livestock and protecting the woodland from fire. In some areas vegetative plantings are needed to improve the habitat and to provide food.

Wetland wildlife habitat has been reduced in extent because of the drainage of wetlands and the destruction of wetland plants, shrubs, and trees. Erosion causes siltation of the streams, and the runoff from fields contains some herbicides, which can destroy aquatic and wetland plants. Great blue heron, American egret, mallard, teal, beaver, muskrat, mink, and otter are a few of the species that depend on wetland areas. Wetland wildlife habitat can be improved by allowing native grasses and shrubs to grow along streambanks and by fencing livestock out of the wetland areas. Diverting runoff from adjacent upland areas away from wetlands helps to ensure that applied chemicals do not harm the wetland plants and animals.

The principal game species in areas of openland wildlife habitat are ring-necked pheasant and Hungarian partridge. Openland wildlife habitat is often limited to road ditches, to areas along fence lines, and to occasional clumps of grasses and shrubs in fields where limestone crops out. These areas can sustain only a limited number of pheasants. Nesting cover and winter cover are the most critical factors affecting the pheasant population. If the plant cover in ditches and along fence lines is left unclipped until early in the summer, the pheasant population can be significantly

Figure 9.—A picnic area in Colwel Park.

increased. Winter cover can be provided by farmstead windbreaks and wildlife plantings. Leaving a few rows of grain near these areas helps to provide an excellent source of winter food.

Wildlife diversity depends on habitat diversity. It can be best achieved by providing edge habitat. An example of edge habitat is a strip of grasses and legumes near a wooded area or a wetland area. Some types of wildlife depend on different kinds of habitat at different times of the year. Quail is an example. The strips of grasses and legumes can be used by other nesting birds and animals, such as plover, rabbit, ring-necked pheasant, and certain waterfowl.

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

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and

other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

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

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

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

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

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

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

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

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

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

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

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities,

construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

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

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

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

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

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

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

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

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base

of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

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

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

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

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

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

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

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

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as

shale and siltstone, are not considered to be sand and gravel.

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

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

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

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

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

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

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by

toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

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

Soil Properties

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

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

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

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

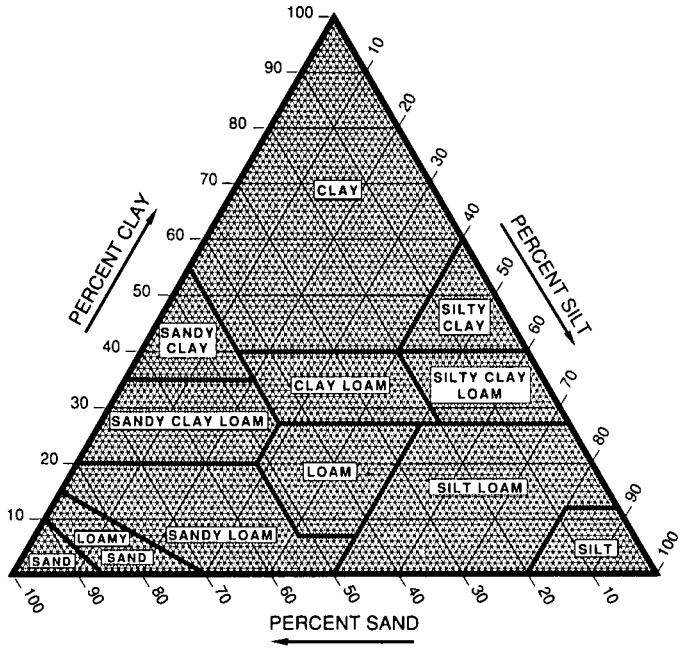

Figure 10.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 10). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

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

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

highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

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

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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

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

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.

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

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

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

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

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

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

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

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

Group C. Soils having a slow infiltration rate when

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

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

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

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

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

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

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

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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

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

are entirely within one kind of soil or within one soil layer.

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(18)*. 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 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

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

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

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

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(19)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(18)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

Aureola Series

The Aureola series consists of deep, well drained soils on flats, ridges, and side slopes in the uplands. These soils formed in loamy sediments overlying weathered, calcareous cretaceous material. The

cretaceous material is weathered mainly from sandstone and is at a depth of 20 to 40 inches. Permeability is moderate in the solum and rapid in the substratum. The native vegetation is prairie grasses. Slopes range from 0 to 16 percent.

Typical pedon of Aureola loam, 2 to 5 percent slopes, in a cultivated field; 2,415 feet north and 190 feet east of the southwest corner of sec. 12, T. 94 N., R. 17 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam (21 percent clay), dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.

A—9 to 14 inches; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) loam (20 percent clay), dark brown (10YR 4/3) dry; weak very fine granular structure; friable; neutral; gradual smooth boundary.

BA—14 to 19 inches; dark brown (10YR 3/3) loam (20 percent clay), brown (10YR 4/3) dry; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; weak very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw1—19 to 26 inches; yellowish brown (10YR 5/4) loam (17 percent clay); few faint dark yellowish brown (10YR 4/4) coatings on faces of peds; weak very fine and fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw2—26 to 33 inches; yellowish brown (10YR 5/6) sandy loam (14 percent clay); weak fine and medium subangular blocky structure; very friable; neutral; abrupt smooth boundary.

2C1—33 to 48 inches; brownish yellow (10YR 6/6) loamy fine sand (7 percent clay); massive; friable; few fibrous roots; violent effervescence; moderately alkaline; clear wavy boundary.

2C2—48 to 60 inches; olive yellow (2.5Y 6/6) loamy fine sand; massive; friable; few fibrous roots; violent effervescence; strongly alkaline.

The thickness of the solum and the depth to material weathered from sandstone range from 20 to 40 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The BA or AB horizon has chroma of 2 or 3. It is loam or silt loam that has a high content of sand. The Bw horizon is fine sandy loam, sandy loam, or loam. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 3 to 6. It ranges from fine sand to fine sandy loam.

The soils in map units 616C2 and 616D2 are taxadjuncts to the Aureola series because they do not have a mollic epipedon. They classify as coarse-loamy, mixed, mesic Typic Eutrochrepts.

Bassett Series

The Bassett series consists of deep, moderately well drained, moderately permeable soils on ridge crests and side slopes in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is mixed prairie grasses and trees. Slopes range from 0 to 14 percent or more.

Typical pedon of Bassett loam, 2 to 5 percent slopes, in a cultivated field; 1,500 feet south and 85 feet west of the center of sec. 35, T. 96 N., R. 15 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.

E—8 to 11 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; few streaks of very dark grayish brown (10YR 3/2) surface material; few distinct very dark brown (10YR 2/2) coatings on faces of peds; weak medium platy structure parting to weak very fine subangular blocky; friable; neutral; clear smooth boundary.

Bt1—11 to 14 inches; brown (10YR 4/3) loam; weak very fine and fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; few distinct light gray (10YR 7/2) silt and sand coatings on faces of peds; slightly acid; abrupt smooth boundary.

2Bt2—14 to 20 inches; yellowish brown (10YR 5/4) loam; weak very fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; stone line in the upper part; few pebbles throughout; medium acid; gradual smooth boundary.

2Bt3—20 to 28 inches; yellowish brown (10YR 5/6) loam; few faint brown (10YR 5/3) coatings on faces of peds; few fine faint grayish brown (10YR 5/2) mottles in the lower part; weak medium prismatic structure parting to weak fine and very fine subangular blocky; firm; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; few distinct light gray (10YR 7/2) sand and silt coatings on faces of peds; few pebbles throughout; strongly acid; gradual smooth boundary.

2Bt4—28 to 36 inches; yellowish brown (10YR 5/6) loam; few faint brown (10YR 4/3) coatings on faces of peds; common fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak fine and medium subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few distinct light gray (10YR 7/2) sand and silt coatings on faces of peds; few

pebbles throughout; strongly acid; gradual smooth boundary.

2Bt5—36 to 45 inches; mottled yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) loam; few faint light brownish gray (10YR 6/2) coatings on faces of peds; few fine faint strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) clay films in root channels; few pebbles throughout; medium acid; gradual smooth boundary.

2C—45 to 60 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) loam; few fine faint strong brown (7.5YR 5/6) mottles; massive; firm; few distinct dark grayish brown (10YR 4/2) clay films in root channels; few pebbles throughout; medium acid.

The thickness of the solum and the depth to carbonates typically range from 40 to 70 inches. The thickness of the A horizon ranges from 6 to 9 inches.

The A horizon has chroma of 2 or 3. It typically is loam, but the range includes silt loam that has a high content of sand. The upper part of the B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The 2B horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 4 or 5, and chroma of 3 to 6. The B horizon is loam, clay loam, or sandy clay loam.

Bolan Series

The Bolan series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy and sandy eolian material. The native vegetation is prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Bolan loam, 2 to 5 percent slopes, in a cultivated field; 260 feet north and 40 feet east of the center of sec. 16, T. 95 N., R. 16 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; medium acid; abrupt smooth boundary.

A1—7 to 14 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine and very fine granular structure; friable; medium acid; gradual smooth boundary.

A2—14 to 19 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 4/3) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; moderate fine granular structure; friable; medium acid; gradual smooth boundary.

Bw1—19 to 26 inches; brown (10YR 4/3) loam; few faint dark brown (10YR 3/3) coatings on faces of peds; weak very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bw2—26 to 33 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine subangular blocky structure; very friable; medium acid; clear smooth boundary.

Bw3—33 to 40 inches; light yellowish brown (10YR 6/4) loamy sand; weak medium subangular blocky structure; very friable; slightly acid; clear smooth boundary.

C1—40 to 48 inches; light yellowish brown (2.5Y 6/4) sand; single grained; loose; slightly acid; clear smooth boundary.

C2—48 to 53 inches; yellowish brown (10YR 5/6) loamy sand; single grained; loose; neutral; abrupt smooth boundary.

C3—53 to 57 inches; yellowish brown (10YR 5/6) loamy sand; common medium distinct grayish brown (10YR 5/2) mottles; single grained; loose; neutral; clear smooth boundary.

C4—57 to 60 inches; light olive brown (2.5Y 5/6) sand; single grained; loose; neutral.

The thickness of the solum ranges from 30 to 48 inches. Carbonates typically are at a depth of more than 60 inches but may be at a depth of 48 inches. Pebbles typically do not occur above a depth of 53 inches but in some pedons are at a depth of 48 inches. The content of clay in the control section ranges from 14 to 18 percent.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam or silt loam that has a high content of sand. It ranges from 10 to 20 inches in thickness. The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is loam in the upper part and sandy loam or loamy sand in the lower part. The C horizon dominantly is loamy sand or sand. In some pedons below a depth of 50 inches, it is stratified sandy loam, silt loam, or loam with variegated colors. Glacial till typically is at a depth of 60 to 80 inches.

The soils in map units 174B2 and 174C2 are taxadjuncts to the Bolan series because they do not have a mollic epipedon. They classify as coarse-loamy, mixed, mesic Mollic Hapludalfs.

Burkhardt Series

The Burkhardt series consists of deep, excessively drained soils on stream terraces, terrace escarpments, and uplands. These soils formed in loamy sediments overlying sand and gravel. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The native vegetation is prairie grasses. Slopes range from 2 to 30 percent.

Typical pedon of Burkhardt sandy loam, 5 to 9

percent slopes, in a cultivated field; 1,625 feet south and 75 feet east of the northwest corner of sec. 1, T. 94 N., R. 18 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common roots; about 5 percent gravel; neutral; abrupt smooth boundary.
Bw—8 to 14 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; few faint very dark brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; common roots; about 8 percent gravel; neutral; gradual smooth boundary.
BC—14 to 20 inches; brown (10YR 4/3) loamy sand; few faint dark brown (10YR 3/3) coatings on faces of peds; weak medium subangular blocky structure; very friable; few roots; about 8 percent gravel; neutral; gradual smooth boundary.
C1—20 to 24 inches; brown (10YR 4/3) sand; single grained; loose; about 8 percent gravel; slightly acid; gradual smooth boundary.
C2—24 to 60 inches; brown (10YR 5/3) sand; single grained; loose; about 8 percent gravel; slightly acid.

The thickness of the solum ranges from 14 to 24 inches. The thickness of the mollic epipedon ranges from 10 to 15 inches. The upper 40 inches of the profile typically ranges from 5 to 15 percent gravel.

The A horizon has value and chroma of 2 or 3. The B horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. The C horizon ranges from loamy sand that contains a few pebbles to gravelly sand.

Calamine Series

The Calamine series consists of deep, poorly drained soils in swales and drainageways and on foot slopes in the uplands. These soils formed in silty sediments and in the underlying material weathered from shale. Permeability is moderate in the upper part of the profile and very slow in the lower part. The native vegetation is prairie grasses. Slopes range from 0 to 3 percent.

Typical pedon of Calamine silty clay loam, 0 to 3 percent slopes, in a cultivated field; 300 feet north and 1,175 feet east of the center of sec. 18, T. 96 N., R. 18 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; friable; mildly alkaline; abrupt smooth boundary.
A1—10 to 16 inches; black (N 2/0) silty clay loam, black (5Y 2/1) dry; weak very fine subangular blocky structure; friable; mildly alkaline; clear smooth boundary.
A2—16 to 20 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; common medium distinct olive (5Y 4/3) mottles; moderate fine subangular blocky structure; friable; mildly alkaline; clear smooth boundary.
Btg1—20 to 24 inches; olive gray (5Y 4/2) silty clay loam; weak very fine subangular blocky structure; friable; few distinct very dark gray (5Y 3/1) and dark olive gray (5Y 3/2) clay films on faces of peds; mildly alkaline; clear smooth boundary.
Btg2—24 to 28 inches; olive gray (5Y 4/2 and 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak fine subangular blocky structure; firm; mildly alkaline; clear smooth boundary.
2Btg3—28 to 32 inches; mottled olive gray (5Y 5/2) and olive yellow (5Y 6/6) silty clay; weak medium prismatic structure; very firm; few faint grayish brown (2.5Y 5/2) clay films on faces of peds; mildly alkaline; clear smooth boundary.
2Cg—32 to 54 inches; olive (5Y 5/4) and gray (5Y 6/1) silty clay; massive; very firm; few distinct black (10YR 2/1) coatings in root channels; mildly alkaline; clear smooth boundary.
2Cr—54 to 60 inches; greenish gray (5GY 6/1) and brownish yellow (10YR 6/6) shale bedrock having a texture of silty clay; massive; very firm; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. The depth to shale bedrock ranges from 40 to 60 inches. The mollic epipedon typically ranges from 14 to 24 inches in thickness.

The Ap or A horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. It is silt loam or silty clay loam. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6. The upper part of the B horizon is silt loam or silty clay loam. The 2B horizon is silty clay loam, silty clay, or clay. The 2C horizon is silty clay or clay.

Calco Series

The Calco series consists of deep, poorly drained, moderately permeable, calcareous soils on flood plains along streams. These soils formed in silty alluvium. The native vegetation is water-tolerant grasses. Slopes range from 0 to 2 percent.

Typical pedon of Calco silty clay loam, 0 to 2 percent slopes, in a cultivated field; 1,440 feet south and 920 feet west of the northeast corner of sec. 27, T. 96 N., R. 16 W.

Ap—0 to 9 inches; black (N 2/0) silty clay loam, dark gray (5Y 4/1) dry; weak very fine subangular blocky structure; friable; slight effervescence; mildly alkaline; abrupt smooth boundary.
A1—9 to 15 inches; black (N 2/0) silty clay loam, dark gray (5Y 4/1) dry; weak fine prismatic structure parting to weak medium subangular blocky; friable; strong effervescence; mildly alkaline; clear smooth boundary.
A2—15 to 31 inches; black (N 2/0) silty clay loam, dark gray (5Y 4/1) dry; weak and moderate very fine subangular blocky structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.
A3—31 to 41 inches; black (N 2/0) silty clay loam, dark gray (5Y 4/1) dry; weak very fine subangular blocky structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.
A4—41 to 48 inches; black (N 2/0) silty clay loam, dark gray (5Y 4/1) dry; weak very fine granular structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.
Cg—48 to 60 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 50 inches. The A horizon is 30 to 50 inches thick. The content of clay in the A horizon ranges from 27 to 35 percent and the content of sand ranges from 5 to 15 percent. Some pedons have an AC horizon. The Bg horizon, if it occurs, has hue of 10YR, 2.5Y, or 5Y or is neutral in hue. It has value of 3 to 6 and typically has chroma of 0 or 1. In some pedons it has grayish brown, yellowish brown, or strong brown mottles. In some pedons the C horizon has strata of sandy loam below a depth of about 40 inches.

Canisteo Series

The Canisteo series consists of very deep, poorly drained, moderately permeable, calcareous soils in drainageways and on adjacent flats in the uplands. These soils formed in silty and loamy sediments and in the underlying glacial till. The native vegetation is water-tolerant grasses. Slopes range from 0 to 2 percent.

The Canisteo soils in this county are taxadjuncts to the series because they formed in silty sediments and in the underlying glacial till and are fine silty. They classify as fine-silty, mixed (calcareous), mesic Typic Haplaquolls.

Typical pedon of Canisteo silty clay loam, 0 to 2 percent slopes, in a cultivated field; 565 feet south and 37 feet east of the northwest corner of sec. 16, T. 94 N., R. 18 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak medium subangular blocky structure parting to weak very fine granular; friable; strong effervescence; moderately alkaline; clear smooth boundary.
A—8 to 16 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak very fine subangular and very fine granular structure; friable; slight effervescence; mildly alkaline; clear smooth boundary.
Bg1—16 to 22 inches; dark olive gray (5Y 3/2) and olive gray (5Y 4/2) silty clay loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; black (N 2/0) krotovina; slight effervescence; mildly alkaline; gradual smooth boundary.
Bg2—22 to 28 inches; olive gray (5Y 5/2) silt loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; few dark concretions of iron and manganese oxide; slight effervescence; mildly alkaline; clear smooth boundary.
2Bg3—28 to 40 inches; olive gray (5Y 5/2) loam; many fine and medium distinct light olive brown (2.5Y 5/6) mottles; weak medium prismatic structure; friable; few pebbles throughout; slight effervescence; mildly alkaline; clear smooth boundary.
2Cg1—40 to 48 inches; olive gray (5Y 5/2) sandy loam; loamy sand in sand wedge; many medium distinct light olive brown (2.5Y 5/6) mottles; massive; very friable; few pebbles throughout; slight effervescence; mildly alkaline; clear smooth boundary.
2Cg2—48 to 60 inches; olive gray (5Y 5/2) loam; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; firm; few pebbles throughout; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 32 to 48 inches. The A horizon has hue of 10YR to 5Y and value of 2 or 3. It is 12 to 22 inches thick. The Bg2 horizon below a depth of 22 inches has hue of 10YR to 5Y, value of 4 or more, and chroma of 1 to 3. It is silt loam that contains more than 20 percent sand or is clay loam or loam. The 2B horizon is loam or clay loam.

Chelsea Series

The Chelsea series consists of deep, excessively drained, rapidly permeable soils on uplands. These soils formed in sandy eolian material. The native

vegetation is oak-hickory forest. Slopes range from 2 to 9 percent.

Typical pedon of Chelsea loamy fine sand, 2 to 9 percent slopes, in an area of bluegrass pasture; 1,950 feet west and 600 feet south of the northeast corner of sec. 12, T. 95 N., R. 15 W.

A—0 to 3 inches; dark brown (10YR 3/3) loamy fine sand; weak very fine subangular blocky structure parting to weak very fine granular; very friable; medium acid; abrupt smooth boundary.
E1—3 to 7 inches; dark yellowish brown (10YR 4/4) loamy fine sand; few faint dark brown (10YR 3/3) coatings on faces of peds; weak very fine subangular blocky structure parting to weak very fine granular; very friable; medium acid; clear smooth boundary.
E2—7 to 12 inches; brown (10YR 4/3) loamy fine sand; few faint dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; very friable; medium acid; clear smooth boundary.
E3—12 to 17 inches; brown (10YR 4/3) loamy fine sand; weak fine and medium subangular blocky structure; very friable; medium acid; clear smooth boundary.
E4—17 to 27 inches; brown (10YR 4/3) loamy fine sand; single grained; loose; medium acid; clear smooth boundary.
E/Bt1—27 to 48 inches; yellowish brown (10YR 5/6) loamy fine sand; single grained; loose; 0.5- to 2.5-inch-thick brown (7.5YR 4/4) bands of sandy loam at 27, 29, 33, 40, and 45 inches; medium acid; gradual smooth boundary.
E/Bt2—48 to 60 inches; brownish yellow (10YR 6/6) loamy sand; single grained; loose; brown (7.5YR 4/4) band of sandy loam at 58 inches; medium acid.

The thickness and color of the A or Ap horizon vary considerably within short distances because the soils are very susceptible to soil blowing and the burrowing of animals. The A or Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is loamy fine sand or sand. The E horizon has chroma of 2 to 4. It also is loamy fine sand or sand. The B part of the E/Bt horizon has 0.5- to 2.0-inch-thick lamellae. The lamellae have hue of 7.5YR or 10YR and value and chroma of 3 or 4. They are sandy loam or loamy sand. The total thickness of the lamellae ranges from 4 to 6 inches.

Clyde Series

The Clyde series consists of deep, poorly drained, moderately permeable soils in drainageways on the lower part of concave slopes and at the head of drainageways on uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 0 to 3 percent.

Typical pedon of Clyde silty clay loam, 0 to 3 percent slopes, in a cultivated field; 915 feet north and 77 feet east of the center of sec. 5, T. 94 N., R. 16 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.
A—8 to 16 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak very fine granular structure; friable; neutral; clear smooth boundary.
AB—16 to 21 inches; very dark gray (5Y 3/1) silty clay loam, dark gray (5Y 4/1) dry; few faint olive gray (5Y 4/2) mottles; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.
Bg1—21 to 29 inches; olive gray (5Y 5/2) loam; common mixed areas of dark gray (5Y 4/1) material; few fine prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; few yellowish red (5YR 5/6) concretions of iron oxide; neutral; clear smooth boundary.
Bg2—29 to 35 inches; olive gray (5Y 5/2) loam; common medium prominent strong brown (7.5YR 5/6) and few fine faint grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; friable; few dark concretions of iron and manganese oxide; neutral; clear smooth boundary.
Bg3—35 to 39 inches; grayish brown (2.5Y 5/2) sandy loam; common medium faint light olive brown (2.5Y 5/6) mottles; weak fine prismatic structure parting to weak medium subangular blocky; friable; few pebbles in the lower part; neutral; clear smooth boundary.
2BC—39 to 45 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure; friable; few dark concretions of iron and manganese oxide; few pebbles; neutral; clear smooth boundary.
2C—45 to 60 inches; yellowish brown (10YR 5/6) loam; many fine distinct gray (5Y 5/1) mottles; massive; firm; few dark concretions of iron and manganese oxide; few pebbles; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. The depth to carbonates ranges from 45 to 70 inches. The thickness of the mollic epipedon ranges from 18 to 24 inches.

The A horizon dominantly is silty clay loam that is

high in content of sand, but the range includes silt loam and clay loam. The Bg horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is loam or clay loam with thin strata of sandy loam or silty clay loam. The 2BC horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 6.

Coland Series

The Coland series consists of very deep, poorly drained, moderately permeable soils on flood plains along streams. These soils formed in loamy alluvium. The native vegetation is water-tolerant grasses. Slopes range from 0 to 2 percent.

Typical pedon of Coland clay loam, 0 to 2 percent slopes, in an area of pasture; 840 feet south and 700 feet east of the center of sec. 20, T. 96 N., R. 18 W.

Ap—0 to 8 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; neutral; abrupt smooth boundary.

A1—8 to 16 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; neutral; gradual smooth boundary.

A2—16 to 33 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; weak fine prismatic structure parting to weak fine and very fine subangular blocky; friable; neutral; gradual smooth boundary.

AC—33 to 42 inches; black (5Y 2/1) clay loam, dark gray (5Y 4/1) dry; weak fine prismatic structure; friable; few small gravels; neutral; gradual smooth boundary.

C1—42 to 49 inches; olive gray (5Y 4/2) clay loam; pockets of very dark gray (5Y 3/1) material; massive; friable; neutral; clear smooth boundary.

C2—49 to 60 inches; olive (5Y 5/2) loam; few fine distinct olive yellow (2.5Y 6/8) mottles; massive; firm; few dark concretions of manganese oxide; few limestone fragments; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 48 inches. The mollic epipedon is 36 inches or more thick. Carbonates generally are at a depth of more than 48 inches.

The A horizon is 24 to 40 inches thick. It is neutral in hue or has hue of 10YR. It has value of 2 or 3 and chroma of 0 or 1. It is clay loam or silty clay loam that has a 27 to 35 percent content of sand. Some pedons have a Bw horizon. The C horizon is neutral in hue or has hue of 2.5Y or 5Y. It has value of 2 to 5 and chroma of 0 to 2. In some pedons below a depth of about 48 inches, it is stratified loam, sandy loam, or loamy sand that contains some gravel.

Cresco Series

The Cresco series consists of deep, moderately well drained, moderately slowly permeable soils on upland ridge crests and side slopes. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 2 to 9 percent.

Typical pedon of Cresco loam, 2 to 5 percent slopes, in a cultivated field; 135 feet west and 170 feet north of the southeast corner of sec. 5, T. 94 N., R. 16 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.

A—8 to 12 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; streaks of very dark grayish brown (10YR 3/2) subsurface material; weak very fine subangular blocky structure parting to weak very fine granular; friable; slightly acid; gradual smooth boundary.

AB—12 to 16 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; few faint black (10YR 2/1) coatings on faces of peds; weak very fine subangular blocky structure parting to weak very fine granular; friable; medium acid; clear smooth boundary.

Bw—16 to 20 inches; brown (10YR 4/3) clay loam; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

2Bt1—20 to 26 inches; brown (10YR 4/3) clay loam; few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; thin stone line in the upper part; few pebbles throughout; strongly acid; clear smooth boundary.

2Bt2—26 to 36 inches; light olive brown (2.5Y 5/4) clay loam; few distinct gray (5Y 5/1) coatings on faces of peds; few medium distinct strong brown (7.5YR 5/8) and common medium faint yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very firm; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; few pebbles throughout; medium acid; abrupt wavy boundary.

2BC—36 to 40 inches; light olive brown (2.5Y 5/4) clay loam; few faint grayish brown (2.5Y 5/2) coatings on faces of peds; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; very firm; few pebbles throughout; slight effervescence; neutral; gradual smooth boundary.

2C—40 to 60 inches; grayish brown (2.5Y 5/2) clay loam; common medium distinct yellowish brown (10YR 5/6) and few medium distinct strong brown (7.5YR 5/8) mottles; massive; very firm; few soft accumulations of calcium carbonate; few pebbles throughout; slight effervescence; mildly alkaline.

The solum is 40 inches or more thick. The depth to carbonates ranges from 40 to 60 inches. The thickness of the mollic epipedon ranges from 10 to 18 inches.

The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. The A horizon typically is loam, but the range includes clay loam. The average content of clay in the 2B horizon ranges from 30 to 35 percent, but in subhorizons of some pedons, it is as much as 37 percent.

Dickinson Series

The Dickinson series consists of very deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in loamy and sandy eolian material. The native vegetation is prairie grasses. Slopes range from 2 to 9 percent.

Typical pedon of Dickinson fine sandy loam, 5 to 9 percent slopes, in an area of pasture; 2,360 feet north and 1,530 feet west of the southeast corner of sec. 31, T. 95 N., R. 17 W.

Ap—0 to 9 inches; black (10YR 2/1) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—9 to 13 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular blocky structure; friable; slightly acid; clear smooth boundary.

A2—13 to 18 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak very fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw1—18 to 30 inches; brown (10YR 4/3) sandy loam; weak fine and medium subangular blocky structure; very friable; neutral; clear smooth boundary.

Bw2—30 to 38 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

BC—38 to 45 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium prismatic structure parting to weak medium subangular blocky; very friable; slightly acid; gradual smooth boundary.

C1—45 to 50 inches; dark yellowish brown (10YR 4/4) sand; single grained; loose; medium acid; gradual smooth boundary.

C2—50 to 60 inches; mottled brown (10YR 4/3) and dark yellowish brown (10YR 4/4) sand; few fine faint dark yellowish brown (10YR 4/6) mottles; single grained; loose; neutral.

The thickness of the solum ranges from 36 to 60 inches. Carbonates are at a depth of more than 60 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The Ap or A horizon typically has value of 2 or 3. The A horizon is 10 to 20 inches thick. The upper part of the Bw horizon has value of 3 to 5 and chroma of 3 to 6. Firm glacial till typically is at a depth of 60 to 80 inches.

Dinsdale Series

The Dinsdale series consists of deep, well drained, moderately permeable soils on convex ridge crests and side slopes in the uplands. These soils formed in loess and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Dinsdale silty clay loam, 2 to 5 percent slopes, in a cultivated field; 1,370 feet south and 375 feet west of the center of sec. 21, T. 94 N., R. 18 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam (27 percent clay), dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; medium acid; clear smooth boundary.

A—7 to 14 inches; black (10YR 2/1) silty clay loam (28 percent clay), dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; medium acid; gradual smooth boundary.

AB—14 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam (29 percent clay), grayish brown (10YR 5/2) dry; pockets of brown (10YR 4/3) subsoil material; moderate very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bt1—18 to 22 inches; brown (10YR 4/3) silty clay loam (28 percent clay); weak very fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—22 to 29 inches; yellowish brown (10YR 5/4) silty clay loam (30 percent clay); weak very fine and moderate fine subangular blocky structure; few faint brown (10YR 4/3) clay films on faces of peds; friable; medium acid; clear smooth boundary.

2Bt3—29 to 40 inches; brown (10YR 5/3) and yellowish brown (10YR 5/6) loam (24 percent clay); few faint

grayish brown (10YR 5/2) coatings on faces of peds; moderate fine prismatic structure parting to weak fine subangular blocky; friable; few distinct very dark gray (10YR 3/1) clay films in root channels; 2- to 4-inch-thick stone line in the upper part; few pebbles throughout; medium acid; clear smooth boundary.

2Bt4—40 to 58 inches; light olive brown (2.5Y 5/4) clay loam (29 percent clay); few fine distinct strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few pebbles throughout; medium acid; abrupt smooth boundary.

2C—58 to 60 inches; light olive brown (2.5Y 5/4) and olive (5Y 5/3) clay loam (29 percent clay); few fine prominent reddish yellow (5YR 5/8) mottles; massive; firm; few dark concretions of iron and manganese oxide; few pebbles throughout; slightly acid.

Typically, the thickness of the solum ranges from 45 to 58 inches, but in some pedons it ranges from 42 to 60 inches. The thickness of the loess generally ranges from 26 to 36 inches, but in some pedons it ranges from 20 to 40 inches.

The Ap or A horizon has value of 2 and chroma of 1 or 2. It is silty clay loam or silt loam. The Bt or Bw horizon, if it occurs, has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The 2Bt and 2C horizons have hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 4 to 6. In places discontinuous lenses separate the loess and the glacial till. They are sandy loam to sand and are 1 to 8 inches thick. Typically, a 2- to 4-inch-thick stone line separates the glacial till and the overlying sediments. The underlying till or till-derived material typically is loam or clay loam, but the range includes sandy clay loam.

Donnan Series

The Donnan series consists of deep, somewhat poorly drained and moderately well drained soils on ridge crests and convex side slopes in the uplands. These soils formed in loamy sediments and in the underlying clayey material. Permeability is moderate in the upper part of the profile and very slow in the lower part. The native vegetation is trees and prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Donnan loam, 2 to 5 percent slopes, in a cultivated field; 1,540 feet north and 320 feet east of the southwest corner of sec. 30, T. 94 N., R. 18 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; slightly acid; abrupt smooth boundary.

BE—7 to 11 inches; dark grayish brown (10YR 4/2) clay loam; few distinct very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) coatings on faces of peds; weak very fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt1—11 to 15 inches; light olive brown (2.5Y 5/4) clay loam; few distinct dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

Bt2—15 to 22 inches; light olive brown (2.5Y 5/4) loam; few fine distinct strong brown (7.5YR 5/8) and few fine distinct olive gray (5Y 5/2) mottles; weak fine subangular blocky structure; friable; few small pebbles; strongly acid; clear smooth boundary.

Bt3—22 to 30 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; friable; few distinct white (10YR 8/1) silt coatings on faces of peds; few pebbles throughout; strongly acid; clear smooth boundary.

2Bt4—30 to 46 inches; very dark gray (10YR 3/1) silty clay; weak medium prismatic structure parting to moderate very fine subangular blocky; very firm; strongly acid; clear smooth boundary.

2Bt5—46 to 60 inches; dark gray (10YR 4/1) silty clay; few faint very dark gray (10YR 3/1) coatings on faces of peds; weak medium prismatic structure; very firm; medium acid.

The thickness of the solum ranges from 40 to 70 inches. Carbonates generally are at a depth of more than 6 feet. The surface layer typically has mollic colors to a depth of 6 to 9 inches.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam or silt loam that has a high content of sand. The Bt horizon has hue of 10YR or 2.5Y. It generally is loam and clay loam. The 2Bt horizon has value of 2 to 6 and chroma of 1 or 2. It is clay or silty clay. Some pedons have a 2C horizon, which is loam or clay loam. The 2C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 2 to 6.

Du Page Series

The Du Page series consists of deep, moderately well drained, moderately permeable, calcareous soils on bottom land along the major streams. These soils formed in loamy alluvium. The native vegetation is prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Du Page loam, 0 to 2 percent slopes, in a cultivated field; 900 feet south and 360 feet east of the center of sec. 20, T. 96 N., R. 18 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine and very fine subangular blocky structure; friable; few shell fragments; slight effervescence; mildly alkaline; abrupt smooth boundary.
A1—8 to 16 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine and very fine subangular blocky structure; friable; few shell fragments; strong effervescence; mildly alkaline; gradual smooth boundary.
A2—16 to 29 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) and dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; few shell fragments; strong effervescence; mildly alkaline; gradual smooth boundary.
A3—29 to 44 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; few shell fragments; strong effervescence; mildly alkaline; gradual smooth boundary.
C—44 to 60 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; massive; friable; violent effervescence; moderately alkaline.

The solum typically is about 44 inches thick, but it ranges from 36 to 60 inches in thickness. The A horizon has value of 2 or 3 and chroma of 1 or 2. The A and AC horizons typically are loam or silt loam. In some pedons thin strata of sandy loam or loamy sand are below a depth of 36 inches.

Emeline Series

The Emeline series consists of shallow and very shallow, somewhat excessively drained, moderately permeable soils on convex side slopes in the uplands and on escarpments on uplands and stream benches. These soils formed in loamy sediments overlying limestone bedrock. The native vegetation is prairie grasses. Slopes range from 2 to 40 percent or more.

Typical pedon of Emeline loam, 2 to 9 percent slopes, in a cultivated field; 1,120 feet north and 100 feet east of the center of sec. 7, T. 94 N., R. 16 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; friable; few fragments of weathered limestone; neutral; abrupt smooth boundary.
Bw—8 to 12 inches; brown (10YR 4/3) clay loam; streaks and pockets of very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) material; moderate very fine subangular blocky structure; friable; few fragments of weathered limestone; neutral; abrupt wavy boundary.
2R—12 inches; level-bedded, hard, fragmented limestone bedrock underlain by nonfragmented, level-bedded limestone bedrock.

The thickness of the solum and the depth to hard limestone bedrock typically range from 8 to 12 inches, but in some pedons they range from 4 to 12 inches. The thickness of the mollic epipedon ranges from 4 to 12 inches.

The A or Ap horizon has value of 2 or 3 and chroma of 1 to 3. It typically is loam, but the range includes clay loam, sandy loam, and silt loam that has a high content of sand. In some pedons thin discontinuous horizons of clayey residuum are in the lower part of the solum. Many pedons contain fragments of limestone throughout the solum. The fragmented upper part of the limestone bedrock ranges from 0 to 4 feet in thickness. As slope increases, the thickness of the fragmented rock typically decreases.

Faxon Series

The Faxon series consists of moderately deep, poorly drained, moderately permeable soils on bottom land. These soils formed in loamy sediments overlying limestone bedrock. The native vegetation is water-tolerant grasses. Slopes range from 0 to 2 percent.

Typical pedon of Faxon silty clay loam, 0 to 2 percent slopes, in a cultivated field; 125 feet east and 580 feet south of the northwest corner of sec. 31, T. 96 N., R. 18 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.
A—8 to 14 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular and moderate very fine subangular blocky structure; friable; neutral; clear smooth boundary.
AB—14 to 18 inches; black (10YR 2/1) silty clay loam; streaks of very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) subsoil material; weak fine subangular blocky structure parting to weak fine granular; friable; few dark concretions of iron and manganese oxide; neutral; clear smooth boundary.
Bg—18 to 25 inches; mixed olive gray (5Y 4/2) and olive (5Y 5/4) clay loam; common distinct very dark gray (10YR 3/1) coatings on faces of peds; few fine prominent yellowish brown (10YR 5/6) mottles;

weak fine and very fine subangular blocky structure; friable; neutral; abrupt irregular boundary.
2R—25 inches; hard, fractured limestone bedrock.

The thickness of the solum and the depth to bedrock typically range from 24 to 36 inches, but in some pedons they range from 20 to 40 inches. The thickness of the mollic epipedon ranges from 14 to 24 inches.

The A horizon has hue of 10YR or is neutral in hue. It has chroma of 0 or 1. It is neutral or mildly alkaline. The B horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 to 4. The Bg horizon is clay loam, loam, or silty clay loam that has a high content of sand.

Flagler Series

The Flagler series consists of deep, somewhat excessively drained soils on stream terraces and uplands. These soils formed in loamy and sandy material over sand. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The native vegetation is prairie grasses. Slopes range from 0 to 9 percent.

Typical pedon of Flagler sandy loam, 2 to 5 percent slopes, in a cultivated field; 1,345 feet west and 300 feet north of the southeast corner of sec. 7, T. 95 N., R. 15 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.
A—8 to 15 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.
AB—15 to 18 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; slightly acid; gradual smooth boundary.
Bw1—18 to 25 inches; brown (10YR 4/3) sandy loam; few faint dark brown (10YR 3/3) coatings on faces of peds; weak very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
Bw2—25 to 31 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; slightly acid; gradual smooth boundary.
2Bw3—31 to 37 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; 5 to 10 percent fine gravel; slightly acid; gradual smooth boundary.
2C1—37 to 44 inches; dark yellowish brown (10YR 4/4) gravelly sand; single grained; loose; about 15 percent fine gravel; medium acid; abrupt smooth boundary.
2C2—44 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grained; loose; about 15 percent fine gravel; slightly acid.

The thickness of the solum typically ranges from 30 to 42 inches. The depth to gravelly sand and loamy sand ranges from 20 to 36 inches.

The Ap or A horizon has chroma of 1 or 2. It contains gravel in some pedons. The B horizon has value and chroma of 3 or 4. The 2B horizon has value of 4 or 5 and chroma of 3 to 6. The content of gravel in the 2B horizon ranges from 5 to 15 percent. The 2C horizon has value of 4 to 6. The content of gravel in the 2C horizon typically ranges from 5 to 15 percent, by volume, but in some pedons it is as high as 20 to 50 percent.

Floyd Series

The Floyd series consists of deep, somewhat poorly drained, moderately permeable soils on slightly concave, lower side slopes adjacent to drainageways in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 0 to 4 percent.

Typical pedon of Floyd loam, 1 to 4 percent slopes, in a cultivated field; 515 feet west and 115 feet north of the southeast corner of sec. 31, T. 94 N., R. 17 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.
A—9 to 16 inches; black (10YR 2/1) and very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.
AB—16 to 20 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; some streaks and pockets of dark grayish brown (10YR 4/2) subsoil material; weak fine granular structure; friable; neutral; gradual smooth boundary.
Bw1—20 to 27 inches; olive brown (2.5Y 4/4) loam; common fine faint dark grayish brown (2.5Y 4/2) mottles; weak very fine and fine subangular blocky structure; friable; neutral; clear smooth boundary.
Bw2—27 to 32 inches; light olive brown (2.5Y 5/4) sandy clay loam; few fine faint grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; friable; weakly expressed stone line in the lower part; neutral; clear smooth boundary.
2Bw3—32 to 45 inches; mottled light olive brown (2.5Y 5/6) and grayish brown (2.5Y 5/2) loam; weak

medium prismatic structure parting to weak fine subangular blocky; friable; few pebbles throughout; neutral; abrupt smooth boundary.

2C—45 to 60 inches; light olive brown (2.5Y 5/6) loam; many medium distinct grayish brown (2.5Y 5/2) mottles; massive; firm; few pebbles throughout; strong effervescence; moderately alkaline.

The thickness of the solum typically ranges from 40 to 60 inches. The depth to carbonates ranges from 45 to 75 inches. The thickness of the mollic epipedon ranges from 16 to 22 inches.

The Ap or A horizon has chroma of 1 or 2. The B horizon has hue of 2.5Y, value of 4 or 5, and chroma of 2 to 6. It commonly is loam, clay loam, or sandy clay loam. In some pedons a 2- to 5-inch layer of loamy sand separates the loamy sediments and the underlying glacial till. The 2C horizon is loam or sandy clay loam. It has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 to 6.

Franklin Series

The Franklin series consists of deep, somewhat poorly drained, moderately permeable soils on upland flats, ridges, and side slopes. These soils formed in loess and in the underlying glacial till. The native vegetation is mixed prairie grasses and trees. Slopes range from 0 to 3 percent.

Typical pedon of Franklin silt loam, 0 to 3 percent slopes, in a cultivated field; 145 feet south and 2,277 feet east of the center of sec. 28, T. 96 N., R. 17 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.

EB—8 to 14 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; black (10YR 2/1) wormcasts; common fine faint light olive brown (2.5Y 5/4) mottles; weak medium platy structure parting to weak very fine subangular blocky; friable; strongly acid; clear smooth boundary.

Bt1—14 to 26 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint light olive brown (2.5Y 5/4) mottles; moderate very fine subangular blocky structure; friable; few dark concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

2Bt2—26 to 40 inches; yellowish brown (10YR 5/6) loam; many medium distinct grayish brown (2.5Y 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; weak fine prismatic structure parting to weak medium subangular blocky; firm; weakly expressed stone line in the upper part; few distinct dark grayish brown (10YR 4/2) clay films in root channels; few pebbles; slightly acid; gradual smooth boundary.

2BC—40 to 48 inches; yellowish brown (10YR 5/6) loam; many fine distinct strong brown (7.5YR 5/6) and common medium distinct grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to weak medium and coarse subangular blocky; firm; few distinct dark gray (10YR 4/1) clay films in root channels; few pebbles; few dark concretions of iron and manganese oxide; neutral; abrupt wavy boundary.

2C—48 to 60 inches; yellowish brown (10YR 5/6) loam; massive; friable; few red (2.5YR 4/6) concretions of iron oxide; few pebbles; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. The loess typically is 24 to 40 inches thick but is as thin as 20 inches in some pedons.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon, if it occurs, has value of 4 or 5 and chroma of 1 or 2. An EB or BE horizon is in most pedons. The upper part of the B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. In most pedons a stone line separates the silty upper part of the B horizon from the loamy lower part. The 2B and 2BC horizons have value of 4 or 5 and chroma of 4 to 8. They typically are loam, but the range includes clay loam and sandy clay loam.

Hanlon Series

The Hanlon series consists of deep, moderately well drained, moderately rapidly permeable soils on natural levees on bottom land. These soils formed in loamy alluvium. The native vegetation is prairie grasses. Slopes range from 0 to 3 percent.

Typical pedon of Hanlon fine sandy loam, 0 to 3 percent slopes, in an area of bluegrass pasture; 190 feet south and 590 feet east of the northwest corner of sec. 24, T. 97 N., R. 17 W.

A1—0 to 12 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak very fine granular; very friable; neutral; gradual smooth boundary.

A2—12 to 21 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; few faint black (10YR 2/1) coatings on faces of peds; weak fine subangular blocky structure parting to weak very fine granular; very friable; neutral; gradual smooth boundary.

A3—21 to 33 inches; very dark brown (10YR 2/2) fine

sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak very fine granular; very friable; neutral; gradual smooth boundary.

A4—33 to 43 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; weak medium subangular blocky structure; very friable; neutral; gradual smooth boundary.

AC—43 to 48 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; mixed areas of very dark grayish brown (10YR 3/2) material; weak medium subangular blocky structure; very friable; neutral; gradual smooth boundary.

C1—48 to 56 inches; brown (10YR 4/3) sand; single grained; loose; neutral; clear smooth boundary.

C2—56 to 60 inches; brown (10YR 4/3) sand; single grained; loose; about 5 percent pebbles; neutral.

The thickness of the solum typically ranges from 40 to 60 inches. The thickness of the mollic epipedon typically ranges from 40 to 70 inches. Free carbonates generally are below a depth of 4 feet. The 10- to 40-inch control section ranges from 12 to 18 percent clay and 50 to 75 percent sand. Most of the sand-sized fraction in the control section is fine sand, some is very fine sand, and a small amount is medium sand.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is fine sandy loam, but in some pedons it is sandy loam. The B horizon, if it occurs, has value of 3 or 4 and chroma of 1 or 2. The C horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 3.

Harpster Series

The Harpster series consists of deep, poorly drained, moderately permeable, calcareous soils on uplands. These soils are in drainageways and on upland flats. They formed in loess overlying loamy sediments or glacial till. The native vegetation is water-tolerant grasses. Slopes range from 0 to 2 percent.

Typical pedon of Harpster silty clay loam, 0 to 2 percent slopes, in a cultivated field; 1,245 feet north and 120 feet west of the southeast corner of sec. 5, T. 96 N., R. 18 W.

Akp—0 to 9 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak very fine subangular blocky structure; friable; violent effervescence; moderately alkaline; abrupt smooth boundary.

Ak1—9 to 13 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; violent effervescence; moderately alkaline; clear smooth boundary.

Ak2—13 to 20 inches; very dark gray (5Y 3/1) silt loam, dark gray (10YR 4/1) dry; few fine prominent reddish brown (5YR 4/4) mottles; weak very fine subangular blocky structure; friable; 1-inch-diameter olive (5Y 4/3) krotovina; violent effervescence; moderately alkaline; clear smooth boundary.

Bg1—20 to 29 inches; olive gray (5Y 4/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few dark concretions of iron and manganese oxide; slight effervescence; mildly alkaline; clear smooth boundary.

Bg2—29 to 36 inches; olive gray (5Y 5/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few dark concretions of iron and manganese oxide; slight effervescence; mildly alkaline; clear smooth boundary.

2BC—36 to 40 inches; olive (5Y 5/3) loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; common dark concretions of iron and manganese oxide; few pebbles throughout; slight effervescence; mildly alkaline; abrupt smooth boundary.

2C1—40 to 50 inches; light olive brown (2.5Y 5/4) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few pebbles throughout; slight effervescence; mildly alkaline; clear smooth boundary.

2C2—50 to 60 inches; olive (5Y 5/3) loam; many medium distinct yellowish brown (10YR 5/6) and common medium distinct gray (5Y 5/1) mottles; massive; firm; few fine dark concretions of iron and manganese oxide; few nodules of calcium carbonate; few pebbles throughout; strong effervescence; moderately alkaline.

The thickness of the solum typically ranges from 35 to 45 inches. The A horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. It is 12 to 22 inches thick. The Bg horizon has hue of 10YR to 5Y, value of 4 or more, and chroma of 1 to 3. It is silty clay loam or silt loam. The 2C horizon ranges from sandy loam to clay loam.

Hayfield Series

The Hayfield series consists of moderately deep, somewhat poorly drained soils on stream terraces and outwash plains and occasionally on uplands. These soils formed in 20 to 40 inches of loamy sediments and in the underlying sand and gravel. Permeability is moderate in the upper part of the profile and rapid in

the lower part. The native vegetation is mixed prairie grasses and trees. Slopes range from 0 to 2 percent.

Typical pedon of Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field; 270 feet north and 325 feet west of the southeast corner of sec. 32, T. 96 N., R. 17 W.

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

E—9 to 16 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure parting to weak fine and very fine granular; friable; slightly acid; clear smooth boundary.

Bt1—16 to 21 inches; brown (10YR 4/3) clay loam; common fine faint dark grayish brown (10YR 4/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak very fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films in root channels; slightly acid; clear smooth boundary.

Bt2—21 to 27 inches; brown (10YR 4/3) sandy clay loam; common fine faint dark grayish brown (10YR 4/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak fine and very fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; few pebbles; medium acid; clear smooth boundary.

2BC—27 to 37 inches; light olive brown (2.5Y 5/4) loamy sand; weak medium subangular blocky structure; very friable; few distinct brown (10YR 4/3) clay films on faces of peds; few pebbles; medium acid; clear smooth boundary.

2C1—37 to 45 inches; light olive brown (2.5Y 5/4) sand; single grained; loose; few distinct grayish brown (10YR 4/2) clay films in root channels; few pebbles; medium acid; clear smooth boundary.

2C2—45 to 48 inches; dark yellowish brown (10YR 4/4) gravelly sand (20 percent gravel); single grained; loose; many faint very dark grayish brown (10YR 3/2) and brown (10YR 4/3) clay films on gravel and clay bridges between sand grains; medium acid; abrupt smooth boundary.

2C3—48 to 60 inches; olive yellow (2.5Y 6/6) sand; single grained; loose; few distinct very dark grayish brown (10YR 3/2) and brown (10YR 4/3) clay bridges between sand grains; few pebbles; medium acid.

The thickness of the solum ranges from 24 to 40 inches. The solum frequently extends into the upper part of the underlying sand and gravel. Carbonates are at a depth of 60 inches or more.

The A and E or EB horizons typically are loam or silt loam that is high in the content of sand. The Bt horizon is clay loam, loam, or sandy clay loam that has a clay content of 28 percent or less. The 2BC horizon and the upper part of the 2C horizon typically are loamy sand or sand that contains gravel.

Jacwin Series

The Jacwin series consists of moderately deep, somewhat poorly drained soils on low uplands and on high stream benches bordering the uplands. These soils formed in silty sediments and in the underlying clayey residuum and shale. Permeability is moderate in the upper part of the profile and very slow in the underlying clayey residuum and shale. The native vegetation is prairie grasses. Slopes range from 1 to 5 percent.

The Jacwin soils in this county are taxadjuncts to the series because the control section is fine silty over clayey. They classify as fine-silty over clayey, mixed, mesic Aquic Hapludolls.

Typical pedon of Jacwin silty clay loam, 1 to 5 percent slopes, in a cultivated field; 256 feet north and 160 feet west of the southeast corner of sec. 7, T. 95 N., R. 18 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine granular and subangular blocky structure; friable; neutral; clear smooth boundary.

A—7 to 13 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; streaks and pockets of olive brown (2.5Y 4/4) subsurface material; few faint black (10YR 2/1) coatings on faces of peds; weak very fine granular structure; friable; neutral; clear smooth boundary.

AB—13 to 16 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, dark grayish brown (2.5Y 4/2) dry; common faint very dark gray (10YR 3/1) coatings on faces of peds; weak very fine and fine granular structure; friable; neutral; clear smooth boundary.

Bw—16 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few faint very dark grayish brown (2.5Y 3/2) coatings on faces of peds; weak fine prismatic structure parting to weak very fine subangular blocky; friable; neutral; abrupt smooth boundary.

2BC—22 to 34 inches; olive gray (5Y 5/2) silty clay; common fine light olive brown (2.5Y 5/6) mottles; moderate fine prismatic structure; very firm; few limestone fragments; weak effervescence; mildly alkaline; clear smooth boundary.

2Cr—34 to 60 inches; mixed gray (5Y 5/1) and pale

olive (5Y 6/4) shale bedrock having a texture of silty clay; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to bedrock range from 30 to 40 inches. The depth to carbonates ranges from 20 to 40 inches. The cumulative thickness of the sediments over the material weathered from shale ranges from 20 to 30 inches. The thickness of the mollic epipedon ranges from 12 to 20 inches.

The A horizon has value of 2 or 3. The A and B horizons are silty clay loam or clay loam. The 2B horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 2 to 6. It is silty clay loam or silty clay. The 2Cr horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 to 6. It has 32 to 50 percent clay.

Jameston Series

The Jameston series consists of deep, poorly drained, slowly permeable soils at the head of drainageways on uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is mixed prairie grasses and sedges. Slopes range from 0 to 2 percent.

Typical pedon of Jameston silty clay loam, 0 to 2 percent slopes, in a cultivated field; 230 feet south and 315 feet west of the northeast corner of sec. 8, T. 94 N., R. 16 W.

Ap—0 to 7 inches thick; black (N 2/0) silty clay loam (29 percent clay), very dark gray (5Y 3/1) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.

A—7 to 14 inches; black (N 2/0) silty clay loam, very dark gray (5Y 3/1) dry; weak very fine and fine granular structure; friable; neutral; clear smooth boundary.

AB—14 to 19 inches; very dark gray (5Y 3/1) and dark olive gray (5Y 3/2) silty clay loam, dark gray (5Y 4/1) and olive gray (5Y 4/2) dry; few faint black (10YR 2/1) coatings on faces of peds; few fine distinct light olive brown (2.5Y 5/6) mottles; weak very fine and fine granular structure; friable; neutral; gradual smooth boundary.

Bg—19 to 25 inches; olive gray (5Y 4/2) silty clay loam; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine distinct reddish yellow (7.5YR 6/8) mottles; moderate very fine subangular blocky structure; friable; black (10YR 2/1) krotovina; neutral; clear smooth boundary.

Btg1—25 to 32 inches; olive (5Y 4/3) silty clay loam; few fine distinct reddish yellow (7.5YR 6/8) mottles; weak fine prismatic structure parting to weak very fine subangular blocky; friable; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few dark concretions of iron and manganese oxide; neutral; abrupt smooth boundary.

2Btg2—32 to 41 inches; mottled olive gray (5Y 5/2), yellowish brown (10YR 5/6), and light olive brown (2.5Y 5/6) clay loam; pockets and streaks of very dark gray (N 3/0) organic material; few faint olive gray (5Y 5/2) coatings on faces of prisms; moderate fine and medium prismatic structure parting to moderate medium subangular blocky; very firm; few faint olive gray (5Y 4/2) clay films on faces of peds; thin stone line in the upper part; few dark concretions of iron and manganese oxide; few pebbles throughout; mildly alkaline; abrupt wavy boundary.

2BCg—41 to 52 inches; mottled olive gray (5Y 5/2), yellowish brown (10YR 5/6), and light olive brown (2.5Y 5/6) clay loam; pockets and streaks of very dark gray (N 3/0) organic material; weak medium prismatic structure; very firm; few pebbles; few dark concretions of iron and manganese oxide; few pebbles throughout; strong effervescence; mildly alkaline; clear smooth boundary.

2Cg—52 to 60 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct olive gray (5Y 5/2) mottles; massive; very firm; yellowish red (5YR 5/8) concretions of iron oxide; few pebbles throughout; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 36 to 60 inches. The thickness of the mollic epipedon ranges from 15 to 22 inches. In many pedons a stone line is at the contact of the loamy sediments and the glacial till.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 and chroma of 0 or 1. The AB horizon has hue of 10YR, 2.5Y, or 5Y, value of 3, and chroma of 1 or 2. The A horizon typically is silty clay loam. The 2B horizon has hue of 7.5YR to 5Y, value of 4 or 5, and chroma of 1 to 8. It has high- and low-chroma mottles. Texture of the B horizon is silty clay loam or clay loam. The 2C horizon has hue of 7.5YR to 5Y, value of 4 and 5, and chroma of 1 to 8. It has high- and low-chroma mottles.

Kenyon Series

The Kenyon series consists of deep, moderately well drained, moderately permeable soils on upland flats, ridge crests, and side slopes. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 0 to 9 percent.

Typical pedon of Kenyon loam, 2 to 5 percent slopes, in a cultivated field; 245 feet west and 60 feet south of the center of sec. 13, T. 95 N., R. 17 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; slightly acid; abrupt smooth boundary.
AB—9 to 13 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; few faint very dark gray (10YR 3/1) coatings on faces of peds; weak very fine granular structure; friable; medium acid; clear smooth boundary.
Bw1—13 to 18 inches; brown (10YR 4/3) loam; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; weak very fine subangular blocky structure; friable; medium acid; clear smooth boundary.
2Bw2—18 to 26 inches; yellowish brown (10YR 5/6) loam; few faint brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; friable; thin stone line in the upper part; about 5 percent pebbles; strongly acid; clear smooth boundary.
2Bw3—26 to 30 inches; yellowish brown (10YR 5/4) loam; few fine faint strong brown (7.5YR 5/6) and brown (10YR 5/3) mottles; weak medium prismatic structure parting to weak fine subangular blocky; friable; about 5 percent pebbles; strongly acid; clear smooth boundary.
2Bw4—30 to 39 inches; light olive brown (2.5Y 5/4) loam; few faint brown (10YR 5/3) coatings on faces of peds; few fine faint strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; few faint dark grayish brown (10YR 4/2) clay films in root channels in the lower part; about 5 percent pebbles; strongly acid; clear smooth boundary.
2BC—39 to 45 inches; light olive brown (2.5Y 5/4) loam; few faint light brownish gray (2.5Y 6/2) coatings on faces of prisms; weak fine prismatic structure; firm; few distinct very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) clay films in root channels; about 5 percent pebbles; neutral; abrupt wavy boundary.
2C—45 to 60 inches; light olive brown (2.5Y 5/4) loam; many coarse distinct light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) mottles; massive; firm; few dark concretions of iron and manganese oxide; few soft accumulations of calcium carbonate; about 5 percent pebbles; strongly effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates typically range from 45 to 60 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. Typically, a 1- to 3-inch-thick stone line separates the glacial till and the overlying sediments.

The A and Bw horizons typically are loam, but the range includes silt loam that has a high content of sand. The 2B horizon typically is loam that has a clay content of 24 to 27 percent, but the range includes sandy clay loam and clay loam.

The soil in map unit 83C2 is a taxadjunct to the Kenyon series because it does not have a mollic epipedon. It classifies as fine-loamy, mixed, mesic Aquic Hapludolls.

Klinger Series

The Klinger series consists of deep, somewhat poorly drained, moderately permeable soils on upland ridges, at the head of upland drainageways, and on side slopes. These soils formed in loess and in the underlying till. The native vegetation is prairie grasses. Slopes range from 0 to 3 percent.

Typical pedon of Klinger silty clay loam, 0 to 3 percent slopes, in a cultivated field; 180 feet north and 2,140 feet east of the southwest corner of sec. 21, T. 94 N., R. 18 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam (30 percent clay), dark gray (10YR 4/1) dry; weak very fine granular structure; friable; medium acid; abrupt smooth boundary.
A—9 to 14 inches; black (10YR 2/1) silty clay loam (31 percent clay), dark gray (10YR 4/1) dry; weak very fine granular structure; friable; strongly acid; gradual smooth boundary.
AB—14 to 18 inches; very dark grayish brown (2.5Y 3/2) silty clay loam (31 percent clay), grayish brown (10YR 5/2) dry; streaks and pockets of dark grayish brown (10YR 4/2) subsoil material; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; weak very fine subangular blocky structure; friable; strongly acid; gradual smooth boundary.
Bt1—18 to 28 inches; dark grayish brown (2.5Y 4/2) silty clay loam (32 percent clay); weak very fine subangular blocky structure; friable; few faint very dark grayish brown (10YR 3/2) clay films in root channels; strongly acid; clear smooth boundary.
2Bt2—28 to 34 inches; yellowish brown (10YR 5/6) loam (23 percent clay); few distinct grayish brown (10YR 5/2) coatings on faces of peds; weak fine prismatic structure parting to moderate fine subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films in root channels; stone line in the upper part; few pebbles throughout; strongly acid; gradual smooth boundary.
2Bt3—34 to 49 inches; yellowish brown (10YR 5/4) clay loam (30 percent clay); few distinct grayish brown (2.5Y 5/2) coatings on faces of peds; moderate medium subangular blocky structure; firm; few

pebbles throughout; medium acid; gradual smooth boundary.
2BC—49 to 55 inches; yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) clay loam (29 percent clay); few fine distinct olive gray (5Y 5/2) mottles; massive; firm; few pebbles throughout; slightly acid; clear smooth boundary.
2C—55 to 60 inches; yellowish brown (10YR 5/6) loam (25 percent clay); massive; firm; few pebbles throughout; violent effervescence; moderately alkaline.

The thickness of the solum typically ranges from 40 to 60 inches. The thickness of the loess typically ranges from 24 to 36 inches, but in some pedons it ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 16 to 24 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 2 to 6. The content of sand in the A horizon and the upper part of the B horizon ranges from 3 to 10 percent. In places thin, discontinuous lenses of sandy loam, loamy sand, or sand are between the loess and the till.

Lamont Series

The Lamont series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in loamy and sandy eolian material. The native vegetation is oak-hickory forest. Slopes range from 2 to 9 percent.

Typical pedon of Lamont fine sandy loam, 2 to 5 percent slopes, in an area of pasture; 1,080 feet south and 25 feet west of the center of sec. 35, T. 97 N., R. 16 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak very fine and fine subangular blocky structure parting to weak fine granular; very friable; slightly acid; clear smooth boundary.
E—5 to 9 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; few faint dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure parting to weak fine subangular blocky; very friable; medium acid; clear smooth boundary.
EB—9 to 18 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; few faint dark brown (10YR 3/3) coatings on faces of peds; weak medium platy structure parting to weak fine and medium subangular blocky; very friable; medium acid; gradual smooth boundary.
Bt1—18 to 30 inches; brown (10YR 4/3) sandy loam; weak fine and very fine subangular blocky structure; very friable; few thin dark brown (7.5YR 4/2) clay films on faces of peds and clay bridges between sand grains; medium acid; clear smooth boundary.
Bt2—30 to 34 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine and medium subangular blocky structure; very friable; few faint dark brown (7.5YR 4/2) clay bridges between sand grains; strongly acid; abrupt smooth boundary.
BC—34 to 45 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; strongly acid; abrupt smooth boundary.
2E and Bt—45 to 60 inches; dark yellowish brown (10YR 4/4) loamy sand (2E); single grained; loose; few thin lamellae of dark brown (7.5YR 4/2) sandy loam (2Bt); medium acid.

The thickness of the solum ranges from 35 to 65 inches. Carbonates are at a depth of more than 60 inches.

The Ap or A horizon has chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The content of clay in the Bt horizon ranges from 8 to 14 percent. The 2E and Bt horizon dominantly has hue of 10YR or 7.5YR, but some sand grains may have grayer hue. The 2E and Bt horizon is sand or loamy sand that has lamellae of sandy loam or loamy sand.

Lawler Series

The Lawler series consists of deep, somewhat poorly drained soils on stream terraces and outwash plains and occasionally on uplands. These soils formed in loamy sediments overlying sand and gravel. Permeability is moderate in the solum and very rapid in the substratum. The native vegetation is prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field; 515 feet west and 100 feet north of the southeast corner of sec. 2, T. 94 N., R. 18 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; neutral; clear smooth boundary
A—8 to 15 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine and very fine granular structure; friable; slightly acid; gradual smooth boundary.
AB—15 to 19 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) dry; streaks and pockets of dark grayish brown (10YR 4/2) subsurface material in the lower part; very dark brown (10YR

2/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary

Bw—19 to 33 inches; dark grayish brown (10YR 4/2) sandy clay loam (23 percent clay); few fine faint yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; few pebbles; medium acid; gradual smooth boundary.

BC—33 to 38 inches; mottled dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) sandy loam (17 percent clay); few fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very friable; medium acid; clear smooth boundary.

2C1—38 to 42 inches; grayish brown (10YR 5/2) and brown (10YR 5/3) loamy sand; weak coarse subangular blocky structure; very friable; few pebbles; medium acid; clear smooth boundary.

2C2—42 to 60 inches; light olive brown (2.5Y 5/4) sand; single grained; loose; few pebbles; slightly acid.

The thickness of the solum typically ranges from 24 to 40 inches and commonly corresponds to the depth to sand and gravel. In some places the solum extends into the upper part of the underlying sand and gravel. Carbonates are at a depth of 48 inches or more.

The A horizon typically is loam or clay loam, but the range includes silt loam that has a sand content of 15 to 20 percent. The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It typically is loam, sandy clay loam, or clay loam. The 2BC horizon and the upper part of the 2C horizon typically range from loamy sand to gravelly sand. The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4.

Lilah Series

The Lilah series consists of deep, excessively drained soils in upland outwash areas and on stream terraces. These soils formed in loamy sediments and in the underlying sand and gravel. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The native vegetation is mixed trees and prairie grasses. Slopes range from 3 to 9 percent.

Typical pedon of Lilah sandy loam, 3 to 9 percent slopes, in an area of pasture; 1,770 feet south and 800 feet east of the northwest corner of sec. 36, T. 96 N., R. 15 W.

A—0 to 6 inches; very dark gray (10YR 3/1) sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; many fine roots; medium acid; clear smooth boundary.

Bt1—6 to 12 inches; dark brown (10YR 4/3) gravelly sandy loam; weak fine subangular blocky structure; very friable; few faint very dark grayish brown (10YR 3/2) clay films on faces of peds; few thin roots; about 25 percent gravel; strongly acid; gradual smooth boundary.

Bt2—12 to 18 inches; dark yellowish brown (10YR 4/4 and 4/6) gravelly loamy sand; weak fine and medium subangular blocky structure; very friable; few faint dark brown (10YR 4/3) clay bridges between sand grains and gravels; few thin roots; about 20 percent gravel; medium acid; gradual smooth boundary.

Bt3—18 to 28 inches; yellowish brown (10YR 5/6) gravelly sand; weak medium subangular blocky structure; very friable; few faint dark brown (10YR 4/3) clay bridges between sand grains and gravels; few thin roots; about 20 percent gravel; medium acid; gradual smooth boundary.

BC—28 to 44 inches; dark yellowish brown (10YR 4/6) gravelly sand; weak medium and coarse subangular blocky structure; very friable and loose; few faint brown (10YR 5/3) clay bridges between sand grains and gravels; few thin roots; about 30 percent gravel; medium acid; gradual smooth boundary.

C—44 to 60 inches; dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) sand; single grained; loose; few faint brown (10YR 5/3) clay bridges between sand grains and gravels; about 10 percent gravel; medium acid.

The thickness of the solum ranges from 36 to 60 inches. The content of gravel in the upper 40 inches of the profile typically ranges from 10 to 30 percent.

The A horizon has chroma of 1 or 2. It is 5 to 8 inches thick. It typically is sandy loam, but the range includes loam and gravelly sandy loam. Some pedons have an E horizon. The Bt horizon ranges from sandy loam to gravelly sand. The C horizon is gravelly sand or sand that contains some gravel.

Limecreek Series

The Limecreek series consists of deep, moderately well drained, moderately permeable soils on ridges and side slopes in the uplands. These soils formed in 20 to 40 inches of silty surficial sediments overlying stratified, unconsolidated material weathered from fossiliferous siltstone and shaly limestone. The native vegetation is prairie grasses. Slopes range from 0 to 9 percent.

Typical pedon of Limecreek silty clay loam, 2 to 5 percent slopes, in an area of bluegrass pasture; 280 feet south and 25 feet east of the northwest corner of sec. 21, T. 94 N., R. 18 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine and very fine granular structure; friable; mildly alkaline; clear smooth boundary.
A—7 to 13 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; few faint black (10YR 2/1) coatings on faces of peds; moderate fine and very fine granular structure; friable; neutral; gradual smooth boundary.
BA—13 to 18 inches; brown (10YR 4/3) silty clay loam; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate very fine and fine subangular blocky structure; friable; neutral; gradual smooth boundary.
Bw—18 to 25 inches; brown (10YR 4/3) clay loam; few fine faint grayish brown (10YR 5/2) mottles; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate very fine and fine subangular blocky structure; friable; neutral; gradual smooth boundary.
C1—25 to 51 inches; light yellowish brown (2.5Y 6/4) silty clay loam; massive with subangular blocky soil fragments; friable; few roots; pebble band of brachiopod fossils and cherty limestone fragments in the upper part; few fossils throughout; strong effervescence; moderately alkaline; clear smooth boundary.
C2—51 to 60 inches; light yellowish brown (2.5Y 6/4) loam; common fine and medium faint light brownish gray (2.5Y 6/2) and common fine distinct yellowish brown (10YR 5/6) mottles; massive with angular blocky soil fragments; firm; few soft dark accumulations of manganese oxide; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 40 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. A stone line that consists mainly of brachiopod fossils and cherty limestone fragments typically separates the silty mantle and the underlying material weathered from fossiliferous shaly limestone.

The A and Bw horizons typically are silty clay loam or silt loam that has a clay content of 24 to 30 percent. The content of silt or sand in the C horizon may be as much as 70 percent or as little as 15 percent. The sand-sized fraction generally is very fine sand and fine sand. The content of clay ranges from 10 to 45 percent in the subhorizons of the C horizon with the average between 25 and 35 percent.

Lourdes Series

The Lourdes series consists of deep, moderately well drained, moderately slowly permeable soils on upland ridge crests and side slopes. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is mixed prairie grasses and deciduous trees. Slopes range from 2 to 9 percent.

Typical pedon of Lourdes loam, 2 to 5 percent slopes, in a cultivated field; 1,790 feet east and 115 feet north of the southwest corner of sec. 33, T. 97 N., R. 15 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.
E—8 to 11 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak medium platy structure parting to weak very fine subangular blocky; friable; neutral; clear smooth boundary.
Bt1—11 to 16 inches; brown (10YR 4/3) loam; moderate very fine and fine subangular blocky structure; friable; common faint very dark gray (10YR 4/2) clay films on faces of peds and in root channels; medium acid; clear smooth boundary.
2Bt2—16 to 23 inches; yellowish brown (10YR 5/4) clay loam; few fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common distinct very dark gray (10YR 4/2) clay films on faces of peds; few faint light gray (10YR 7/2) silt coatings on faces of peds; stone line in the upper part; few pebbles; strongly acid; clear smooth boundary.
2Bt3—23 to 32 inches; yellowish brown (10YR 5/6) clay loam; few fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common distinct light gray (10YR 7/2) silt coatings on faces of prisms; few pebbles; strongly acid; very firm; clear smooth boundary.
2Bt4—32 to 43 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) clay loam; weak medium prismatic structure parting to weak medium subangular blocky; very firm; common distinct dark gray (10YR 4/1) clay films in root channels and on faces of peds; few pebbles; medium acid; clear smooth boundary.
2BC—43 to 52 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) clay loam; few medium faint strong brown (7.5YR 5/8) mottles; weak medium prismatic structure; very firm; few distinct dark grayish brown (10YR 4/2) clay films in root channels; few pebbles; medium acid; clear wavy boundary.

2C—52 to 60 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) clay loam; common fine strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; very firm; few distinct dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) clay films in root channels; few pebbles; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 60 inches. The thickness of the material having mollic colors ranges from 6 to 10 inches.

The Ap or A horizon has value of 2 or 3. The E horizon is 2 to 6 inches thick. The average content of clay in the 2B horizon typically ranges from 30 to 35 percent, but in some subhorizons it is as much as 38 percent.

Marshan Series

The Marshan series consists of deep, poorly drained soils on stream terraces and outwash plains. These soils formed in loamy sediments over sand. Permeability is moderate in the solum and rapid in the substratum. The native vegetation is water-tolerant grasses. Slopes range from 0 to 2 percent.

Typical pedon of Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field; 1,560 feet north and 250 feet east of the southwest corner of sec. 34, T. 94 N., R. 18 W.

Ap—0 to 8 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A—8 to 14 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; weak very fine granular structure; friable; neutral; gradual smooth boundary.

AB—14 to 21 inches; very dark gray (5Y 3/1) clay loam, dark gray (5Y 4/1) dry; weak very fine and fine granular structure; friable; neutral; clear smooth boundary.

Bg1—21 to 27 inches; olive gray (5Y 4/2) loam (25 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; weak fine and very fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bg2—27 to 32 inches; grayish brown (2.5Y 5/2) loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

BCg—32 to 36 inches; grayish brown (2.5Y 5/2) sandy loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; neutral; clear smooth boundary.

2Cg—36 to 50 inches; grayish brown (2.5Y 5/2) sand; many medium distinct light olive brown (2.5Y 5/6) mottles; single grained; loose; about 5 percent gravel; neutral; clear smooth boundary.

2Cg—50 to 60 inches; yellowish brown (10YR 5/6) coarse sand; many medium and coarse strong brown (7.5YR 5/6) mottles; single grained; loose; about 15 percent gravel; neutral.

The thickness of the solum ranges from 24 to 40 inches and commonly corresponds to the depth to sand and gravel. In some areas the solum extends into the upper part of the underlying sand and gravel. Carbonates are at a depth of 48 inches or more.

The A horizon has hue of 10YR or is neutral in hue. It has chroma of 0 or 1. The AB horizon, if it occurs, has hue of 10YR to 5Y and chroma of 1 or 2. The upper part of the Bg horizon also has hue of 10YR to 5Y and chroma of 1 or 2. It is clay loam, loam, or silty clay loam. The BCg or 2BCg horizon ranges from sandy loam to sand. The 2C horizon is sand or gravelly sand.

Maxfield Series

The Maxfield series consists of deep, poorly drained, moderately permeable soils on upland flats and in shallow drainageways. These soils formed in loess and in the underlying glacial till. The native vegetation is water-tolerant grasses. Slopes range from 0 to 2 percent.

Typical pedon of Maxfield silty clay loam, 0 to 2 percent slopes, in a cultivated field; 550 feet north and 300 feet east of the southwest corner of sec. 22, T. 94 N., R. 18 W.

Ap—0 to 9 inches; black (N 2/0) silty clay loam (34 percent clay), very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A—9 to 15 inches; black (N 2/0) silty clay loam (36 percent clay), very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

AB—15 to 19 inches; very dark gray (5Y 3/1) silty clay loam (34 percent clay); pockets of olive (5Y 5/3) subsoil material; few fine prominent strong brown (7.5YR 4/6) mottles; weak fine granular structure; friable; neutral; gradual smooth boundary.

Bg1—19 to 28 inches; olive gray (5Y 5/2) and olive (5Y 5/3) silty clay loam (30 percent clay); few fine prominent yellowish red (5YR 5/8) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; neutral; clear smooth boundary.

2Bg2—28 to 39 inches; yellowish brown (10YR 5/6)

clay loam (30 percent clay); many medium prominent grayish brown (2.5Y 5/2) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay flows in root channels; few dark concretions of iron and manganese oxide; few small pebbles; neutral; abrupt smooth boundary.

2BC—39 to 48 inches; yellowish brown (10YR 5/6) clay loam (30 percent clay); common medium prominent grayish brown (2.5Y 5/2) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; firm; few distinct dark grayish brown (10YR 4/2) clay films in root channels; few dark concretions of iron and manganese oxide; few small pebbles; slight effervescence; mildly alkaline; abrupt smooth boundary.

2C—48 to 60 inches; yellowish brown (10YR 5/6) loam (26 percent clay); common medium prominent grayish brown (2.5Y 5/2) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; firm; few dark concretions of iron and manganese oxide; few soft accumulations of calcium carbonate as much as 2 inches in size; few small pebbles; violent effervescence; mildly alkaline.

The solum typically is 38 to 54 inches thick. The A horizon is 15 to 23 inches thick. The content of clay in the A horizon ranges from about 30 to 35 percent. The AB horizon, if it occurs, has hue of 10YR or 5Y. The content of clay in the upper part of the Bg horizon ranges from about 30 to 35 percent. The Bg and 2Bg horizons have hue of 10YR to 5Y and value of 4 or 5. The 2Bg horizon typically is clay loam, but the range includes loam that has thin, discontinuous strata of sandy loam.

Mottland Series

The Mottland series consists of deep, well drained soils on moderately sloping and strongly sloping side slopes and narrow ridge crests on uplands. These soils formed in loamy sediments overlying residuum derived from shaly limestone deposits. Permeability is moderate in the upper part of the profile and moderately rapid in the substratum. The native vegetation is prairie grasses. Slopes range from 5 to 14 percent.

The Mottland soils in this county are taxadjuncts to the series because they have a higher content of clay than is definitive for the series. They differ from the Mottland soils in other areas in that they formed in material weathered from shaly limestone deposits. They classify as fine-silty, carbonitic, mesic Entic Hapludolls.

Typical pedon of Mottland loam, 9 to 14 percent slopes, moderately eroded, in an area of bluegrass pasture; 2,040 feet east and 34 feet south of the northwest corner of sec. 21, T. 94 N., R. 18 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) kneaded, grayish brown (10YR 5/2) dry; moderate fine and very fine granular structure; friable; strong effervescence; moderately alkaline; many roots; clear smooth boundary.

C1—6 to 11 inches; light olive brown (2.5Y 5/4) loam; few faint brown (10YR 4/3) coatings on faces of peds; moderate very fine subangular blocky structure; friable; many roots; strong effervescence; moderately alkaline; clear smooth boundary.

C2—11 to 25 inches; light yellowish brown (2.5Y 6/4) silty clay loam (about 28 percent clay); rock structure and moderate very fine subangular blocky structure; friable; few roots; strong effervescence; moderately alkaline; clear smooth boundary.

C3—25 to 36 inches; light yellowish brown (2.5Y 6/4) silty clay loam (about 28 percent clay); rock structure and moderate very fine subangular and angular blocky structure; firm; strong effervescence; moderately alkaline; clear smooth boundary.

C4—36 to 44 inches; light yellowish brown (2.5Y 6/4) loam; common fine distinct yellowish brown (10YR 5/6) and common fine and medium faint light brownish gray (2.5Y 6/2) mottles; rock structure and moderate fine and medium angular and subangular blocky structure; firm; few roots; few dark concretions of iron and manganese oxide; strong effervescence; moderately alkaline; clear smooth boundary.

C5—44 to 60 inches; olive yellow (2.5Y 6/6) loam; common medium faint light brownish gray (2.5Y 6/2) mottles; rock structure and moderate fine and medium angular and subangular blocky structure; firm; few dark concretions of iron and manganese oxide; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 6 to 20 inches. The thickness of the mollic epipedon ranges from 6 to 10 inches. Fragments of brachiopods, other fossils, and cherty limestone are common on the surface and within the profile.

The A horizon is loam or silt loam that has a high content of very fine sand and fine sand. The percentage of sand, silt, and clay in the material weathered from shaly limestone varies greatly between horizons. The content of clay ranges from 10 to 35 percent in the C horizon with the average between 25 and 30 percent. The content of coarse fragments in the C horizon ranges from 3 to 10 percent. The fragments generally are from brachiopods.

Mt. Carroll Series

The Mt. Carroll series consists of deep, well drained, moderately permeable soils on ridges and side slopes in the uplands. These soils formed in loess. The native vegetation is prairie grasses and trees. Slopes range from 2 to 5 percent.

Typical pedon of Mt. Carroll silt loam, 2 to 5 percent slopes, in a cultivated field; 1,000 feet north and 375 feet west of the southeast corner of sec. 32, T. 97 N., R. 16 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; weak very fine granular structure; friable; neutral; abrupt smooth boundary.

E—7 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; pockets of dark grayish brown (10YR 4/2) material; weak medium platy structure parting to weak very fine subangular blocky; friable; slightly acid; clear smooth boundary.

Bt1—10 to 18 inches; yellowish brown (10YR 5/4) silt loam; few faint brown (10YR 5/3) coatings on faces of peds; moderate fine and very fine subangular blocky structure; friable; few distinct light brownish gray (10YR 6/2) sand and silt coatings on faces of peds; slightly acid; gradual smooth boundary.

Bt2—18 to 28 inches; yellowish brown (10YR 5/4) silt loam; moderate fine and very fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—28 to 36 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt4—36 to 46 inches; yellowish brown (10YR 5/4) silt loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds and in root channels; medium acid; gradual smooth boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (2.5Y 6/2) mottles; massive; friable; medium acid.

The thickness of the solum ranges from 40 to 50 inches. The depth to carbonates ranges from 45 to 70 inches. The thickness of the material having mollic colors ranges from 6 to 10 inches.

The Ap or A horizon has value of 2 or 3. The E horizon, if it occurs, has value of 4 or 5 and chroma of 2 or 3. It is as much as 6 inches thick. The Bt horizon typically has value of 4 or 5 and chroma of 3 or 4.

Norville Series

The Norville series consists of deep, moderately well drained soils on uplands. These soils formed in 20 to 40 inches of silty sediments overlying red, clayey cretaceous deposits. Permeability is moderate in the upper part of the profile and slow in the lower part. The native vegetation is prairie grasses. Slopes range from 0 to 9 percent.

Typical pedon of Norville silty clay loam, 2 to 5 percent slopes, in a cultivated field; 2,380 feet south and 185 feet east of the northwest corner of sec. 26, T. 96 N., R. 18 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine and very fine granular structure; friable; neutral; abrupt smooth boundary.

A—9 to 12 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; few faint black (10YR 2/1) coatings on faces of peds; pockets of very dark grayish brown (10YR 3/2) subsurface material in the lower part; weak fine and very fine granular structure; friable; neutral; clear smooth boundary.

AB—12 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular structure; friable; neutral; clear smooth boundary.

Bw1—16 to 24 inches; brown (10YR 4/3) silty clay loam (28 percent clay); few faint dark brown (10YR 3/3) coatings on faces of peds; weak very fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw2—24 to 28 inches; brown (10YR 4/3) silty clay loam (28 percent clay); weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw3—28 to 37 inches; red (2.5YR 4/6) silty clay; weak medium prismatic structure; very firm; few roots; mildly alkaline; abrupt smooth boundary.

2C1—37 to 50 inches; red (2.5YR 4/6) silty clay; thin strata of light olive gray (5Y 6/2); massive with prismatic soil fragments; very firm; violent effervescence; mildly alkaline; abrupt smooth boundary.

2C2—50 to 60 inches; red (2.5YR 4/6) loam; few fragments of light brownish gray (2.5Y 6/2) sandstone; massive; firm; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to reddish silty clay typically are about 28 inches but range from 20 to 40 inches. A 2BC horizon has developed in the red clayey material of some pedons.

The Ap or A horizon has chroma of 1 or 2. The thickness of the A horizon ranges from 10 to 16 inches. The AB or BA horizon has chroma of 2 or 3. The mollic epipedon typically is silty clay loam or silt loam, but the range includes loam that has a sand content of 20 to 30 percent. The Bw horizon has value of 4 or 5 and chroma of 3 to 6. It ranges from silty clay loam to loam. The 2Bw and 2C horizons have hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. They range from silty clay to loam.

The Norville soil in map unit 194C3 is a taxadjunct to the series because it does not have a mollic epipedon. It classifies as fine-silty over clayey, mixed, mesic Typic Eutrochrepts.

Oakton Series

The Oakton series consists of deep, somewhat poorly drained soils on uplands. These soils formed in loamy and sandy eolian material. Permeability is moderate in the upper part of the profile and rapid in the lower part. The native vegetation is mixed prairie grasses and trees. Slopes range from 0 to 2 percent.

Typical pedon of Oakton loam, 0 to 2 percent slopes, in a cultivated field; 2,320 feet east and 115 feet south of the northwest corner of sec. 27, T. 95 N., R. 16 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loam, dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.

EB—9 to 13 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure parting to weak fine subangular blocky; friable; strongly acid; clear smooth boundary.

Bt1—13 to 18 inches; grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) loam; weak fine subangular blocky structure; friable; few fine dark grayish brown (10YR 4/2) clay films in root channels; strongly acid; gradual smooth boundary.

Bt2—18 to 24 inches; olive brown (2.5Y 4/4) loam; common fine faint grayish brown (2.5Y 5/2) and few distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; few dark grayish brown (10YR 4/2) clay films; strongly acid; gradual smooth boundary.

Bt3—24 to 29 inches; light olive brown (2.5Y 5/4) fine sandy loam; few fine distinct strong brown (7.5YR 5/8) and few fine faint light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; few dark grayish brown (10YR 4/2) clay films; medium acid; gradual smooth boundary.

Bt4—29 to 36 inches; light olive brown (2.5Y 5/4) fine sandy loam; few fine distinct strong brown (7.5YR 5/8) and few fine faint light brownish gray (10YR 6/2) mottles; weak fine prismatic structure parting to weak fine and medium subangular blocky; very friable; few dark grayish brown (10YR 4/2) clay films; few dark concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

Bt5—36 to 47 inches; light olive brown (2.5Y 5/4) loamy fine sand; few medium distinct light brownish gray (10YR 6/2) mottles; weak fine prismatic structure; very friable; few dark grayish brown (10YR 4/2) clay films; common dark concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

C—47 to 60 inches; light olive brown (2.5Y 5/4) sand; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure in the upper part; massive in the lower part; loose; slightly acid.

The thickness of the solum ranges from 36 to 50 inches. Carbonates are at a depth of more than 60 inches. Pebbles typically are not within a depth of 5 feet, but in some pedons they are at a depth of 4 feet. The content of clay in the control section ranges from 14 to 18 percent.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. It is 6 to 10 inches thick. The E, EB, or BE horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. The sand-sized fraction in the Bt horizon generally is fine sand or very fine sand above a depth of 40 inches. The C horizon dominantly is sand or loamy sand. In some pedons below a depth of 60 inches, it is stratified sandy loam, silt loam, and loam with variegated colors. Firm glacial till typically is below a depth of 65 inches.

Olin Series

The Olin series consists of deep, well drained, moderately permeable soils on ridge crests and convex side slopes in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 2 to 6 percent.

Typical pedon of Olin sandy loam, 2 to 6 percent slopes, in a cultivated field; 2,360 feet east and 245 feet north of the southwest corner of sec. 26, T. 95 N., R. 15 W.

Ap—0 to 9 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure parting to very weak

fine granular; friable; neutral; clear smooth boundary.

A—9 to 15 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; streaks and pockets of very dark grayish brown (10YR 3/2) subsurface material in the lower part; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.

AB—15 to 21 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 4/3) dry; common faint very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.

Bw1—21 to 29 inches; brown (10YR 4/3) sandy loam; few faint dark brown (10YR 3/3) coatings on faces of peds; weak fine and medium subangular blocky structure; very friable; slightly acid; abrupt smooth boundary.

2Bw2—29 to 38 inches; yellowish brown (10YR 5/4) loam; common fine distinct yellowish brown (10YR 5/6) and common fine faint grayish brown (2.5Y 5/2) mottles; weak fine prismatic structure parting to weak fine and medium subangular blocky; firm; stone line in the upper part; few pebbles throughout; slightly acid; gradual smooth boundary.

2BC—38 to 45 inches; light olive brown (2.5Y 5/4) clay loam; common fine distinct strong brown (7.5YR 5/6) and many fine distinct dark gray (10YR 4/1) mottles; weak medium prismatic structure; firm; few distinct dark grayish brown (10YR 4/2) clay films in root channels; few red (2.5YR 4/6) concretions of iron oxide and common fine black (10YR 2/1) concretions of manganese oxide; few pebbles throughout; strongly acid; gradual smooth boundary.

2C—45 to 60 inches; light olive brown (2.5Y 5/4) clay loam; common fine distinct strong brown (7.5YR 5/6) and many fine distinct dark gray (10YR 4/1) mottles; massive; firm; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to carbonates ranges from 50 to 80 inches. The content of clay in the 10- to 40-inch control section ranges from 12 to 18 percent. The thickness of the mollic epipedon ranges from 10 to 21 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The A and Bw horizons typically are sandy loam but range to fine sandy loam. In some pedons the Bw horizon has layers of loamy sand that are 1 to 5 inches thick. In many pedons a stone line is at the contact of the sandy loam and till. The 2B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 6. The 2B and C horizons are loam or clay loam.

Oran Series

The Oran series consists of deep, somewhat poorly drained, moderately permeable soils on slightly convex crests and side slopes in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is trees and prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Oran loam, 0 to 2 percent slopes, in a cultivated field; 255 feet north and 170 feet west of the southeast corner of sec. 4, T. 95 N., R. 15 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.

BE—8 to 12 inches; dark grayish brown (10YR 4/2) loam (25 percent clay); weak thin platy structure parting to weak very fine subangular blocky; friable; very dark grayish brown (10YR 3/2) wormcasts; medium acid; clear smooth boundary.

Bt1—12 to 17 inches; dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4) loam (25 percent clay); common fine distinct yellowish brown (10YR 5/6) mottles; weak fine and very fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films in root channels and on faces of peds; medium acid; clear smooth boundary.

2Bt2—17 to 30 inches; yellowish brown (10YR 5/6 and 5/4) loam; weak medium prismatic structure parting to weak fine and medium subangular blocky; friable in upper 3 inches; firm in lower part; few distinct dark grayish brown (10YR 4/2) clay films in root channels; few faint brown (10YR 5/3) coatings on faces of peds; stone line in the upper part; few stones as much as 1 inch in diameter; strongly acid; clear smooth boundary.

2BC—30 to 40 inches; yellowish brown (10YR 5/4) loam; many fine distinct strong brown (7.5YR 5/8) and few medium distinct olive gray (5Y 5/2) and light gray (5Y 7/2) mottles; weak fine prismatic structure parting to weak medium subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay flows; few pebbles throughout; slightly acid; clear smooth boundary.

2C—40 to 60 inches; yellowish brown (10YR 5/6) loam; many fine distinct strong brown (7.5YR 5/8) and few medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; few dark concretions of iron and manganese oxide; common soft accumulations of calcium carbonate; few pebbles throughout; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 50 inches. The depth to carbonates ranges from 40 to 70

inches. The surface layer typically has mollic colors to a depth of about 8 inches.

The Ap horizon typically has value of 2 or 3 and chroma of 1 or 2. The A horizon is loam or silt loam that is high in content of sand. The B, 2B, and 2C horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 8. They are loam, clay loam, or sandy clay loam.

Ostrander Series

The Ostrander series consists of deep, well drained, moderately permeable soils on ridge crests and side slopes and in low, benchlike positions and shallow drainageways on uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 0 to 9 percent.

Typical pedon of Ostrander loam, 2 to 5 percent slopes, in a cultivated field; 520 feet north and 1,640 feet west of the southeast corner of sec. 11, T. 95 N., R. 17 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—9 to 12 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

AB—12 to 16 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; weak very fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bw1—16 to 19 inches; dark brown (10YR 4/3) loam; few distinct very dark brown (10YR 2/2) coatings on faces of peds; moderate medium subangular blocky structure; friable; neutral; clear smooth boundary.

2Bw2—19 to 25 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; stone line in the upper part; slightly acid; clear smooth boundary.

2Bw3—25 to 38 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

2Bw4—38 to 44 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; very friable; neutral; abrupt wavy boundary.

2C1—44 to 54 inches; brownish yellow (10YR 6/6) loam; massive; friable; few small soft accumulations of calcium carbonate; strong effervescence; mildly alkaline; abrupt wavy boundary.

2C2—54 to 60 inches; very pale brown (10YR 7/4) loam; common fine distinct yellowish brown (10YR 5/8) mottles; massive; friable; common large accumulations of calcium carbonate; violent effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 44 to 76 inches. The thickness of the mollic epipedon ranges from 10 to 18 inches. In many areas a stone line is at the contact of the loamy sediments and the underlying glacial till.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The A and B horizons typically are loam. In some pedons the A horizon is silt loam that has a high content of sand. The 2B horizon has value of 4 or 5 and chroma of 4 to 6. It generally is loam, sandy loam, or sandy clay loam, but the range includes loamy sand, which is in thin subhorizons. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 4 to 8. It is friable and firm loam and sandy loam.

Palms Series

The Palms series consists of very deep, very poorly drained organic soils that are mainly on the lower part of hillsides and in drainageways on uplands. In a few places these soils are on stream benches and flood plains. They formed in organic material overlying loamy mineral sediments. Permeability is moderately rapid to moderately slow in the organic material and moderately slow in the substratum. The native vegetation is water-tolerant grasses and sedges. Slopes range from 0 to 5 percent.

Typical pedon of Palms muck, 0 to 5 percent slopes, in an area of uncultivated pasture; 1,220 feet east and 75 feet south of the northwest corner of sec. 1, T. 95 N., R. 15 W.

Oa1—0 to 14 inches; sapric material, black (N 2/0) broken face and rubbed; about 5 percent herbaceous fiber; weak fine granular structure; slightly sticky; neutral; gradual smooth boundary.

Oa2—14 to 24 inches; sapric material, black (N 2/0) broken face and rubbed; about 8 percent herbaceous fiber; massive and weak coarse subangular blocky structure; slightly sticky; slightly acid; clear smooth boundary.

Oa3—24 to 27 inches; sapric material, black (N 2/0) broken face, black (10YR 2/1) rubbed; about 10 percent herbaceous fiber; massive and weak coarse subangular blocky structure; slightly sticky; medium acid; clear smooth boundary.

Oa4—27 to 43 inches; sapric material, black (N 2/0) broken face and rubbed; about 5 percent herbaceous fiber; massive and weak coarse subangular blocky structure; slightly sticky; medium acid; abrupt smooth boundary.

2Cg1—43 to 52 inches; very dark gray (5Y 3/1) and

dark gray (5Y 4/1) silt loam; massive; friable; medium acid; clear smooth boundary.
2Cg2—52 to 60 inches; olive gray (5Y 5/2) sandy loam; massive; friable; mildly alkaline.

The organic material typically ranges from 20 to 43 inches in thickness, but in some pedons it ranges from 16 to 50 inches. It has hue of 10YR or is neutral in hue. It has chroma of 0 to 2. The colors of the organic material are similar, even when the material has been broken, rubbed, or pressed. The organic material typically is sapric, but some pedons have thin layers of hemic material. The 2C horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 2 to 6 and chroma of 0 to 2.

Pinicon Series

The Pinicon series consists of deep, somewhat poorly drained, moderately permeable soils on flats and low, slightly convex ridges in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is oak-hickory forest. Slopes range from 0 to 2 percent.

Typical pedon of Pinicon silt loam, 0 to 2 percent slopes, in a cultivated field; 500 feet south and 880 feet west of the center of sec. 3, T. 96 N., R. 16 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.
E—8 to 12 inches; light olive brown (2.5Y 5/4) silt loam, pale yellow (2.5Y 7/4) dry; common fine faint grayish brown (2.5Y 5/2) and few fine prominent strong brown (7.5YR 5/6) mottles; weak medium platy structure; friable; medium acid; clear smooth boundary.
EB—12 to 17 inches; light brownish gray (2.5Y 6/2) loam, light gray (2.5Y 7/1) dry; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium platy structure parting to weak fine subangular blocky; friable; strongly acid; clear smooth boundary.
2Bt1—17 to 27 inches; mottled light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; few distinct grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) clay films on faces of peds and in root channels; many reddish yellow (5YR 6/8) concretions of iron oxide; stone line in the upper part; few pebbles throughout; very strongly acid; clear smooth boundary.
2Bt2—27 to 37 inches; mottled light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) loam; few fine distinct reddish yellow (5YR 6/8) mottles; moderate medium subangular blocky structure; firm; few distinct dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) clay films on faces of peds and in root channels; few pebbles throughout; strongly acid; clear smooth boundary.
2Bt3—37 to 43 inches; mottled light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) loam; few fine distinct reddish yellow (5YR 6/8) mottles; weak medium prismatic structure; firm; common distinct dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) clay films on faces of prisms; few distinct dark grayish brown (10YR 4/2) clay films in root channels; few pebbles throughout; strongly acid; clear smooth boundary.
2BC—43 to 51 inches; mottled light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) loam; few fine distinct reddish yellow (5YR 6/8) mottles; weak coarse prismatic structure; firm; few distinct dark grayish brown (10YR 4/2) and grayish brown clay films on faces of prisms; few prominent thick very dark gray (10YR 3/1) clay films in root channels; few pebbles throughout; medium acid; clear smooth boundary.
2C—51 to 60 inches; mottled light yellowish brown (2.5Y 6/4) and strong brown (7.5YR 5/8) loam; massive; firm; few distinct very dark gray (10YR 3/1) clay films in root channels; few pebbles throughout; medium acid.

The thickness of the solum ranges from 45 to 70 inches. The depth to carbonates ranges from 45 to 72 inches. Typically, a 1- to 3-inch-thick stone line separates the glacial till and the overlying sediment.

In areas of native woodland, the A horizon may have mollic colors and is 2 to 4 inches thick. The Ap horizon typically has chroma of 1 or 2. The A horizon is loamy sand, sandy loam, loam, or silt loam that has a high content of sand. The E horizon is similar to the A horizon in texture. It has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4. The 2Bt horizon is mottled. It has hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 6. The 2B horizon is loam or clay loam.

Protivin Series

The Protivin series consists of deep, somewhat poorly drained, moderately slowly permeable soils on the lower side slopes and on the very gently sloping ridge crests in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is mixed prairie grasses. Slopes range from 1 to 4 percent.

Typical pedon of Protivin clay loam, 1 to 4 percent slopes, in a cultivated field; 80 feet west and 70 feet south of the northeast corner of sec. 8, T. 94 N., R. 16 W.

Ap—0 to 7 inches; black (10YR 2/1) clay loam (28 percent clay), dark gray (10YR 4/1) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.
A—7 to 13 inches; black (10YR 2/1) clay loam (28 percent clay), dark gray (10YR 4/1) dry; weak fine granular and weak fine subangular blocky structure; friable; neutral; clear smooth boundary.
AB—13 to 17 inches; very dark grayish brown (2.5Y 3/2) loam (27 percent clay), grayish brown (2.5Y 5/2) dry; few faint very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.
Bw—17 to 23 inches; dark grayish brown (2.5Y 4/2) loam (27 percent clay); few faint very dark grayish brown (2.5Y 3/2) coatings on faces of peds; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.
2Bt1—23 to 36 inches; mottled dark gray (5Y 4/1) and strong brown (7.5YR 5/6) clay loam (35 percent clay); moderate fine prismatic structure parting to weak medium subangular blocky; very firm; common faint dark grayish brown (2.5Y 4/2) clay films on faces of peds; few soft dark accumulations of iron and manganese oxide; weak stone line at a depth of 23 inches; few pebbles throughout; slightly acid; abrupt smooth boundary.
2Bt2—36 to 42 inches; mottled gray (5Y 5/1) and light olive brown (2.5Y 5/4) clay loam (33 percent clay); few fine distinct (10YR 5/6) mottles; weak fine prismatic structure; very firm; few faint olive gray (5Y 4/2) clay films on faces of peds; few yellowish red (5YR 4/6) concretions of iron oxide and few black (10YR 2/1) concretions of iron and manganese oxide; common soft accumulations of calcium carbonate; few pebbles throughout; strong effervescence; mildly alkaline; abrupt smooth boundary.
2C1—42 to 46 inches; mottled olive (5Y 5/3) and olive brown (2.5Y 4/4) clay loam (33 percent clay); common fine distinct yellowish brown (10YR 5/6) mottles; massive; very firm; few dark concretions of iron and manganese oxide; few large soft accumulations of calcium carbonate; few pebbles throughout; strong effervescence; mildly alkaline; abrupt smooth boundary.
2C2—46 to 60 inches; mottled olive (5Y 5/3) and olive brown (2.5Y 4/4) clay loam (32 percent clay); common fine distinct yellowish brown (10YR 5/6) and common medium distinct gray (5Y 5/1) mottles; massive; very firm; common distinct dark gray (10YR 4/1) clay films in root channels; few dark concretions of iron and manganese oxide; few soft accumulations of calcium carbonate; few pebbles throughout; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 36 to 60 inches. The thickness of the mollic epipedon ranges from 14 to 24 inches.

The A horizon is loam or clay loam. The AB horizon has hue of 10YR or 2.5Y and chroma of 1 or 2. The average content of clay in the 2Bt horizon ranges from 30 to 35 percent, but in subhorizons of some pedons it is as much as 37 percent.

Racine Series

The Racine series consists of deep, well drained, moderately permeable soils on ridge crests and side slopes in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses and trees. Slopes range from 0 to 9 percent.

Typical pedon of Racine loam, 2 to 5 percent slopes, in a cultivated field; 295 feet south and 2,110 feet west of the northeast corner of sec. 15, T. 95 N., R. 18 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; slightly acid; abrupt smooth boundary.
E—8 to 14 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; dark grayish brown (10YR 4/2) coatings on faces of peds; weak medium platy structure parting to weak very fine subangular blocky; friable; slightly acid; clear smooth boundary.
Bt1—14 to 21 inches; brown (10YR 4/3) loam; moderate very fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear smooth boundary.
2Bt2—21 to 28 inches; dark yellowish brown (10YR 4/4) loam; few faint dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; stone line in the lower part; medium acid; gradual smooth boundary.
2Bt3—28 to 38 inches; yellowish brown (10YR 5/4) sandy clay loam; few faint brown (10YR 5/3) coatings on faces of peds; weak medium prismatic structure parting to weak fine subangular blocky; friable; few distinct light gray (10YR 7/2) sand and silt coatings in the lower part; few pebbles

throughout; medium acid; gradual smooth boundary.
2Bt4—38 to 52 inches; yellowish brown (10YR 5/4) sandy clay loam (22 percent clay); few faint brown (10YR 5/3) coatings on faces of peds; weak medium prismatic structure parting to weak medium subangular blocky; friable; few dark concretions of iron and manganese oxide; 2 to 3 percent coarse fragments; medium acid; gradual smooth boundary.
2BC—52 to 60 inches; light olive brown (2.5Y 5/4) loam; few fine faint yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to weak coarse prismatic; friable; few dark concretions of iron and manganese oxide; few pebbles throughout; slightly acid.

The thickness of the solum ranges from 36 to 60 inches. The depth to carbonates ranges from 40 to 70 inches. In many areas a stone line is at the contact of the loamy sediments and the underlying glacial till material.

The Ap or A horizon has chroma of 2 or 3. It is loam or silt loam that has a high content of sand. The Bt1 horizon has chroma of 3 or 4. It is loam or silt loam that has a high content of sand. The 2B horizon has value of 4 or 5 and chroma of 4 to 6. It is loam, sandy clay loam, or clay loam that has thin layers of sandy loam. The 2BC horizon typically has chroma of 4 to 6. It is loam or sandy clay loam.

Raddle Series

The Raddle series consists of deep, well drained, moderately permeable soils on nearly level stream terraces. These soils formed in silty alluvial sediments overlying sand. The native vegetation is prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Raddle silt loam, 0 to 2 percent slopes, in a cultivated field; 135 feet north and 1,220 feet west of the southeast corner of sec. 1, T. 94 N., R. 18 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; streaks and pockets of very dark brown (10YR 2/2) subsurface material; weak very fine granular structure; friable; neutral; abrupt smooth boundary.
A1—8 to 15 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; slightly acid; clear smooth boundary.
A2—15 to 21 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; neutral; clear smooth boundary.
AB—21 to 24 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure parting to weak very fine granular; friable; neutral; clear smooth boundary.
Bw1—24 to 35 inches; brown (10YR 4/3) silt loam; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds in the upper part; weak very fine subangular blocky structure; friable; neutral; gradual smooth boundary.
Bw2—35 to 40 inches; yellowish brown (10YR 5/4) silt loam; weak very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.
Bw3—40 to 60 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The thickness of the mollic epipedon ranges from 12 to 24 inches.

The upper part of the A horizon has chroma of 1 or 2. The lower part has value and chroma of 2 or 3. The Bw1 horizon has value and chroma of 3 or 4. The Bw2 and Bw3 horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. If a C horizon occurs above a depth of 48 inches, it has colors similar to those of the Bw horizon. If a C horizon and a 2C horizon occur below a depth of 48 inches, they have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4.

Readlyn Series

The Readlyn series consists of deep, somewhat poorly drained, moderately permeable soils on slightly convex ridge crests and side slopes in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Readlyn loam, 0 to 2 percent slopes, in a cultivated field; 1,180 feet south and 540 feet west of the northeast corner of sec. 10, T. 95 N., R. 15 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
A—10 to 17 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; common faint very dark gray (10YR 3/1) coatings on faces of peds; weak medium subangular blocky structure parting to weak very fine granular; friable; neutral; clear smooth boundary.
BA—17 to 20 inches; very dark grayish brown (2.5Y

3/2) and dark grayish brown (2.5Y 4/2) clay loam (28 percent clay), grayish brown (2.5Y 5/2) dry; few faint very dark gray (10YR 3/1) coatings on faces of peds; moderate very fine subangular blocky structure; friable; medium acid; clear smooth boundary.

2Bw1—20 to 24 inches; light olive brown (2.5Y 5/4) clay loam; few distinct very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine and very fine subangular blocky structure; friable; stone line in the upper part; few pebbles throughout; medium acid; clear smooth boundary.

2Bw2—24 to 36 inches; light olive brown (2.5Y 5/4) loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak fine prismatic structure parting to weak fine and medium subangular blocky; firm; few distinct very dark gray (10YR 3/1) clay films in root channels; few pebbles throughout; medium acid; clear wavy boundary.

2BC—36 to 46 inches; mottled light olive brown (2.5Y 5/6) and light brownish gray (2.5Y 6/2) loam; weak medium prismatic structure parting to weak coarse subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films in root channels; few pebbles throughout; strong effervescence; mildly alkaline; gradual smooth boundary.

2C—46 to 60 inches; mottled light olive brown (2.5Y 5/4) and light brownish gray (2.5Y 6/2) loam; massive; firm; few pebbles throughout; strong effervescence; moderately alkaline.

The thickness of the solum typically ranges from 40 to 60 inches. The depth to carbonates ranges from 36 to 60 inches. The thickness of the mollic epipedon ranges from 12 to 20 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam, loam, or clay loam. The 2B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 8.

Renova Series

The Renova series consists of deep, well drained, moderately permeable soils on ridge crests and side slopes in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is oak-hickory forest. Slopes range from 1 to 5 percent.

Typical pedon of Renova silt loam, 1 to 5 percent slopes, in a cultivated field; 1,550 feet north and 940 feet west of the southeast corner of sec. 4, T. 96 N., R. 16 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam (16 percent clay); weak very fine granular structure; friable; medium acid; abrupt smooth boundary.

EB—5 to 11 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) loam; pale brown (10YR 6/3) dry; few faint brown (10YR 4/3) coatings on faces of peds; weak coarse platy structure parting to weak very fine subangular blocky; friable; medium acid; clear smooth boundary.

Bt1—11 to 19 inches; yellowish brown (10YR 5/4) sandy clay loam; weak fine subangular blocky structure; friable; few faint brown (10YR 4/3) clay films on faces of peds; few pebbles; medium acid; clear smooth boundary.

2Bt2—19 to 34 inches; yellowish brown (10YR 5/4) loam; few medium distinct yellowish red (5YR 5/8) mottles in the lower part; weak medium prismatic structure parting to weak medium subangular blocky; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of prisms and peds; few distinct light gray (10YR 7/2) sand and silt coatings on faces of prisms; stone line in the upper part; few pebbles throughout; medium acid; clear smooth boundary.

2BC—34 to 42 inches; mottled grayish brown (10YR 5/2) and light yellowish brown (10YR 6/4) loam; few fine prominent yellowish red (5YR 5/8) mottles; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; few faint light gray (10YR 7/2) sand and silt coatings on faces of prisms; few pebbles throughout; medium acid; clear smooth boundary.

2C—42 to 60 inches; mottled grayish brown (10YR 5/2) brown (7.5YR 4/4) and strong brown (7.5YR 5/8) loam; common fine distinct yellowish red (5YR 5/8) mottles; massive; firm; medium acid.

The thickness of the solum ranges from 48 to 60 inches. The depth to carbonates ranges from 50 to 75 inches. In many areas a stone line is at the contact of the loamy sediments and the underlying glacial till material.

In areas of native woodland, the A horizon may have mollic colors and is 2 to 4 inches thick. The Ap horizon has chroma of 2 or 3. The A horizon is loamy sand, sandy loam, loam, or silt loam that has a high content of sand. The E horizon is loam or silt loam. The 2B horizon typically is loam or sandy clay loam. In some pedons it has thin layers of sandy loam in the upper part. The depth to gray mottles typically is more than 34 inches. The 2C horizon is loam or sandy clay loam.

Riceville Series

The Riceville series consists of deep, somewhat poorly drained, moderately slowly permeable soils on

the lower side slopes and on the very gently sloping ridge crests in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is mixed prairie grasses and deciduous trees. Slopes range from 1 to 4 percent.

Typical pedon of Riceville silt loam, 1 to 4 percent slopes, in a cultivated field; 2,230 feet east and 210 feet north of the southwest corner of sec. 4, T. 96 N., R. 15 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak very fine subangular blocky structure parting to weak very fine granular; friable; neutral; abrupt smooth boundary.

EB—7 to 12 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to weak very fine subangular blocky; friable; few fine dark concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt1—12 to 18 inches; dark grayish brown (2.5Y 4/2) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse platy structure parting to moderate fine subangular blocky; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; few dark concretions of iron and manganese oxide; medium acid; clear smooth boundary.

2Bt2—18 to 29 inches; mottled light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6) clay loam; common fine distinct strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films and light gray (2.5Y 7/2) silt coatings on faces of peds; weak stone line in the upper part; few pebbles throughout; medium acid; clear smooth boundary.

2Bt3—29 to 47 inches; mottled gray (10YR 5/1) and yellowish brown (10YR 5/6) clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; very firm; few faint dark gray (10YR 4/1) clay films on faces of peds; few faint very dark gray (10YR 3/1) clay films in root channels; few pebbles throughout; slightly acid; gradual smooth boundary.

2BC—47 to 58 inches; mottled gray (10YR 5/1) and yellowish brown (10YR 5/6) clay loam; few fine faint brownish yellow (10YR 6/8) mottles; weak coarse subangular blocky structure; very firm; few faint dark gray (10YR 4/1) clay films in root channels; few dark concretions of iron and manganese oxide; few pebbles throughout; neutral; clear wavy boundary.

2C—58 to 60 inches; mottled gray (10YR 5/1) and yellowish brown (10YR 5/6) clay loam; few fine distinct strong brown (7.5YR 5/6) and few fine faint brownish yellow (10YR 6/8) mottles; massive; very firm; few dark concretions of iron and manganese oxide; few pebbles throughout; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 70 inches. The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. It is 7 to 10 inches thick. The E horizon, if it occurs, is silt loam or loam. The stone line is in the lower part of the Bt1 horizon or the upper part of the 2Bt horizon. The 2Bt horizon is mottled. It has hue of 10YR to 2.5Y, value of 5 or 6, and chroma of 1 to 8. Typically, the content of clay in the 2Bt horizon ranges from 30 to 35 percent, but in some pedons it is as much as 38 percent in thin layers within the horizon.

Ripon Series

The Ripon series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in a thin remnant of till or till-derived sediments over limestone bedrock. The native vegetation is prairie grasses. Slopes range from 1 to 5 percent.

The Ripon soils in the county are taxadjuncts to the series because they typically do not have the increase in clay necessary for an argillic horizon. They classify as fine-silty, mixed, mesic Typic Hapludolls.

Typical pedon of Ripon silt loam, 20 to 30 inches to limestone, 1 to 5 percent slopes, in a cultivated field; 1,670 feet north and 225 feet east of the southwest corner of sec. 27, T. 96 N., R. 18 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; friable; neutral; clear smooth boundary.

AB—8 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; streaks and pockets of brown (10YR 4/3) subsurface material in the lower part; weak very fine granular structure; friable; slightly acid; gradual smooth boundary.

Bw—13 to 18 inches; brown (10YR 4/3) silt loam; few faint dark brown (10YR 3/3) coatings on faces of peds; weak very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bt1—18 to 24 inches; brown (10YR 4/3) silt loam; weak

fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds and in pores; slightly acid; clear smooth boundary.

2Bt2—24 to 27 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds and in pores; few pebbles throughout; neutral; abrupt wavy boundary.

3R—27 inches; hard, fractured limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The A or Ap horizon has chroma of 1 or 2. The A horizon is 8 to 16 inches thick. The AB or BA horizon has value and chroma of 2 or 3. The 2B horizon has value of 4 or 5 and chroma of 3 to 6. It is loam, sandy loam, sandy clay loam, or clay loam.

Rocksan Series

The Rocksan series consists of deep, poorly drained soils on upland flats and in shallow drainageways. These soils formed in loamy sediments and in the underlying calcareous cretaceous material. The cretaceous material is weathered mainly from sandstone. Permeability is moderate in the solum and rapid in the substratum. The native vegetation is water-tolerant prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Rocksan silty clay loam, 0 to 2 percent slopes, in a cultivated field; 2,635 feet north and 900 feet west of the southeast corner of sec. 5, T. 94 N., R. 17 W.

Ap—0 to 9 inches; black (N 2/0) silty clay loam, very dark gray (5Y 3/1) dry; weak very fine subangular blocky structure; friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A—9 to 14 inches; black (N 2/0) silty clay loam, very dark gray (5Y 3/1) dry; weak fine granular structure; friable; slight effervescence; mildly alkaline; clear smooth boundary.

AB—14 to 17 inches; black (5Y 2/1) silty clay loam, very dark gray (5Y 3/1) dry; some mixed areas of dark gray (5Y 4/1) subsoil material; weak very fine and fine subangular blocky structure; friable; few dark concretions of iron and manganese oxide; slight effervescence; mildly alkaline; clear smooth boundary.

Bg—17 to 21 inches; olive gray (5Y 5/2) loam; few fine distinct yellowish brown (10YR 5/6) mottles; some mixed areas of dark gray (5Y 4/1) subsoil material; weak very fine subangular blocky structure; friable; few dark concretions of iron and manganese oxide; strong effervescence; mildly alkaline; gradual smooth boundary.

BC—21 to 25 inches; light olive brown (2.5Y 5/4) sandy loam; common fine faint grayish brown (2.5Y 5/2) mottles; weak very fine subangular blocky structure; friable; few very dark gray (5Y 3/1) soil material in root channels; strong effervescence; moderately alkaline; abrupt smooth boundary.

2C1—25 to 33 inches; brownish yellow (10YR 6/6) loamy fine sand; massive; friable; few fibrous roots; violent effervescence; strongly alkaline; clear smooth boundary.

2C2—33 to 55 inches; light yellowish brown (2.5Y 6/4) loamy fine sand; massive; friable and firm; few fibrous roots; violent effervescence; strongly alkaline; abrupt smooth boundary.

3C3—55 to 60 inches; mottled reddish brown (2.5YR 5/4) and pale olive (5Y 6/3) silty clay; massive; very firm; violent effervescence; mildly alkaline.

The A horizon is 12 to 20 inches thick. It has hue of 10YR to 5Y or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is silty clay loam or clay loam. The Bg horizon typically has less clay than the overlying horizons. The 2C horizon is loamy sand or sandy loam. It has hue of 2.5YR and 5Y, value of 5 to 7, and chroma of 3 to 6.

Rockton Series

The Rockton series consists of moderately deep, well drained, moderately permeable soils on uplands and high stream benches. These soils formed in loamy sediments and residuum overlying limestone bedrock. The native vegetation is prairie grasses. Slopes range from 0 to 9 percent.

Typical pedon of Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes, in a cultivated field; 1,480 feet south and 80 feet west of the northeast corner of sec. 30, T. 94 N., R. 16 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; slightly acid; clear smooth boundary.

AB—9 to 15 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; weak very fine granular structure; friable; slightly acid; gradual smooth boundary.

Bt1—15 to 21 inches; brown (10YR 4/3) sandy clay loam; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine prismatic structure parting to weak very fine subangular blocky; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear smooth boundary.

2Bt2—21 to 24 inches; brown (10YR 4/3) clay loam; weak medium subangular blocky structure; firm; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; weak stone line at a depth of 21 inches; slightly acid; abrupt irregular boundary.
2R—24 to 60 inches; hard, shattered limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The Ap or A horizon has chroma of 1 or 2. The A horizon ranges from 10 to 20 inches in thickness. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is loam, sandy clay loam, or clay loam. The 2Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, clay, or silty clay. It is 1 to 5 inches thick. The shattered upper part of the limestone bedrock ranges from 2 to 5 feet in thickness and has 5 to 10 percent loamy material. As slope increases, the thickness of the shattered limestone bedrock generally decreases.

Saude Series

The Saude series consists of deep, well drained soils on stream terraces and uplands. These soils formed in loamy sediments overlying sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation is prairie grasses. Slopes range from 0 to 9 percent.

Typical pedon of Saude loam, 0 to 2 percent slopes, in a cultivated field; 250 feet north and 66 feet west of the southeast corner of sec. 7, T. 94 N., R. 16 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; medium acid; abrupt smooth boundary.
A—9 to 13 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; medium acid; clear smooth boundary.
AB—13 to 17 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; medium acid; clear smooth boundary.
Bw1—17 to 24 inches; brown (10YR 4/3) loam; few faint dark brown (10YR 3/3) coatings on faces of peds; weak very fine subangular blocky structure; friable; medium acid; clear smooth boundary.
Bw2—24 to 28 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.
2BC—28 to 34 inches; brown (10YR 4/3) gravelly loamy sand; very weak medium subangular blocky structure; very friable; medium acid; clear smooth boundary.
2C1—34 to 42 inches; yellowish brown (10YR 5/4) sand; single grained; loose; about 10 percent fine and medium gravel; slightly acid; gradual smooth boundary.
2C2—42 to 60 inches; yellowish brown (10YR 5/4 and 5/6) sand; single grained; loose; about 5 percent fine and medium gravel; slightly acid.

The thickness of the solum typically ranges from 30 to 42 inches. Depth of the loamy material ranges from 20 to 32 inches.

The A horizon has chroma of 1 or 2. It is 10 to 18 inches thick. The upper part of the B horizon is loam or sandy loam, and the lower part is loamy sand or gravelly loamy sand. The 2C horizon has value of 4 or 5 and chroma of 4 to 6. It ranges from loamy sand to gravelly sand.

Schley Series

The Schley series consists of deep, somewhat poorly drained, moderately permeable soils on the slightly concave, lower side slopes adjacent to drainageways in the uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is mixed prairie grasses and trees. Slopes range from 1 to 4 percent.

Typical pedon of Schley silt loam, 1 to 4 percent slopes, in a cultivated field; 1,960 feet north and 310 feet east of the southwest corner of sec. 36, T. 95 N., R. 16 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.
E—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium platy structure parting to weak very fine subangular blocky; friable; strongly acid; clear smooth boundary.
Bt1—13 to 21 inches; mottled grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) silty clay loam; common fine faint yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to weak very fine subangular blocky; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds and in root channels; strongly acid; clear smooth boundary.
Bt2—21 to 24 inches; grayish brown (10YR 5/2) loam; common fine distinct yellowish brown (10YR 5/6)

and common fine prominent yellowish red (5YR 5/8) mottles; weak medium prismatic structure parting to weak fine subangular blocky; friable; few faint dark grayish brown (10YR 4/2) clay films in root channels and on faces of peds; strongly acid; abrupt smooth boundary.

Bt3—24 to 37 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) sandy loam; weak medium prismatic structure parting to weak medium subangular blocky; very friable; few faint dark grayish brown (10YR 4/2) clay films in root channels and on faces of peds; strongly acid; gradual smooth boundary.

2Bt4—37 to 48 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) loam; many fine and medium distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few faint dark grayish brown (10YR 4/2) clay films in root channels; few pebbles; medium acid; gradual smooth boundary.

2C—48 to 60 inches; yellowish brown (10YR 5/6) loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure; firm; few faint dark grayish brown clay films in root channels; few pebbles; few fine dark concretions of iron and manganese oxide; medium acid.

The thickness of the solum typically ranges from 45 to 60 inches, but in some pedons it ranges from 40 to 70 inches. Carbonates typically are at a depth of more than 60 inches. The thickness of the material having mollic colors ranges from 6 to 10 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. The A or Ap horizon and the E horizon are loam or silt loam that has a high content of sand. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It ranges from sandy loam to silty clay loam and has a high content of sand. The 2Bt horizon is loam, sandy clay loam, or clay loam. In some pedons a 2- to 5-inch layer of loamy sand is at the contact of the loamy sediments and the underlying glacial till.

Shellwood Series

The Shellwood series consists of deep, moderately well drained, moderately rapidly permeable, calcareous soils on flood plains. These soils formed in loamy alluvium. The native vegetation is prairie grasses. Slopes range from 0 to 3 percent.

Typical pedon of Shellwood sandy loam, 0 to 3 percent slopes, in an area vegetated with prairie grasses; 2,300 feet south and 1,120 feet east of the center of sec. 20, T. 96 N., R. 18 W.

Ap—0 to 9 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak very fine and fine granular structure; very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A1—9 to 17 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak very fine granular; very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

A2—17 to 29 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure parting to weak very fine granular; very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

A3—29 to 46 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky structure; very friable; many fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

AC—46 to 56 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C—56 to 60 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; massive; very friable; violent effervescence; moderately alkaline.

The thickness of the solum typically ranges from 40 to 60 inches. The thickness of the mollic epipedon typically ranges from 40 to 70 inches. The 10- to 40-inch control section ranges from 12 to 18 percent clay and 50 to 75 percent sand. Most of the sand-sized fraction is fine sand or medium sand.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is sandy loam, but in some pedons it is fine sandy loam. The B horizon, if it occurs, has value of 3 or 4 and chroma of 1 or 2. The C horizon has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 2 or 3.

Sparta Series

The Sparta series consists of very deep, excessively drained, rapidly permeable soils on uplands. These soils formed in sandy eolian deposits. The native vegetation is prairie grasses. Slopes range from 2 to 6 percent.

Typical pedon of Sparta loamy fine sand, 2 to 6 percent slopes, in an area of bluegrass pasture; 2,440

feet north and 1,800 feet west of the southeast corner of sec. 31, T. 95 N., R. 17 W.

Ap—0 to 8 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; neutral; abrupt smooth boundary.
A—8 to 11 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; weak very fine subangular blocky structure; very friable; neutral; clear smooth boundary.
AB—11 to 18 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak very fine and fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.
Bw1—18 to 28 inches; brown (10YR 4/3) loamy fine sand; weak medium prismatic structure parting to weak fine subangular blocky; very friable; slightly acid; clear smooth boundary.
Bw2—28 to 36 inches; dark yellowish brown (10YR 4/4) fine sand; weak medium prismatic structure parting to weak medium subangular blocky; very friable; slightly acid; gradual smooth boundary.
C1—36 to 45 inches; dark yellowish brown (10YR 4/4) fine sand; weak medium prismatic structure; very friable; slightly acid; gradual smooth boundary.
C2—45 to 56 inches; dark yellowish brown (10YR 4/4) fine sand; single grained; loose; medium acid; clear smooth boundary.
C3—56 to 60 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) sand; single grained; loose; slightly acid.

The solum typically is about 36 inches thick, but in some pedons it ranges from 30 to 45 inches in thickness. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has value of 4 to 6 and chroma of 3 to 6. The A and Bw horizons are loamy fine sand, loamy sand, fine sand, or sand. The C horizon has value of 4 to 6 and chroma of 3 to 6.

Spillville Series

The Spillville series consists of deep, moderately well drained, moderately permeable soils on bottom land along the major streams and some intermittent streams. These soils formed in loamy alluvium. The native vegetation is prairie grasses. Slopes range from 0 to 3 percent.

Typical pedon of Spillville loam, 0 to 2 percent slopes, in an area of bluegrass pasture; 3,920 feet north and 170 feet east of the southwest corner of sec. 10, T. 95 N., R. 17 W.

A1—0 to 12 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; neutral; gradual smooth boundary.
A2—12 to 33 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine granular; friable; neutral; gradual smooth boundary.
A3—33 to 47 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; few faint black (10YR 2/1) coatings on faces of peds; weak medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.
C—47 to 60 inches; dark brown (10YR 3/3) loam; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; massive; friable; neutral.

The solum typically is about 47 inches thick, but in some pedons it ranges from 36 to 56 inches in thickness. The A horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have high- or low-chroma mottles in the horizons below the A horizon. Below a depth of 36 inches, the texture typically is loam, sandy loam, or clay loam.

Talcot Series

The Talcot series consists of very deep, poorly drained, calcareous soils on stream benches and in upland alluvial areas. These soils formed in 32 to 40 inches of loamy alluvial deposits over sandy material. Permeability is moderate in the solum and rapid in the substratum. The native vegetation is prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field; 90 feet south and 750 feet east of the northwest corner of sec. 33, T. 97 N., R. 18 W.

Ap—0 to 9 inches; black (N 2/0) clay loam, very dark gray (5Y 4/1) dry; weak very fine subangular blocky structure; friable; common small shell fragments; strong effervescence; mildly alkaline; abrupt smooth boundary.
A1—9 to 16 inches; black (5Y 2.5/1) clay loam, dark gray (5Y 4/1) dry; weak very fine subangular blocky structure; friable; strong or violent effervescence; mildly alkaline; gradual smooth boundary.
A2—16 to 22 inches; very dark gray (5Y 3/1) clay loam, gray (5Y 5/1) dry; few fine distinct yellowish brown (10YR 5/6) mottles; weak very fine subangular

blocky structure parting to weak fine subangular blocky; friable; strong effervescence; mildly alkaline; clear smooth boundary.

BAg—22 to 26 inches; dark gray (5Y 4/1) clay loam; few distinct dark olive gray (5Y 3/2) coatings on faces of peds; few fine faint olive gray (5Y 5/2) mottles; weak very fine subangular blocky structure parting to weak fine subangular blocky; friable; few dark concretions of iron and manganese oxide; few soft accumulations of calcium carbonate; slight effervescence; neutral; clear smooth boundary.

Bg—26 to 32 inches; olive gray (5Y 5/2) loam; few fine faint light olive brown (2.5Y 5/6) mottles; weak fine subangular blocky structure; friable; few dark concretions of iron and manganese oxide; strong effervescence; mildly alkaline; abrupt smooth boundary.

BCg—32 to 38 inches; olive gray (5Y 5/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few dark concretions of iron and manganese oxide; few soft accumulations of calcium carbonate; about 10 percent gravel; strong effervescence; mildly alkaline; abrupt smooth boundary.

2C1—38 to 42 inches; yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) coarse sand; single grained; loose; about 15 percent gravel; strong effervescence; mildly alkaline; abrupt smooth boundary.

2C2—42 to 60 inches; light yellowish brown (2.5Y 6/4) coarse sand; single grained; loose; about 15 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 32 to 40 inches. The thickness of the mollic epipedon ranges from 14 to 24 inches.

The Ap or A horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 2 or 3 and chroma of 0 or 1. It typically is clay loam, but the range includes silty clay loam that has a high content of sand. Effervescence is strong or violent. The B horizon has hue of 2.5Y or 5Y, value of 1 or 2, and chroma of 4 or 5. The upper part of the B horizon is loam, clay loam, or silty clay loam. The lower part and the 2B horizon are loam, sandy loam, loamy sand, or sand. The 2C horizon is gravelly loamy sand or sand that contains gravel.

Terril Series

The Terril series consists of very deep, moderately well drained, moderately permeable soils in waterways and narrow upland valleys and on foot slopes. These soils formed in loamy local alluvium. The native vegetation is prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Terril loam, 2 to 5 percent slopes, in a cultivated field; 555 feet west and 280 feet north of the southeast corner of sec. 33, T. 94 N., R. 17 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; streaks and pockets of dark grayish brown (10YR 4/2) sandy loam overwash; weak very fine granular structure; friable; slightly acid; clear smooth boundary.

A1—8 to 15 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine granular structure; friable; slightly acid; gradual smooth boundary.

A2—15 to 24 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; few faint black (10YR 2/1) coatings on faces of peds; weak very fine and fine granular structure; friable; slightly acid; gradual smooth boundary.

A3—24 to 31 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; few faint black (10YR 2/1) coatings on faces of peds; weak very fine and fine granular structure; friable; slightly acid; clear smooth boundary.

AB—31 to 36 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; some streaks and pockets of brown (10YR 4/3) subsoil material; very dark brown (10YR 2/2) coatings on faces of peds; weak very fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bw1—36 to 40 inches; brown (10YR 4/3) loam; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; weak very fine subangular structure; friable; slightly acid; gradual smooth boundary.

Bw2—40 to 52 inches; brown (10YR 4/3) loam; few faint very dark brown (10YR 3/3) coatings on faces of peds; weak very fine and fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

BC—52 to 60 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; very friable; few pebbles throughout; slightly acid.

The thickness of the solum typically ranges from 45 to 70 inches. The thickness of the mollic epipedon ranges from 24 to 36 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is loam or silt loam. The Bw horizon typically is loam or clay loam. Horizons that are 6 inches or less thick may be sandy loam.

Tripoli Series

The Tripoli series consists of deep, poorly drained, moderately permeable soils on upland flats and in shallow drainageways. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation is prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Tripoli silty clay loam, 0 to 2 percent slopes, in a cultivated field; 420 feet north and 140 feet west of the southeast corner of sec. 4, T. 95 N., R. 15 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—8 to 11 inches; black (10YR 2/1) silty clay loam, dark gray (5Y 3/1) dry; weak very fine granular structure; friable; neutral; clear smooth boundary.

AB—11 to 15 inches; very dark gray (5Y 3/1) clay loam, dark gray (5Y 4/1) dry; few faint dark gray (5Y 4/1) coatings on faces of peds; weak very fine granular structure; friable; few red (2.5YR 4/6) concretions of iron oxide; neutral; clear smooth boundary.

Bw1—15 to 20 inches; grayish brown (2.5Y 5/2) clay loam; common medium distinct light olive brown (2.5Y 5/4 and 5/6) mottles; weak very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

2Bw2—20 to 24 inches; yellowish brown (10YR 5/6) loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; stone line in the upper part; few pebbles throughout; neutral; clear smooth boundary.

2Bw3—24 to 38 inches; yellowish brown (10YR 5/6) loam; common fine and medium distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) mottles; weak medium prismatic and weak medium subangular blocky structure; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few pebbles throughout; neutral; abrupt wavy boundary.

2C1—38 to 45 inches; yellowish brown (10YR 5/6) loam; common fine and medium distinct grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few pebbles throughout; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—45 to 60 inches; yellowish brown (10YR 5/6) loam; common medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; few pebbles throughout; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 36 to 48 inches. The thickness of the mollic epipedon ranges from 14 to 24 inches.

The Ap or A horizon has hue of 10YR or is neutral in hue. It has chroma of 0 or 1. The AB horizon has hue of 10YR or 5Y and chroma of 1 or 2. The Bw1 horizon has hue of 2.5Y or 5Y and chroma of 1 or 2. The AB and Bw1 horizons are silty clay loam or clay loam. The 2B and 2C horizons commonly are loam, but the range includes clay loam and sandy clay loam.

Turlin Series

The Turlin series consists of deep, somewhat poorly drained soils on bottom land and low terraces along streams. These soils formed in loamy alluvium. Permeability is moderate in the upper part of the profile and rapid in the lower part. The native vegetation is prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Turlin loam, 0 to 2 percent slopes, in a cultivated field; 1,400 feet north and 174 feet east of the southwest corner of sec. 3, T. 95 N., R. 16 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; neutral; abrupt smooth boundary.

A1—9 to 14 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to weak very fine granular; friable; neutral; clear smooth boundary.

A2—14 to 29 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure parting to weak very fine granular; friable; neutral; clear smooth boundary.

A3—29 to 33 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; some streaks and pockets of dark grayish brown (2.5Y 3/2) subsurface material; weak very fine subangular blocky structure parting to weak very fine granular; friable; neutral; clear smooth boundary.

AB—33 to 36 inches; very dark grayish brown (2.5Y 3/2) loam, dark grayish brown (2.5Y 4/2) dry; very dark gray (10YR 3/1) coatings on faces of peds; weak fine prismatic structure parting to weak fine subangular blocky; friable; neutral; clear smooth boundary.

Bw—36 to 40 inches; dark grayish brown (2.5Y 4/2) loam; few faint very dark grayish brown (2.5Y 3/2) coatings on faces of peds; weak fine prismatic structure parting to weak fine subangular blocky; friable; neutral; abrupt smooth boundary.

BC—40 to 50 inches; dark grayish brown (2.5Y 4/2) sandy loam; weak fine subangular blocky structure; very friable; neutral; clear smooth boundary.

2C—50 to 60 inches; brown (10YR 4/3) loamy sand; single grained; loose; neutral.

The thickness of the solum typically ranges from 40 to 60 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is 24 to 36 inches thick. The B horizon ranges from clay loam to sandy loam above a depth of 40 inches. Textures coarser than sandy loam are at a depth of about 48 inches or more.

Wapsie Series

The Wapsie series consists of deep, well drained soils on stream terraces and uplands. These soils formed in loamy sediments overlying sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation is mixed prairie grasses and trees. Slopes range from 0 to 9 percent.

Typical pedon of Wapsie loam, 0 to 2 percent slopes, in a cultivated field; 140 feet south and 1,160 feet west of the northeast corner of sec. 9, T. 95 N., R. 17 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak very fine granular; friable; neutral; abrupt smooth boundary.

E—7 to 14 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; few faint dark grayish brown (10YR 4/2) coatings on faces of peds; weak medium platy structure; friable; slightly acid; clear smooth boundary.

Bt1—14 to 18 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—18 to 24 inches; brown (10YR 4/3) sandy clay loam; weak medium subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; abrupt smooth boundary.

BC—24 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; medium acid; clear smooth boundary.

2C1—28 to 40 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; medium acid; clear smooth boundary.

2C2—40 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; massive; loose; strongly acid.

The thickness of the solum typically ranges from 24 to 44 inches. The thickness of the mollic epipedon ranges from 6 to 9 inches. The depth to sand and gravel is 24 to 36 inches. Carbonates are at a depth of 72 inches or more.

The Ap or A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loam or silt loam that has a high content of sand. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or sandy clay loam. The 2C horizon ranges from loamy sand to gravelly sand.

Waubeek Series

The Waubeek series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying glacial till. The native vegetation is mixed prairie grasses and trees. Slopes range from 0 to 5 percent.

Typical pedon of Waubeek silt loam, 2 to 5 percent slopes, in a cultivated field; 155 feet south and 900 feet east of the northwest corner of sec. 19, T. 96 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; some streaks and pockets of brown (10YR 4/3) subsurface material; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

EB—8 to 14 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium platy structure parting to weak very fine subangular blocky; friable; small very dark grayish brown (10YR 3/2) krotovina; medium acid; clear smooth boundary.

Bt1—14 to 21 inches; brown (10YR 4/3) silty clay loam (29 percent clay); weak fine prismatic structure parting to weak very fine subangular blocky; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—21 to 29 inches; brown (10YR 4/3) silt loam (26 percent clay); weak fine prismatic structure parting to weak very fine subangular blocky; friable; few distinct very dark gray (10YR 3/1) clay films on faces of peds in the lower part; strongly acid; abrupt smooth boundary.

2Bt3—29 to 33 inches; brown (10YR 4/3) loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; few faint dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) clay films on faces of peds and in root channels; stone line in the upper part; few pebbles; strongly acid; clear smooth boundary.

2Bt4—33 to 38 inches; brown (10YR 4/3) loam; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; few thin very dark grayish brown (10YR 3/2) clay films on faces

of peds; few pebbles; medium acid; clear smooth boundary.
2BC—38 to 46 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; few pebbles; slightly acid; clear smooth boundary.
2C—46 to 60 inches; yellowish brown (10YR 5/6) loam; massive; friable; few pebbles; slightly acid.

The thickness of the solum ranges from 45 to 65 inches. The Ap or A horizon has value of 2 or 3. It is 6 to 9 inches thick. The content of sand in the A, E, and B horizons typically ranges from 5 to 12 percent but is higher near the contact with the till or till-derived sediments. The 2B horizon is loam or sandy clay loam. In most pedons a stone line at a depth of 24 to 32 inches is at the boundary between the Bt and 2Bt horizons.

Waukee Series

The Waukee series consists of deep, well drained soils on stream benches and occasionally on uplands. These soils formed in loamy sediments and in the underlying sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation is prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Waukee loam, 0 to 2 percent slopes, in a cultivated field; 240 feet south and 300 feet east of the northwest corner of sec. 10, T. 95 N., R. 16 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.
A—9 to 13 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; streaks and pockets of very dark grayish brown (10YR 3/2) subsurface material; weak very fine granular structure; friable; medium acid; gradual smooth boundary.
AB—13 to 19 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; few faint very dark brown (10YR 2/2) coatings on faces of peds; weak very fine subangular blocky and weak very fine granular structure; friable; medium acid; gradual smooth boundary.
Bw1—19 to 24 inches; brown (10YR 4/3) loam; few faint very dark grayish brown (10YR 3/2) coatings on faces of peds; weak very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.
Bw2—24 to 32 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) loam; few faint dark brown (10YR 3/3) coatings on faces of peds; weak very fine and fine subangular blocky structure; friable; few pebbles; medium acid; clear smooth boundary.
BC—32 to 36 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; very friable; about 5 percent gravel; medium acid; clear smooth boundary.
2C1—36 to 48 inches; yellowish brown (10YR 5/4) loamy sand; weak medium subangular blocky structure; very friable; about 15 percent gravel; medium acid; clear smooth boundary.
2C2—48 to 60 inches; yellowish brown (10YR 5/6) sand; single grained; loose; about 15 percent gravel; medium acid.

The solum typically is 36 inches thick, but in some pedons it ranges from 30 to 45 inches in thickness. Depth of the loamy material ranges from 30 to 40 inches.

The Ap or A horizon has value of 2 or 3. It is 10 to 20 inches thick. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, sandy clay loam, or sandy loam. The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

Whalan Series

The Whalan series consists of moderately deep, well drained, moderately permeable soils on ridge crests and side slopes in the uplands. These soils formed in loamy sediments overlying a thin clayey layer and limestone bedrock. The native vegetation is oak-hickory forest. Slopes range from 1 to 5 percent.

Typical pedon of Whalan silt loam, 1 to 5 percent slopes, in a cultivated field; 1,260 feet north and 400 feet east of the southwest corner of sec. 3, T. 96 N., R. 16 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; weak very fine granular structure; friable; medium acid; abrupt smooth boundary.
EB—7 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse platy structure parting to weak very fine granular; friable; medium acid; clear smooth boundary.
Bt1—11 to 17 inches; yellowish brown (10YR 5/4) silt loam; moderate very fine granular structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear smooth boundary.
Bt2—17 to 25 inches; yellowish brown (10YR 5/4) clay loam; moderate very fine subangular blocky structure; firm; common faint dark grayish brown

(10YR 4/2) clay films on faces of peds; few pebbles; neutral; clear smooth boundary.

2Bt3—25 to 29 inches; mottled strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) clay; moderate fine subangular blocky structure; firm; common very dark gray (10YR 3/1) clay films on faces of peds; neutral; abrupt irregular boundary.

2R—29 inches; hard limestone bedrock.

The thickness of the solum and the depth to bedrock typically range from 20 to 30 inches, but in some pedons they range to 40 inches. In areas of native woodland, the A horizon may have mollic colors and is 2 to 4 inches thick. The Ap or A horizon is loamy sand, sandy loam, loam, or silt loam that has a high content of sand, The Bt1 and Bt2 horizons are silt loam, loam, sandy clay loam, or clay loam. The 2Bt horizon is clay or silty clay. It is 1 to 5 inches thick.

Winneshiek Series

The Winneshiek series consists of moderately deep, well drained, moderately permeable soils on uplands and high stream benches. These soils formed in loamy sediments overlying a thin clayey layer and limestone bedrock. The native vegetation is prairie grasses and trees. Slopes range from 0 to 9 percent.

Typical pedon of Winneshiek silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes, in a cultivated field; 200 feet south and 2,500 feet east of the northwest corner of sec. 15, T. 95 N., R. 17 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; slightly acid; abrupt smooth boundary.

EB—8 to 13 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; few faint discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds and in root channels; weak medium platy structure parting to weak very fine subangular blocky; friable; neutral; clear smooth boundary.

Bt1—13 to 20 inches; brown (10YR 4/3) clay loam; few faint dark brown (10YR 3/3) coatings on faces of peds; weak very fine and fine subangular blocky structure; friable; few faint very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; neutral; gradual smooth boundary.

Bt2—20 to 29 inches; brown (10YR 4/3) sandy clay loam; weak medium prismatic structure parting to weak fine subangular blocky; friable; few faint dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) clay films on faces of peds; neutral; clear wavy boundary.

2Bt3—29 to 33 inches; brown (10YR 4/3) clay; few faint very dark grayish brown (10YR 3/2) and very dark brown (10YR 3/3) coatings on faces of peds; weak medium prismatic structure parting to weak very fine subangular blocky; firm; few small sandstone fragments; slight effervescence; mildly alkaline; abrupt irregular boundary.

2R—33 inches; 3 inches of calcareous sandstone bedrock overlying shattered limestone bedrock; few fibrous roots in sandstone bedrock; few distinct dark grayish brown (10YR 4/2) clay films in root channels.

The thickness of the solum and the depth to limestone bedrock typically range from 30 to 40 inches. In some pedons the thickness of the solum ranges from 20 to 40 inches.

The A or Ap horizon has value of 2 or 3. It typically is 6 to 9 inches thick. Some pedons have an E horizon. This horizon has chroma of 2 or 3. It is 2 to 4 inches thick. The EB horizon has value of 4 or 5 and chroma of 3 to 6. It typically is silt loam or loam. The Bt horizon is sandy clay loam or clay loam. The 2Bt horizon formed in clayey material. It has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. It is clay or silty clay. It is 1 to 5 inches thick. The shattered upper part of the limestone bedrock ranges from 2 to 5 feet in thickness and has 5 to 10 percent loamy material. As slope increases, the thickness of the shattered limestone bedrock generally decreases.

Formation of the Soils

This section describes the factors of soil formation and relates these factors to the soils in Floyd County. It also describes the processes that result in the formation of soil horizons.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by five soil-forming factors: the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material. Human activities also affect soil formation.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of parent material into a soil. The length of time may be long or short, but some time is always required for differentiation of soil horizons. A long time generally is required for the development of distinct horizons.

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

Parent Material

The accumulation of parent material is the first step in the development of a soil. Some soils in the county formed in sandstone bedrock or shale bedrock that weathered in place. Most of the soils in the county, however, formed in material that was transported from other locations and redeposited through the action of glacial ice, water, wind, or gravity. The main kinds of parent material in the county are glacial drift, loess, alluvium, and eolian deposits. The less extensive kinds are shale beds, sandstone bedrock, and organic deposits. Some moderately deep soils in the county formed in glacial or loess-derived material over limestone bedrock.

Glacial drift is the most extensive parent material in the county. It is all rock material transported or deposited by glacial ice, including glacial till and the material sorted by meltwater. Glacial till is unsorted sediment in which particles range in size from boulders to clay. At least twice during the glacial period, continental glaciers moved over the land. The record of these two ice invasions is contained in the unconsolidated rock material that was deposited by the melting ice and meltwater streams. The older ice sheet, known as the Nebraskan Glaciation, covered the area about 750,000 years ago *(10)*. It was followed by the Aftonian interglacial period. The Kansas Glaciation is thought to have started 500,000 years ago. A more recent glaciation, the Iowa substage of the Wisconsin Glaciation, was recognized in a study published in 1933 *(6)*.

Recent studies of Iowan glacial till indicate that the conclusions formed from studies made before 1960 are questionable. Intensive, detailed geomorphic and stratigraphic work shows that the landscape is a multilevel sequence of erosion surfaces and that many of the levels are cut into Kansan and Nebraskan till *(12)*. Landscapes similar to those in Floyd County have been studied in detail *(10)*. Subsurface investigations and studies demonstrate that the Iowan till does not exist but that an erosional surface cut does exist in the Iowa region. The Iowan erosion surface is arranged in a series of steps from the major drainageways toward the bounding divides (fig. 11). It is marked by a stone line where it cuts through Kansan and Nebraskan till. The stone line occurs on all levels of the stepped surfaces and under the alluvium along the drainageways.

Bassett, Canisteo, Clyde, Cresco, Donnan, Floyd, Jameston, Kenyon, Lourdes, Olin, Oran, Ostrander, Pinicon, Protivin, Racine, Readlyn, Renova, Riceville,

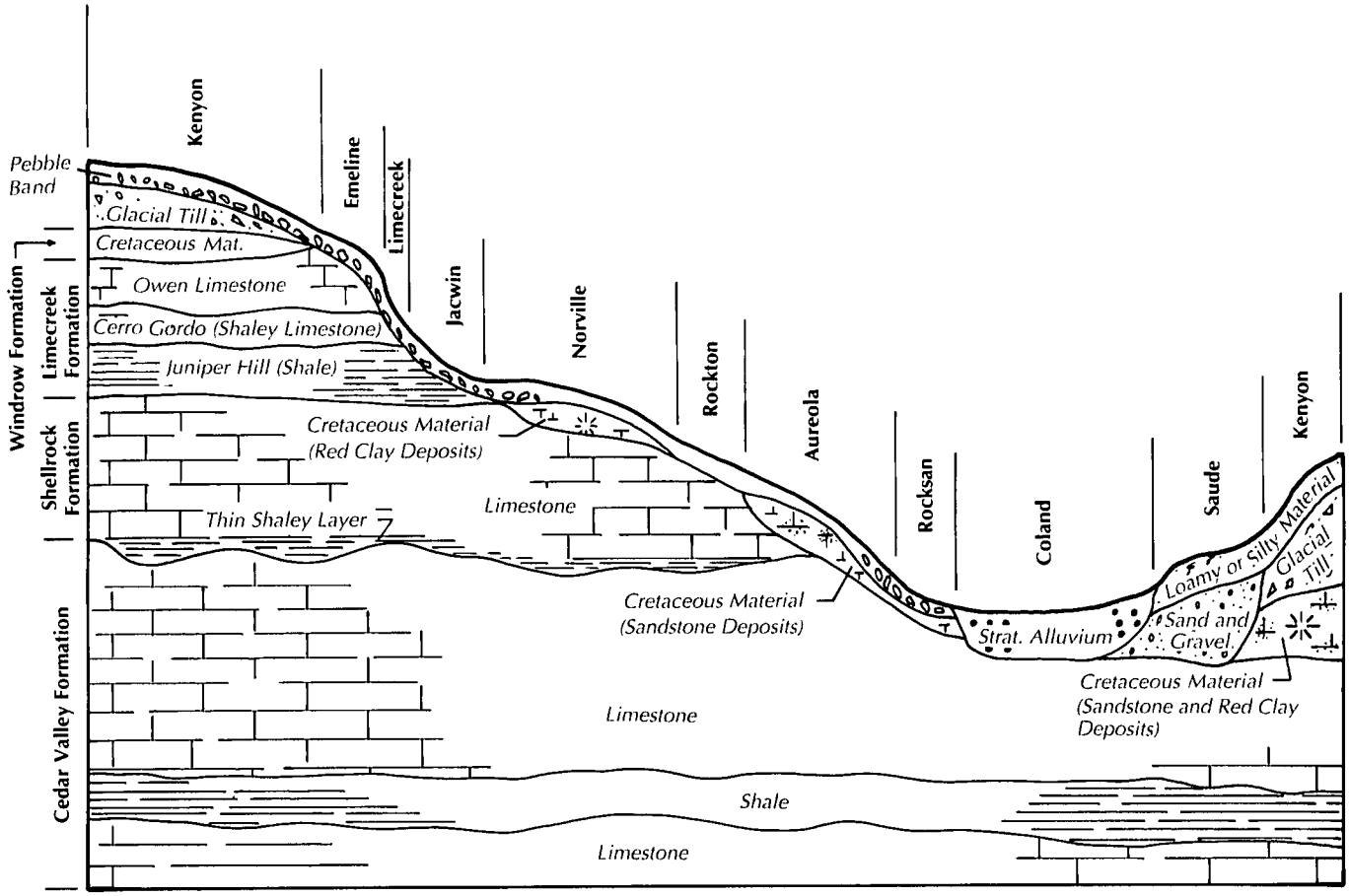

Figure 11.—A cross section showing the parent material of some of the soils in Floyd County.

Schley, and Tripoli soils formed in loamy sediments and in the underlying glacial till on the Iowan erosion surface. The loamy sediments generally are about 1 to 2 feet deep over the glacial material. They are deeper, however, in areas of Clyde, Floyd, and other soils on the lower concave slopes and in drainageways. A stone line or band of pebbles commonly separates the friable loamy surficial sediments from the firm loam or clay loam glacial till *(9)*.

Loess is silty material deposited by wind. It consists mostly of silt and clay. It does not contain coarse sand or gravel because those materials are commonly too large to be moved more than a short distance by wind, but it does contain small amounts of fine and very fine sand. In most places the thickness of the loess ranges from about 20 to 40 inches, but in a few places it ranges from about 45 inches to more than 6 feet. Franklin, Harpster, Klinger, Maxfield, and Waubeek soils formed in loess and in the underlying glacial till. Mt. Carroll soils formed in the thicker deposits of loess. Norville soils formed in loess and in the underlying red cretaceous shale bedrock. Ripon soils formed in loess and in the underlying till-derived sediments and limestone bedrock.

Alluvium is material deposited by water on flood plains and benches along streams and on upland outwash plains. It occurs as lenses and layers of sand, gravel, silt, and clay. The major areas in the county in which soils formed in alluvium are along Flood Creek and along the Cedar, Little Cedar, Shell Rock, and Winnebago Rivers and their major tributaries.

Calco, Coland, Du Page, Hanlon, Shellwood, Spillville, and Turlin soils formed in alluvium. They are on flood plains. Burkhardt, Flagler, Hayfield, Lawler, Lilah, Marshan, Saude, Talcot, Wapsie, and Waukee soils also formed in alluvium. They are on stream terraces and in outwash areas. They formed in moderately coarse textured to moderately fine textured loamy material and the underlying sand or gravel. The loamy material is 20 to 40 inches thick. Raddle soils

formed in medium textured and moderately fine textured silty sediments and the underlying sand or gravel. They are on stream terraces. The silty material is 5 to 6 feet thick. Burkhardt and Lilah soils formed in sandy loam and the underlying gravelly sand or gravel. They are in outwash areas on uplands and on stream terraces. The thickness of the sandy loam ranges from less than 5 inches to 15 inches. The content of gravel is higher in the steeper outwash areas in the uplands.

Some of the alluvial material has been transported only a short distance and has accumulated at the foot of the slope on which it originated. This material is called local alluvium, and it retains many characteristics of the soils in the area from which it was eroded. Terril soils formed in this material.

Eolian material is sandy and loamy parent material deposited by the wind. It consists of silt, medium to very fine sand, and a small amount of clay. Most of this material occurs as low mounds or dunes on uplands. The sand in these eolian deposits is largely quartz, which is highly resistant to weathering, and has not been altered appreciably since it was deposited. Bolan, Chelsea, Dickinson, Lamont, Oakton, and Sparta soils formed in eolian material.

Limestone and dolomite are the most extensive sedimentary rocks in the county (fig. 12). Except for a

Figure 12.—An outcrop of hard, fractured limestone bedrock.

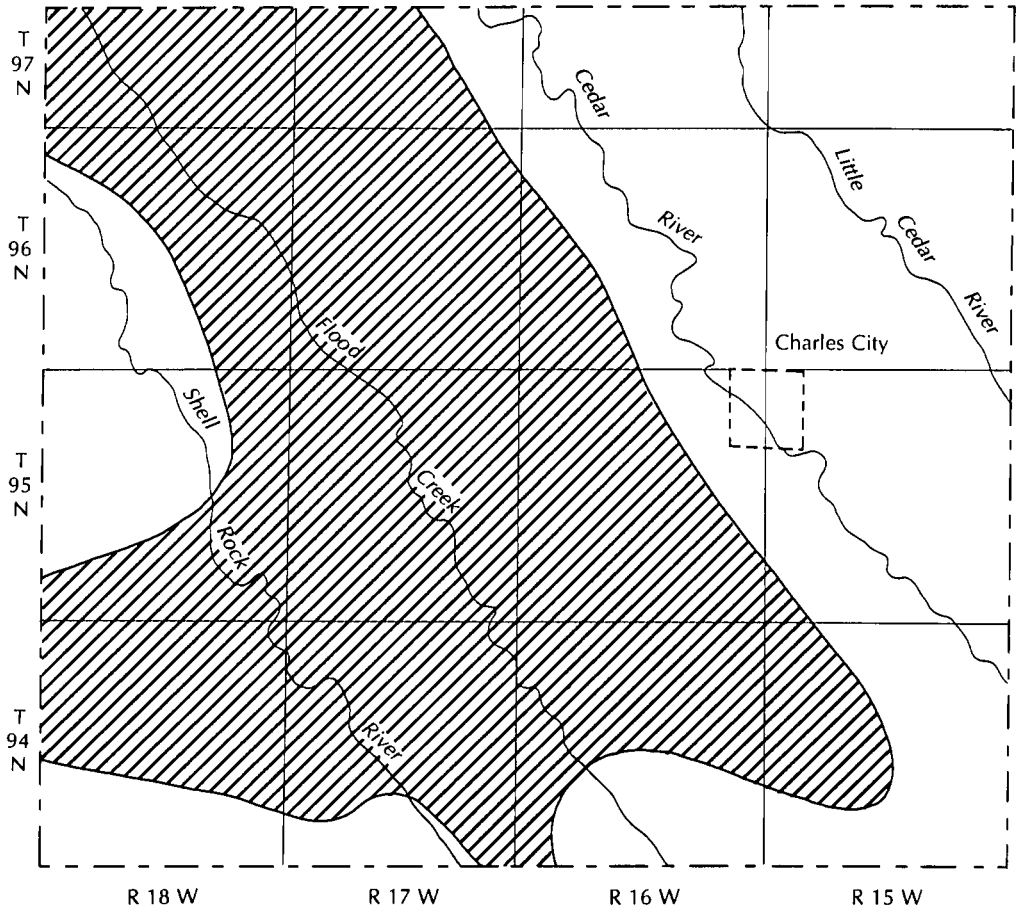

Figure 13.—The hatched area shows the location of deposits of cretaceous age in the county. The deposits occur principally as sandstone or reddish clay ranging in thickness from a few inches to more than 20 feet.

few areas where they outcrop, they are covered by glacial drift, loess, or alluvium. The thickness of this cover ranges from 4 to 40 inches in soils that are strongly affected by these two kinds of rock. Examples are Emeline, Faxon, Ripon, Rockton, Whalan, and Winneshiek soils.

Organic deposits consist of plant material that has accumulated in seepy areas on hillsides and in drainageways where the growth of water-tolerant plants is thick. Organic soils, which include peat soils and muck soils, form in these deposits. Muck is a more complete state of decomposition of the original organic plant remains than peat. In Floyd County the mucky Palms soils occur in wet areas where poor drainage has delayed the decay of plant remains that have accumulated over a period of time. The thickness of the organic material in the Palms soils typically ranges from 16 to 50 inches. In a few small areas, these deposits may be as much as 6 feet thick and may include thin layers of peat.

Cretaceous deposits, mainly highly calcareous sandstone and red fluvial clays *(15)*, occur in a significant acreage of the county (fig. 13). They also include siltstone, conglomerate, and iron deposits, which are much less extensive in the county. These deposits have been assigned to the Windrow Formation based on the discovery of fossils during the soil survey of Floyd County. The Windrow Formation is made up of alternating layers of sandstone and red clayey deposits. An earlier study had assigned the deposits to the Dakota Formation *(3)*. Aureola and Rocksan soils formed in loamy surficial sediments and the underlying sandstone. Norville soils formed in silty sediments and the underlying red clay.

In some areas in the southwestern part of the county, siltstone outcrops possibly are the reason for the silty

nature of some of the glacial drift. The conglomerate consists of highly polished pebbles cemented together by iron. In a few areas the boulders, which are 1 to 4 feet in diameter, exposed on the surface are conglomerate. In other areas the highly polished cretaceous pebbles are no longer cemented and locally outcrop. In one gravel pit nearly all of the pebbles are cretaceous in origin. The iron deposits occur as concentrations of flags with inclusions of petrified wood in some areas to a massive iron deposit several hundred feet in length in another area.

The data from the many cores taken and the landscape observations made during this soil survey indicate that cretaceous deposits in the county are much more extensive than previously thought. A deep core was drilled on a high, nearly level interstream divide located in sec. 22, T. 95 N., R. 16 W. *(22)*. This area was thought to have a thick deposit of glacial till more than 50 feet deep; however, the glacial material was shown to be only about 30 feet deep. About 20 feet of cretaceous material lies between the glacial till and the Cedar Valley Formation.

The cretaceous deposits in the county are the youngest bedrock beneath the glacial drift. They overlie the Cedar Valley, Shell Rock, and Lime Creek Formations *(4)*. The calcareous sandstone from well log samples may have been interpreted as glacial in origin in the past, and thus the geographic extent of the cretaceous deposits was underestimated. From the significant amount of cretaceous material found during this soil survey, it is apparent that this local, soft bedrock is undoubtedly a significant component of the local glacial drift. It would be reasonable to assume that its greatest influence would be on the glacial drift deposited in the earliest glacial period.

Climate

The soils in Floyd County formed under the influence of a midcontinental, subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate was conducive to the growth of forest vegetation *(8)*. The morphology of most of the soils in the county indicates that the climate under which they formed was similar to the present one. The climate is fairly uniform throughout the county but is marked by wide seasonal extremes in temperature. Precipitation is distributed throughout the year.

Climate is a major factor in determining what soils form in the various kinds of parent material. It affects the rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions in the soil. Temperature, rainfall, relative humidity, and length of the frost-free period affect the kind of vegetation on the soil.

The influence of the general climate of the region is somewhat modified by local conditions. For example, soils on south-facing slopes formed under a microclimate that is warmer and drier than the average climate in nearby areas. Poorly drained soils in low areas formed under a climate that is wetter and colder than that in most of the surrounding areas. These local conditions account for some of the differences between soils that are within the same general climatic regions.

Plant and Animal Life

Plant and animal life is an important factor in soil formation. Plants are especially significant. Soil formation begins with the growth of vegetation. As plants grow and die, they add organic matter to the upper layers of the soil material. Native grasses have myriads of fibrous roots that penetrate the soil to a depth of 10 to 20 inches and add large amounts of organic matter to the surface layer. Trees commonly feed on plant nutrients deep in the subsoil. Consequently, they add little organic matter to the surface layer other than that gained from falling leaves and dead trees. Much of the organic matter from dead trees remains on the surface or is lost through decomposition.

Soils formed under forest vegetation have a dark surface layer that generally is less than 5 inches thick. They have a lighter colored E horizon directly below the surface layer. In contrast, soils that formed under prairie grasses contain a large amount of organic matter derived from roots and have a thick, dark surface layer.

Most of the soils in the county formed under prairie grasses or a mixture of prairie grasses and water-tolerant plants. Dinsdale, Kenyon, and Ostrander are examples of soils that formed under prairie grasses. Clyde and Marshan are examples of soils that formed under prairie grasses and water-tolerant plants. Pinicon, Renova, and Whalan are examples of soils that formed entirely under trees. Bassett and Oran soils have properties that are intermediate between those of the soils that formed entirely under prairie grasses and those that formed entirely under forest vegetation.

Oran, Pinicon, and Readlyn soils are members of a biosequence, which is a group of soils that formed in the same kind of parent material and in a similar environment but that supported different kinds of native vegetation. Variations in the native vegetation caused the main morphological differences among the soils in this group.

Earthworms and burrowing animals help to keep the

soil porous. Bacteria and fungi, which decompose the vegetation, release nutrients for plant food.

Relief

Relief, or topography, can cause important differences among soils. It indirectly influences soil formation through its effect on drainage. The soils in the county range from level to very steep. Many nearly level soils are frequently flooded and have a seasonal high water table. Water soaks into the nearly level soils that are not flooded. Much of the rainfall runs off the surface of the more sloping soils, and less of it penetrates the surface.

Generally, the soils in the county that are affected by a seasonal high water table have a dominantly olive gray subsoil. Clyde, Marshan, Maxfield, and Tripoli soils are examples. Soils that formed in areas where the water table was below the subsoil have a yellowish brown subsoil. Examples are Dinsdale, Kenyon, Ostrander, and Saude soils. Floyd, Klinger, Lawler, and Readlyn soils formed in areas where natural drainage was intermediate. They have a mottled, grayish brown subsoil. Of the soils that formed under prairie vegetation, those that have a high water table generally have more organic matter in the surface layer than those that are characterized by good natural drainage.

The nearly level Lawler, Marshan, and Saude soils are examples of soils that formed in the same kind of parent material and under similar vegetation but that differ from each other because of slight differences in topographic position. Their microrelief affects runoff and depth to the water table. Marshan soils, which are in low areas on stream terraces, have a seasonal high water table and are poorly drained. Lawler soils, which are in the slightly higher areas on terraces, are somewhat poorly drained. Saude soils, which are in the higher areas on terraces, are well drained.

Aspect, as well as gradient, significantly influences soil formation. Because they generally are warmer and drier, south-facing slopes support a different kind and amount of vegetation than north-facing slopes.

The influence of porous, rapidly permeable parent material can override the influence of topography. For example, Flagler soils are level, but they are somewhat excessively drained because they are moderately rapidly permeable in the subsoil and very rapidly permeable in the substratum. Dinsdale and Ostrander soils are level and deep, but they are well drained because porous, fractured limestone bedrock is within 5 to 10 feet of the surface. The crevices in the bedrock act like closely spaced drainage tile.

Topography also affected the formation of Terril and Mottland soils. Terril soils are on foot slopes and in narrow waterways on uplands. They have properties similar to those of the higher lying soils from which they received sediments. In many areas Mottland soils are strongly sloping to steep. Because most of the rainfall in these areas runs off the surface and does not enter the soils, the effects of soil formation are minimized.

Time

Time is necessary for the various processes of soil formation. The amount of time necessary ranges from a few hundred years for the formation of soils in alluvial deposits, such as Coland soils, to thousands of years for the paleosol that makes up the subsoil of Donnan soils. The age of the parent material, however, does not necessarily reflect the true age of the soil profile.

Generally, if other factors are favorable, the texture of the subsoil becomes finer and a greater amount of soluble material is leached out as the soils continue to weather. Exceptions are Sparta soils and other soils that formed in quartz sand or in other material that is resistant to weathering. These soils do not change much over a long period of time. Other exceptions are the steep soils where runoff from rainfall is rapid and a limited amount of water infiltrates the soil. These soils weather more slowly than stable, less sloping soils.

Where organic material, such as trees, has been buried by later deposition through the action of ice, water, or wind, the age of a landscape can be determined by radiocarbon dating the organic material *(11)*. The loess that covers part of the county is about 14,000 to 20,000 years old. Dinsdale, Klinger, and Maxfield soils formed in this material. The maximum age for these soils on stable summits is 14,000 years *(7)*. The Iowan erosion surface formed between 14,000 and 20,000 years ago during the period of loess deposition *(12)*. The Iowan surface beneath the loess possibly is only 14,000 years old. This dates the close of the major period of loess deposition in Iowa. The surface might also be younger than the loess. In areas where the Iowan surface is covered by loamy surficial sediment, it is less than 14,000 years old *(12)*. Kenyon, Ostrander, and Readlyn soils formed in this material. Floyd soils are younger because they are in the lower areas.

Human Activities

Important changes took place when the county was settled. Some changes had little effect on soil productivity; others had drastic effects. The most apparent effects are those caused by water erosion. Breaking the prairie sod and clearing the timber

removed and changed the protective plant cover.

Cultivation increases the susceptibility of the more sloping areas to erosion, which removes topsoil, organic matter, and plant nutrients. Sheet erosion, which is prevalent in the county, removes a small amount of topsoil at a time, but cultivation generally destroys all evidence of this loss. In some areas, shallow and deep gullies have formed and the material removed through erosion has been deposited on the lower slopes. As the land was brought under cultivation, the runoff rate increased and the rate at which water moved into the soil decreased. As a result, accelerated erosion has removed part or all of the original surface layer from many of the more sloping soils. Examples are the moderately eroded Bassett and Kenyon soils.

Erosion is the main cause of the loss of organic matter in soils, but as much as one-third of the organic matter can be lost through causes other than erosion *(14)*. Maintaining as high a reserve of organic matter as was originally present under native grasses is not economically feasible. Measures that help to maintain a safe, economical level for crops, however, are needed. Erosion-control measures especially are needed in areas where the soils have a low content of organic matter.

Soil blowing occurs after soils are cultivated. Light textured soils are highly susceptible to soil blowing, especially if the surface is bare and the topsoil is dry. If nearly level fields are plowed in the fall, soil blowing can mix the dark topsoil with snow or pile it along fence rows and in road ditches.

In fields that are cultivated year after year, the well developed granular structure of the surface layer, which is so apparent in virgin grassland, begins to break down. The surface layer often is baked and hard when dry. The fine textured soils that are plowed when wet tend to puddle and are less permeable than similar soils in noncultivated areas. In some fields of finer textured soils, a compact layer forms below the plow layer. The compact layer, which is called a plow sole or plowpan, hardens when it dries and is less permeable than the subsoil.

Management practices have increased the productivity of some soils and reclaimed areas that otherwise were not suitable for crops. For example, drainage ditches and diversions at the foot of slopes have helped to control flooding and thus have made areas of bottom land suitable for cultivation. Installing drainage tile has helped to overcome the wetness in many soils, and terracing has helped to control erosion. Applications of commercial fertilizer and lime have made many soils more productive now than they were in their natural state.

Processes of Horizon Differentiation

Horizon differentiation is caused by four basic kinds of change. These are additions, removals, transfers, and transformations *(13)*. Each of these kinds of change affects many of the substances that make up soils, such as organic matter, soluble salts, carbonates, sesquioxides, and silicate clay minerals. In general, these processes tend to promote horizon differentiation, but some tend to offset or retard it. The processes and the resulting changes proceed simultaneously in soils, and the ultimate nature of the profile is governed by the balance of these changes.

The accumulation of organic matter is an early step in the process of horizon differentiation in most soils. The content of organic matter ranges from very high to very low in the A horizon of the soils in Floyd County. For example, Renova soils have a thin A horizon and have a low content of organic matter. Clyde and Coland soils have a thick A horizon and have a very high content of organic matter. Some soils that formerly had a high content of organic matter now have a low one because of erosion.

The removal of substances from parts of the soil profile is important in the differentiation of soil horizons. The downward movement of calcium carbonates and bases is an example. The upper part of many of the soils in the county has been leached of calcium carbonates. The subsoil of some soils has been so strongly leached that it is strongly acid or very strongly acid.

The transfer of substances from one horizon to another is evident in the soils of the county. Phosphorus is removed from the subsoil by plant roots and transferred to parts of the plant growing above the ground. It is then added to the surface layer in the plant residue. This process affects the form and distribution of phosphorus in the soil.

The translocation of silicate clay minerals is an important process of horizon differentiation. The clay minerals are carried downward in suspension in percolating water from the A horizon. They accumulate in the B horizon in pores and root channels and as clay films on the faces of peds. This process has affected many of the soils in the county. In other soils, however, the content of clay in the A horizon is not markedly different from that in the B horizon and other evidence of clay movement is minimal.

Transformations are physical and chemical. The weathering of soil particles to smaller sizes is an example of a transformation. Gleying, or the reduction of iron, is an example of a physical transformation. This process occurs when poorly drained soils, such as

Clyde soils, are saturated for long periods. These soils have enough organic matter for biological activity to take place during the periods of saturation. Gleying is evidenced by the presence of ferrous iron and gray colors. Reductive extractable iron, or free iron, generally is not so evident in somewhat poorly drained soils, such as Floyd and Lawler soils.

Another kind of transformation is the weathering of the primary apatite minerals in the parent material to secondary phosphorus compounds. This transformation tends to occur in soils that have a pH level near 7. Thus, soils that have a pH level of more than 7, such as Du Page soils, have less available phosphorus than soils that have a pH level near 7, such as Clyde soils.

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Glossary

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.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). 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.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to

the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

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.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

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 between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The 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.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

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 is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 drawbar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

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.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

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.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, 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 substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing 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 soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of 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.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

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 (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-84 at Charles City, Iowa)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	23.6	5.4	14.5	46	-24	0	0.84	0.31	1.27	3	8.1
February	30.4	12.1	21.3	52	-20	0	.94	.25	1.49	3	6.8
March	40.5	22.7	31.6	72	-9	16	2.13	1.10	3.02	6	10.3
April	58.2	36.6	47.4	86	16	80	3.44	2.05	4.68	8	2.2
May	71.2	48.1	59.7	91	29	315	4.28	2.82	5.60	8	.0
June	80.6	57.4	69.0	95	41	570	4.78	2.77	6.56	8	.0
July	84.3	61.7	73.0	97	47	713	4.11	2.39	5.63	7	.0
August	82.7	59.6	71.2	95	43	657	4.04	1.80	5.94	7	.0
September	74.3	50.4	62.4	92	30	372	3.53	1.15	5.47	6	.0
October	62.7	40.2	51.5	87	21	145	2.44	1.17	3.56	5	.1
November	44.3	26.8	35.6	69	1	0	1.62	.53	2.52	4	3.4
December	29.4	13.6	21.5	56	-19	0	1.09	.53	1.56	4	7.7
Yearly:											
Average	56.9	36.2	46.6	---	---	---	---	---	---	---	---
Extreme	---	---	---	98	-27	---	---	---	---	---	---
Total	---	---	---	---	---	2,868	33.24	28.07	38.16	69	38.6

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-84 at Charles City, Iowa)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 17	Apr. 29	May 15
2 years in 10 later than--	Apr. 12	Apr. 25	May 10
5 years in 10 later than--	Apr. 4	Apr. 17	May 1
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 15	Sept. 30	Sept. 22
2 years in 10 earlier than--	Oct. 20	Oct. 5	Sept. 26
5 years in 10 earlier than--	Oct. 29	Oct. 14	Oct. 5

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-84 at Charles City, Iowa)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	191	162	140
8 years in 10	196	168	145
5 years in 10	207	179	156
2 years in 10	218	191	167
1 year in 10	224	197	172

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
27	Terril loam, 0 to 2 percent slopes	1,480	0.5
27B	Terril loam, 2 to 5 percent slopes	3,415	1.1
41B	Sparta loamy fine sand, 2 to 6 percent slopes	320	0.1
63C	Chelsea loamy fine sand, 2 to 9 percent slopes	325	0.1
83	Kenyon loam, 0 to 2 percent slopes	925	0.3
83B	Kenyon loam, 2 to 5 percent slopes	19,120	6.0
83C	Kenyon loam, 5 to 9 percent slopes	750	0.2
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	1,065	0.3
84	Clyde silty clay loam, 0 to 3 percent slopes	35,370	11.0
96	Turlin loam, 0 to 2 percent slopes	1,420	0.4
110B	Lamont fine sandy loam, 2 to 5 percent slopes	650	0.2
110C	Lamont fine sandy loam, 5 to 9 percent slopes	310	0.1
135	Coland clay loam, 0 to 2 percent slopes	3,865	1.2
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	370	0.1
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,775	0.6
171	Bassett loam, 0 to 2 percent slopes	865	0.3
171B	Bassett loam, 2 to 5 percent slopes	8,360	2.6
171C	Bassett loam, 5 to 9 percent slopes	1,000	0.3
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded	1,475	0.5
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded	370	0.1
174	Bolan loam, 0 to 2 percent slopes	2,385	0.7
174B	Bolan loam, 2 to 5 percent slopes	2,310	0.7
174B2	Bolan loam, 2 to 5 percent slopes, moderately eroded	1,475	0.5
174C2	Bolan loam, 5 to 9 percent slopes, moderately eroded	280	0.1
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	1,520	0.5
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	425	0.1
177	Saude loam, 0 to 2 percent slopes	7,405	2.3
177B	Saude loam, 2 to 5 percent slopes	4,115	1.3
177C	Saude loam, 5 to 9 percent slopes	475	0.1
178	Waukee loam, 0 to 2 percent slopes	2,910	0.9
178B	Waukee loam, 2 to 5 percent slopes	1,460	0.5
184	Klinger silty clay loam, 0 to 3 percent slopes	12,235	3.8
194	Norville silty clay loam, 0 to 2 percent slopes	995	0.3
194B	Norville silty clay loam, 2 to 5 percent slopes	995	0.3
194C3	Norville silt loam, 5 to 9 percent slopes, severely eroded	230	0.1
198	Floyd loam, 0 to 2 percent slopes	510	0.2
198B	Floyd loam, 1 to 4 percent slopes	17,735	5.5
201B	Coland-Terril complex, 1 to 5 percent slopes	205	0.1
213	Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes	520	0.2
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes	2,055	0.6
214	Rockton loam, 20 to 30 inches to limestone, 0 to 2 percent slopes	395	0.1
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes	3,250	1.0
214C	Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes	780	0.2
214C2	Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes, moderately eroded	205	0.1
216B	Ripon silt loam, 20 to 30 inches to limestone, 1 to 5 percent slopes	300	0.1
217B	Ripon silt loam, 30 to 40 inches to limestone, 1 to 5 percent slopes	460	0.1
221B	Palms muck, 0 to 5 percent slopes	335	0.1
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	2,050	0.6
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	2,460	0.8
284	Flagler sandy loam, 0 to 2 percent slopes	825	0.3
284B	Flagler sandy loam, 2 to 5 percent slopes	975	0.3
284C	Flagler sandy loam, 5 to 9 percent slopes	280	0.1
285B	Burkhardt sandy loam, 2 to 5 percent slopes	815	0.3
285C	Burkhardt sandy loam, 5 to 9 percent slopes	830	0.3
285F	Burkhardt sandy loam, 14 to 30 percent slopes	215	0.1
303	Pinicon silt loam, 0 to 2 percent slopes	445	0.1
377	Dinsdale silty clay loam, 0 to 2 percent slopes	3,235	1.0
377B	Dinsdale silty clay loam, 2 to 5 percent slopes	2,695	0.8
382	Maxfield silty clay loam, 0 to 2 percent slopes	16,270	5.0
391B	Clyde-Floyd complex, 1 to 4 percent slopes	6,920	2.2
394	Ostrander loam, 0 to 2 percent slopes	5,345	1.7
394B	Ostrander loam, 2 to 5 percent slopes	10,365	3.2

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
394C	Ostrander loam, 5 to 9 percent slopes	730	0.2
394C2	Ostrander loam, 5 to 9 percent slopes, moderately eroded	335	0.1
398	Tripoli silty clay loam, 0 to 2 percent slopes	18,220	5.6
399	Readlyn loam, 0 to 2 percent slopes	16,350	5.0
399B	Readlyn loam, 2 to 5 percent slopes	8,830	2.8
407B	Schley silt loam, 1 to 4 percent slopes	4,635	1.4
408B	Olin sandy loam, 2 to 6 percent slopes	560	0.2
412C	Emeline loam, 2 to 9 percent slopes	975	0.3
412E	Emeline loam, 9 to 18 percent slopes	340	0.1
412G	Emeline loam, 18 to 40 percent slopes	730	0.2
444B	Jacwin silty clay loam, 1 to 5 percent slopes	960	0.3
457	Du Page loam, 0 to 2 percent slopes	1,830	0.6
471	Oran loam, 0 to 2 percent slopes	8,190	2.6
471B	Oran loam, 2 to 5 percent slopes	2,560	0.8
482	Racine loam, 0 to 2 percent slopes	1,130	0.4
482B	Racine loam, 2 to 5 percent slopes	2,945	0.9
482C	Racine loam, 5 to 9 percent slopes	915	0.3
482C2	Racine loam, 5 to 9 percent slopes, moderately eroded	565	0.2
485	Spillville loam, 0 to 2 percent slopes	2,325	0.7
491B	Renova silt loam, 1 to 5 percent slopes	340	0.1
507	Canisteo silty clay loam, 0 to 2 percent slopes	770	0.2
535	Shellwood sandy loam, 0 to 3 percent slopes	415	0.1
536	Hanlon fine sandy loam, 0 to 3 percent slopes	865	0.3
537	Du Page-Calco complex, 0 to 2 percent slopes	400	0.1
551	Calamine silty clay loam, 0 to 3 percent slopes	460	0.1
559	Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	320	0.1
595	Harpster silty clay loam, 0 to 2 percent slopes	300	0.1
612C2	Mottland loam, 5 to 9 percent slopes, moderately eroded	325	0.1
612D2	Mottland loam, 9 to 14 percent slopes, moderately eroded	340	0.1
616	Aureola loam, 0 to 2 percent slopes	500	0.2
616B	Aureola loam, 2 to 5 percent slopes	940	0.3
616C2	Aureola sandy loam, 5 to 9 percent slopes, moderately eroded	410	0.1
616D2	Aureola sandy loam, 9 to 16 percent slopes, moderately eroded	200	0.1
631	Limecreek silty clay loam, 0 to 2 percent slopes	295	0.1
631B	Limecreek silty clay loam, 2 to 5 percent slopes	655	0.2
631C	Limecreek silty clay loam, 5 to 9 percent slopes	255	0.1
651	Faxon silty clay loam, 0 to 2 percent slopes	210	0.1
662B	Mt. Carroll silt loam, 2 to 5 percent slopes	260	0.1
697	Rocksan silty clay loam, 0 to 2 percent slopes	640	0.2
713	Winneshiek silt loam, 30 to 40 inches to limestone, 0 to 2 percent slopes	350	0.1
713B	Winneshiek silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes	750	0.2
714B	Winneshiek silt loam, 20 to 30 inches to limestone, 2 to 5 percent slopes	875	0.3
714C	Winneshiek silt loam, 20 to 30 inches to limestone, 5 to 9 percent slopes	515	0.2
725	Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	635	0.2
726	Hayfield loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	440	0.1
733	Calco silty clay loam, 0 to 2 percent slopes	675	0.2
761	Franklin silt loam, 0 to 3 percent slopes	4,365	1.4
771	Waubeek silt loam, 0 to 2 percent slopes	210	0.1
771B	Waubeek silt loam, 2 to 5 percent slopes	420	0.1
776C	Lilah sandy loam, 3 to 9 percent slopes	760	0.2
777	Wapsie loam, 0 to 2 percent slopes	880	0.3
777B	Wapsie loam, 2 to 5 percent slopes	2,070	0.6
777C	Wapsie loam, 5 to 9 percent slopes	480	0.1
781B	Lourdes loam, 2 to 5 percent slopes	4,780	1.5
781C	Lourdes loam, 5 to 9 percent slopes	490	0.2
781C2	Lourdes loam, 5 to 9 percent slopes, moderately eroded	460	0.1
782	Donnan loam, 0 to 2 percent slopes	250	0.1
782B	Donnan loam, 2 to 5 percent slopes	775	0.2
783B	Cresco loam, 2 to 5 percent slopes	1,130	0.4
783C	Cresco loam, 5 to 9 percent slopes	310	0.1
784B	Riceville silt loam, 1 to 4 percent slopes	2,560	0.8
789	Oakton loam, 0 to 2 percent slopes	880	0.3
797	Jameston silty clay loam, 0 to 2 percent slopes	930	0.3

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
798B	Protivin clay loam, 1 to 4 percent slopes	3,435	1.1
806B	Whalan silt loam, 1 to 5 percent slopes	215	0.1
936	Coland-Spillville complex, 0 to 2 percent slopes	1,070	0.3
976	Raddle silt loam, 0 to 2 percent slopes	205	0.1
1537	Du Page-Shellwood-Calco complex, channeled, 0 to 3 percent slopes	1,325	0.4
1936	Spillville-Hanlon-Coland complex, channeled, 0 to 3 percent slopes	1,600	0.5
4000	Urban land	410	0.1
5010	Pits, sand and gravel	335	0.1
5030	Pits, limestone quarry	270	0.1
5040	Orthents, loamy	900	0.3
5060	Pits, clay	100	*
	Total	320,800	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
27	Terril loam, 0 to 2 percent slopes
27B	Terril loam, 2 to 5 percent slopes
83	Kenyon loam, 0 to 2 percent slopes
83B	Kenyon loam, 2 to 5 percent slopes
84	Clyde silty clay loam, 0 to 3 percent slopes (where drained)
96	Turlin loam, 0 to 2 percent slopes
110B	Lamont fine sandy loam, 2 to 5 percent slopes
135	Coland clay loam, 0 to 2 percent slopes (where drained)
151	Marshan clay loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes (where drained)
152	Marshan clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes (where drained)
171	Bassett loam, 0 to 2 percent slopes
171B	Bassett loam, 2 to 5 percent slopes
174	Bolan loam, 0 to 2 percent slopes
174B	Bolan loam, 2 to 5 percent slopes
174B2	Bolan loam, 2 to 5 percent slopes, moderately eroded
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
177	Saude loam, 0 to 2 percent slopes
177B	Saude loam, 2 to 5 percent slopes
178	Waukee loam, 0 to 2 percent slopes
178B	Waukee loam, 2 to 5 percent slopes
184	Klinger silty clay loam, 0 to 3 percent slopes
194	Norville silty clay loam, 0 to 2 percent slopes
194B	Norville silty clay loam, 2 to 5 percent slopes
198	Floyd loam, 0 to 2 percent slopes
198B	Floyd loam, 1 to 4 percent slopes
201B	Coland-Terril complex, 1 to 5 percent slopes (where drained)
213	Rockton loam, 30 to 40 inches to limestone, 0 to 2 percent slopes
213B	Rockton loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
214	Rockton loam, 20 to 30 inches to limestone, 0 to 2 percent slopes
214B	Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
216B	Ripon silt loam, 20 to 30 inches to limestone, 1 to 5 percent slopes
217B	Ripon silt loam, 30 to 40 inches to limestone, 1 to 5 percent slopes
225	Lawler loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
303	Pinicon silt loam, 0 to 2 percent slopes
377	Dinsdale silty clay loam, 0 to 2 percent slopes
377B	Dinsdale silty clay loam, 2 to 5 percent slopes
382	Maxfield silty clay loam, 0 to 2 percent slopes (where drained)
391B	Clyde-Floyd complex, 1 to 4 percent slopes (where drained)
394	Ostrander loam, 0 to 2 percent slopes
394B	Ostrander loam, 2 to 5 percent slopes
398	Tripoli silty clay loam, 0 to 2 percent slopes (where drained)
399	Readlyn loam, 0 to 2 percent slopes
399B	Readlyn loam, 2 to 5 percent slopes
407B	Schley silt loam, 1 to 4 percent slopes (where drained)
408B	Olin sandy loam, 2 to 6 percent slopes
444B	Jacwin silty clay loam, 1 to 5 percent slopes
457	Du Page loam, 0 to 2 percent slopes
471	Oran loam, 0 to 2 percent slopes
471B	Oran loam, 2 to 5 percent slopes
482	Racine loam, 0 to 2 percent slopes
482B	Racine loam, 2 to 5 percent slopes
485	Spillville loam, 0 to 2 percent slopes
507	Canisteo silty clay loam, 0 to 2 percent slopes (where drained)
535	Shellwood sandy loam, 0 to 3 percent slopes
536	Hanlon fine sandy loam, 0 to 3 percent slopes
537	Du Page-Calco complex, 0 to 2 percent slopes (where drained)
551	Calamine silty clay loam, 0 to 3 percent slopes (where drained)

TABLE 5.--PRIME FARMLAND--Continued

Map symbol	Soil name
559	Talcot clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes (where drained)
595	Harpster silty clay loam, 0 to 2 percent slopes (where drained)
616	Aureola loam, 0 to 2 percent slopes
616B	Aureola loam, 2 to 5 percent slopes
631	Limecreek silty clay loam, 0 to 2 percent slopes
631B	Limecreek silty clay loam, 2 to 5 percent slopes
651	Faxon silty clay loam, 0 to 2 percent slopes (where drained)
662B	Mt. Carroll silt loam, 2 to 5 percent slopes
697	Rocksan silty clay loam, 0 to 2 percent slopes (where drained)
713	Winneshiek silt loam, 30 to 40 inches to limestone, 0 to 2 percent slopes
713B	Winneshiek silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes
714B	Winneshiek silt loam, 20 to 30 inches to limestone, 2 to 5 percent slopes
725	Hayfield loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
726	Hayfield loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
733	Calco silty clay loam, 0 to 2 percent slopes (where drained)
761	Franklin silt loam, 0 to 3 percent slopes
771	Waubeek silt loam, 0 to 2 percent slopes
771B	Waubeek silt loam, 2 to 5 percent slopes
777	Wapsie loam, 0 to 2 percent slopes
777B	Wapsie loam, 2 to 5 percent slopes
781B	Lourdes loam, 2 to 5 percent slopes
782	Donnan loam, 0 to 2 percent slopes
782B	Donnan loam, 2 to 5 percent slopes
783B	Cresco loam, 2 to 5 percent slopes
784B	Riceville silt loam, 1 to 4 percent slopes
789	Oakton loam, 0 to 2 percent slopes
797	Jameston silty clay loam, 0 to 2 percent slopes (where drained)
798B	Protivin clay loam, 1 to 4 percent slopes (where drained)
806B	Whalan silt loam, 1 to 5 percent slopes
936	Coland-Spillville complex, 0 to 2 percent slopes (where drained)
976	Raddle silt loam, 0 to 2 percent slopes

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
27---------- Terril	I	92	157	48	94	6.6	3.9	6.4	11.1
27B---------- Terril	IIe	87	154	47	92	6.5	3.8	6.3	10.8
41B---------- Sparta	IVs	40	77	26	46	3.2	1.9	3.2	5.3
63C---------- Chelsea	IVs	21	63	21	38	2.6	1.5	2.6	4.4
83---------- Kenyon	I	89	155	47	93	6.5	3.8	6.4	10.9
83B---------- Kenyon	IIe	84	152	46	91	6.4	3.7	6.2	10.7
83C---------- Kenyon	IIIe	69	147	45	88	6.2	3.6	6.0	10.4
83C2---------- Kenyon	IIIe	67	143	44	86	6.0	3.5	5.9	10.0
84---------- Clyde	IIw	77	144	44	86	4.3	3.5	5.9	7.2
96---------- Turlin	IIw	90	153	47	92	6.1	3.8	6.3	10.2
110B---------- Lamont	IIIe	47	94	31	56	3.9	2.3	3.9	6.6
110C---------- Lamont	IIIe	32	89	30	53	3.7	2.2	3.6	6.2
135---------- Coland	IIw	80	136	46	82	4.1	3.3	5.6	6.8
151---------- Marshan	IIw	64	112	34	67	3.4	---	---	---

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
152---------- Marshan	IIw	72	126	38	76	3.8	3.1	5.2	6.3
171---------- Bassett	I	84	146	45	88	6.1	3.6	6.0	10.2
171B---------- Bassett	IIe	79	143	44	86	6.0	3.5	5.9	10.0
171C---------- Bassett	IIIe	64	138	42	83	5.8	3.4	5.7	9.7
171C2---------- Bassett	IIIe	62	134	41	80	5.6	3.3	5.5	9.4
171D2---------- Bassett	IIIe	56	125	38	75	5.3	3.1	5.1	8.8
174---------- Bolan	IIs	75	124	38	74	5.2	3.1	5.1	8.7
174B---------- Bolan	IIe	70	121	37	73	5.1	3.0	5.0	8.5
174B2---------- Bolan	IIe	68	117	36	70	4.9	2.9	4.8	8.2
174C2---------- Bolan	IIIe	53	112	34	67	4.7	2.8	4.6	7.8
175B---------- Dickinson	IIIe	55	109	37	65	4.6	2.7	4.5	7.7
175C---------- Dickinson	IIIe	40	104	35	62	4.4	2.6	4.3	7.3
177---------- Saude	IIs	63	107	33	64	4.5	2.6	4.4	7.5
177B---------- Saude	IIe	58	104	32	62	4.4	2.6	4.3	7.3
177C---------- Saude	IIIe	38	99	30	59	4.2	2.4	4.1	6.9

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
178---------- Waukee	IIs	79	132	40	79	5.5	3.2	5.4	9.2
178B---------- Waukee	IIe	74	129	39	77	5.4	3.2	5.3	9.0
184---------- Klinger	I	95	168	56	101	6.7	4.1	6.9	11.2
194---------- Norville	I	79	130	40	78	5.2	3.2	5.3	8.7
194B---------- Norville	IIe	74	127	39	76	5.1	3.1	5.2	8.5
194C3---------- Norville	IVe	39	110	34	66	4.4	2.7	4.5	7.3
198---------- Floyd	IIw	79	145	44	87	5.8	3.6	5.9	9.7
198B---------- Floyd	IIw	74	142	43	85	5.7	3.5	5.8	9.5
201B---------- Coland-Terril	IIw	64	136	46	82	4.1	3.3	5.6	6.7
213---------- Rockton	IIs	79	132	40	79	5.5	3.2	5.4	9.2
213B---------- Rockton	IIe	74	129	39	77	5.4	3.2	5.3	9.0
214---------- Rockton	IIs	63	107	33	64	4.5	2.6	4.4	7.5
214B---------- Rockton	IIe	58	104	32	62	4.4	2.6	4.3	7.3
214C---------- Rockton	IIIe	38	99	30	59	4.2	2.4	4.1	7.0
214C2---------- Rockton	IIIe	33	95	29	57	4.0	2.3	3.9	6.7

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
216B---------- Ripon	IIe	65	116	39	70	4.9	2.9	4.8	8.2
217B---------- Ripon	IIe	79	137	46	82	5.8	3.4	5.6	9.7
221B---------- Palms	IIIw	45	112	38	67	3.4	2.8	4.6	5.7
225---------- Lawler	IIs	66	119	36	71	4.8	2.9	4.9	8.0
226---------- Lawler	IIs	78	138	42	83	5.5	3.4	5.7	9.2
284---------- Flagler	IIIs	50	87	29	52	3.7	2.1	3.6	6.2
284B---------- Flagler	IIIe	45	84	28	50	3.5	2.1	3.4	5.8
284C---------- Flagler	IIIe	30	79	26	47	3.3	1.9	3.2	5.5
285B---------- Burkhardt	IIIs	25	49	16	29	2.1	1.2	2.0	3.5
285C---------- Burkhardt	IIIs	5	---	---	26	1.8	1.1	1.8	3.0
285F---------- Burkhardt	VIIe	5	---	---	---	---	0.2	0.3	---
303---------- Pinicon	IIw	79	139	42	83	5.6	3.4	5.7	9.1
377---------- Dinsdale	I	95	163	55	98	6.8	4.0	6.7	11.4
377B---------- Dinsdale	IIe	90	160	54	96	6.7	3.9	6.6	11.2
382---------- Maxfield	IIw	90	160	54	96	4.8	3.9	6.6	8.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
391B---- Clyde-Floyd	IIw	73	135	41	81	4.1	3.3	5.5	8.1
394---- Ostrander	I	89	155	47	93	6.5	3.8	6.4	6.7
394B---- Ostrander	IIe	84	152	46	91	6.4	3.7	6.2	6.7
394C---- Ostrander	IIIe	69	147	45	88	6.2	3.6	6.0	6.3
394C2---- Ostrander	IIIe	67	143	44	86	6.0	3.5	5.9	6.0
398---- Tripoli	IIw	79	151	46	91	4.5	3.7	6.2	7.7
399---- Readlyn	I	89	155	47	93	6.2	3.8	6.4	10.5
399B---- Readlyn	IIe	84	152	46	91	6.1	3.7	6.2	10.3
407B---- Schley	IIw	69	128	39	77	5.1	3.1	5.2	8.5
408B---- Olin	IIe	67	133	45	80	5.6	3.3	5.5	9.4
412C---- Emeline	IVs	13	61	20	37	2.6	1.5	2.5	2.6
412E---- Emeline	VIs	5	---	---	---	---	0.9	1.4	---
412G---- Emeline	VIIs	5	---	---	---	---	0.5	0.8	---
444B---- Jacwin	IIe	60	116	35	70	4.6	2.9	4.8	7.7
457---- Du Page	IIw	72	136	46	82	5.7	3.3	5.6	9.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
471 Oran	I	84	146	45	88	5.8	3.6	6.0	9.7
471B Oran	IIe	79	143	44	86	5.7	3.5	5.9	9.5
482 Racine	I	84	146	45	88	6.1	3.6	6.0	10.2
482B Racine	IIe	79	143	44	86	6.0	3.5	5.9	10.0
482C Racine	IIIe	64	138	42	83	5.8	3.4	5.7	9.7
482C2 Racine	IIIe	62	134	41	80	5.6	3.3	5.5	9.4
485 Spillville	IIw	92	156	48	94	6.6	3.8	6.4	11.0
491B Renova	IIe	74	134	41	80	5.6	3.3	5.5	9.4
507 Canisteo	IIw	79	137	46	82	4.1	3.4	5.8	6.9
535 Shellwood	IIs	65	118	40	71	5.0	2.9	4.8	8.3
536 Hanlon	IIs	70	120	40	72	5.0	3.0	4.9	8.3
537 Du Page-Calco	IIIw	65	134	45	80	4.0	3.3	5.5	5.8
551 Calamine	IIIw	60	100	31	60	3.0	2.5	4.1	5.0
559 Talcot	IIw	72	125	42	75	3.8	3.1	5.1	6.3
595 Harpster	IIw	85	147	49	88	4.4	3.6	6.0	7.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
612C2---------- Mottland	IIIe	46	108	33	65	4.5	2.7	4.4	7.5
612D2---------- Mottland	IVe	38	99	30	59	4.2	2.4	4.1	7.0
616---------- Aureola	IIs	75	119	36	71	5.0	2.9	4.9	8.3
616B---------- Aureola	IIe	70	116	35	70	4.9	2.9	4.8	8.2
616C2---------- Aureola	IIIe	45	107	33	64	4.5	2.6	4.4	7.5
616D2---------- Aureola	VIe	30	---	---	59	4.1	2.4	4.0	6.9
631---------- Limecreek	I	87	150	46	90	6.3	3.7	6.2	10.5
631B---------- Limecreek	IIe	82	147	45	88	6.2	3.6	6.0	10.4
631C---------- Limecreek	IIIe	67	142	43	85	6.0	3.5	5.8	10.0
651---------- Faxon	IIIw	57	106	36	64	3.2	2.6	4.3	5.3
662B---------- Mt. Carroll	IIe	90	158	53	95	6.6	3.9	6.5	11.0
697---------- Rocksan	IIw	60	112	34	67	3.4	2.8	4.6	5.7
713---------- Winneshiek	IIs	74	123	38	74	5.2	3.0	5.0	8.7
713B---------- Winneshiek	IIe	69	120	37	72	5.0	3.0	4.9	8.4
714B---------- Winneshiek	IIe	53	95	29	57	4.0	2.3	3.9	6.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
714C---------- Winneshiek	IIIe	33	90	27	54	3.8	2.2	3.7	6.4
725---------- Hayfield	IIs	61	110	34	66	4.4	2.7	4.5	7.4
726---------- Hayfield	IIs	73	129	39	77	5.2	3.2	5.3	8.7
733---------- Calco	IIw	75	130	44	78	3.9	3.2	5.3	6.5
761---------- Franklin	I	90	154	52	92	6.2	3.8	6.3	10.4
771---------- Waubeek	I	90	154	52	92	6.5	3.8	6.3	10.9
771B---------- Waubeek	IIe	85	151	51	91	6.3	3.7	6.2	10.5
776C---------- Lilah	IVs	8	43	14	26	1.8	1.1	1.8	3.0
777---------- Wapsie	IIs	58	95	29	57	4.0	2.3	3.9	6.6
777B---------- Wapsie	IIe	53	92	28	55	3.9	2.3	3.8	6.5
777C---------- Wapsie	IIIe	33	87	27	52	3.7	2.1	3.6	6.2
781B---------- Lourdes	IIe	60	118	36	71	5.0	2.9	4.8	8.3
781C---------- Lourdes	IIIe	40	113	34	68	4.7	2.8	4.6	7.8
781C2---------- Lourdes	IIIe	35	109	33	65	4.6	2.7	4.5	7.7
782---------- Donnan	IIw	55	95	29	57	3.8	2.3	3.9	6.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM**	AUM**	AUM**
782B---------- Donnan	IIe	50	92	28	55	3.7	2.3	3.7	6.2
783B---------- Cresco	IIe	65	127	39	76	5.3	3.1	5.2	8.9
783C---------- Cresco	IIIe	45	122	37	73	5.1	3.0	5.0	8.6
784B---------- Riceville	IIw	50	114	35	68	4.6	2.8	4.7	7.7
789---------- Oakton	IIs	69	124	38	74	5.0	3.1	5.1	8.3
797---------- Jameston	IIw	55	122	37	73	3.7	3.0	5.0	6.1
798B---------- Protivin	IIw	55	123	38	74	4.9	3.0	5.0	8.2
806B---------- Whalan	IIe	56	99	30	59	4.2	2.4	4.1	7.0
936---------- Coland-Spillville	IIw	75	139	47	83	4.2	3.4	5.7	6.2
976---------- Raddle	I	95	162	54	97	6.8	4.0	6.6	11.4
1537---------- Du Page-Shellwood-Calco	Vw	25	---	---	---	---	0.5	---	6.9
1936---------- Spillville-Hanlon-Coland	Vw	25	---	---	---	---	1.9	---	---
4000***. Urban land									
5010***. Pits, sand and gravel									

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY, CORN SUITABILITY RATING, AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn suitability rating	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		RV*	Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
5030***. Pits, limestone quarry									
5040***. Orthents									
5060***. Pits, clay									

* Relative value: The value for corn suitability rating.

** Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

*** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
41B---------- Sparta	6A	Slight	Slight	Slight	Slight	Moderate	Jack pine----------	57	6	Red pine, eastern white pine, jack pine.
							Northern red oak----	47	2	
							Red pine----------	---	---	
63C---------- Chelsea	5S	Slight	Slight	Moderate	Slight	Moderate	White oak----------	70	5	Eastern white pine, red pine, jack pine.
							Red pine----------	72	9	
							Eastern white pine--	83	13	
							Jack pine----------	70	7	
							Quaking aspen-------	72	6	
110B, 110C--------- Lamont	3A	Slight	Slight	Slight	Slight	Moderate	Northern red oak----	55	3	Eastern white pine.
							White oak----------	55	3	
171, 171B, 171C, 171C2, 171D2------ Bassett	3A	Slight	Slight	Slight	Slight	Slight	White oak----------	55	3	Eastern white pine, red pine, black walnut, sugar maple.
							Northern red oak----	55	3	
194, 194B, 194C3--- Norville	3D	Slight	Slight	Slight	Moderate	Moderate	Northern red oak----	55	3	Eastern white pine, red pine, white spruce, black walnut.
							White oak----------	---	---	
							Green ash----------	---	---	
221B---------- Palms	2W	Slight	Severe	Severe	Severe	Severe	Red maple----------	55	2	Northern whitecedar, tamarack.
							Silver maple--------	80	2	
							White ash----------	---	---	
							Quaking aspen-------	---	---	
							Northern whitecedar-	---	---	
							Tamarack----------	61	4	
							Black ash----------	---	---	
285B, 285C--------- Burkhardt	2S	Slight	Moderate	Slight	Slight	Moderate	Northern pin oak----	52	2	Eastern white pine, jack pine, Norway spruce.
							Jack pine----------	---	---	
285F---------- Burkhardt	2R	Moderate	Moderate	Moderate	Slight	Moderate	Northern pin oak----	52	2	Eastern white pine, jack pine, Norway spruce.
							Jack pine----------	---	---	
303---------- Pinicon	3A	Slight	Slight	Slight	Slight	Moderate	White oak----------	55	3	Eastern white pine, red pine, black walnut, sugar maple.
							Northern red oak----	55	3	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
407B---------- Schley	3W	Slight	Moderate	Slight	Slight	Moderate	White oak----------	55	3	Eastern white pine, red pine, black walnut, sugar maple.
							Northern red oak----	55	3	
412C, 412E---------- Emeline	2D	Slight	Severe	Severe	Severe	Slight	Black oak----------	50	2	Eastern redcedar, eastern white pine, red pine, jack pine, bur oak.
							Bur oak----------	50	2	
							Eastern redcedar----	50	4	
							Shagbark hickory----	50	---	
							Northern red oak----	50	2	
							American elm--------	50	---	
412G---------- Emeline	2R	Moderate	Severe	Severe	Severe	Slight	Black oak----------	50	2	Eastern redcedar, eastern white pine, red pine, jack pine, bur oak.
							Bur oak----------	50	2	
							Eastern redcedar----	50	4	
							Shagbark hickory----	50	---	
							Northern red oak----	50	2	
							American elm--------	50	---	
471, 471B---------- Oran	3A	Slight	Slight	Slight	Slight	Slight	White oak----------	55	3	Eastern white pine, red pine, black walnut, sugar maple.
							Northern red oak----	55	3	
482, 482B, 482C, 482C2---------- Racine	4A	Slight	Slight	Slight	Slight	Severe	American basswood---	68	4	White spruce, eastern white pine, black walnut, green ash.
							Northern red oak----	65	4	
							Black walnut--------	60	---	
							Sugar maple---------	60	3	
491B---------- Renova	4A	Slight	Slight	Slight	Slight	Moderate	American basswood---	69	4	Black walnut, northern red oak, American basswood, silver maple, white oak.
							Black walnut--------	62	---	
							Northern red oak----	69	4	
							Eastern cottonwood--	92	8	
							Eastern white pine--	64	9	
							White oak----------	62	4	
536---------- Hanlon	3A	Slight	Slight	Slight	Slight	Moderate	Northern red oak----	55	3	Eastern white pine, red pine, black walnut, sugar maple, European larch.
							White oak----------	55	3	
551---------- Calamine	2W	Slight	Severe	Severe	Severe	Slight	Silver maple--------	70	2	Silver maple, white ash, cottonwood.
							White ash----------	---	---	
							American elm--------	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
662B---------- Mt. Carroll	5A	Slight	Slight	Slight	Slight	Moderate	Northern red oak----	70	5	Black walnut, eastern white pine, red pine.
							American basswood---	---	---	
							Sugar maple---------	---	---	
713, 713B, 714B, 714C---------- Winneshiek	4D	Slight	Slight	Slight	Moderate	Moderate	Northern red oak----	65	4	Eastern white pine, red pine, black walnut.
							White oak----------	65	4	
725, 726---------- Hayfield	4A	Slight	Slight	Slight	Slight	Severe	Northern red oak----	65	4	Northern red oak, white oak, silver maple, eastern white pine, black walnut, red pine, white spruce, white ash.
							White oak----------	65	4	
							Eastern white pine--	60	8	
761---------- Franklin	4A	Slight	Slight	Slight	Slight	Moderate	White oak----------	65	4	Eastern white pine, white oak, black walnut, sugar maple, northern red oak.
							Northern red oak----	65	4	
771, 771B---------- Waubeek	4A	Slight	Slight	Slight	Slight	Moderate	White oak----------	65	4	Eastern white pine, red pine, black walnut, sugar maple.
							Northern red oak----	65	4	
776C---------- Lilah	3S	Slight	Slight	Severe	Slight	Moderate	Northern red oak----	55	3	Eastern white pine, white oak, eastern redcedar.
777, 777B, 777C---- Wapsie	3A	Slight	Slight	Slight	Slight	Moderate	Northern red oak----	55	3	Eastern white pine, red pine, black walnut, sugar maple.
							White oak----------	55	3	
781B, 781C, 781C2-- Lourdes	3A	Slight	Slight	Slight	Slight	Moderate	White oak----------	55	3	Eastern white pine, red pine, black walnut, sugar maple.
							Northern red oak----	55	3	
782, 782B---------- Donnan	3A	Slight	Slight	Slight	Slight	Moderate	White oak----------	55	3	Eastern white pine, red pine, black walnut, silver maple.
							Northern red oak----	55	3	
784B---------- Riceville	3A	Slight	Slight	Slight	Slight	Moderate	White oak----------	55	3	Eastern white pine, red pine, black walnut, sugar maple.
							Northern red oak----	55	3	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
806B---------- Whalan	8D	Slight	Slight	Slight	Moderate	Moderate	Eastern white pine-- Northern red oak---- White oak---------- Black walnut-------- American basswood--- Black cherry-------- Quaking aspen------- Bitternut hickory--- Paper birch---------	58 79 78 55 65 57 75 69 55	8 6 5 --- 4 2 6 --- 4	Eastern white pine, northern red oak, white oak, silver maple.
1936**: Spillville.										
Hanlon---------- Coland.	3A	Slight	Slight	Slight	Slight	Moderate	Northern red oak---- White oak----------	55 55	3 3	Eastern white pine, red pine, black walnut, sugar maple, European larch.

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
27B---------- Terril	---	Gray dogwood, Siberian peashrub, redosier dogwood, lilac.	Honeylocust, Russian-olive, Amur maple, blue spruce, northern whitecedar, eastern redcedar.	Eastern white pine, green ash.	---
41B---------- Sparta	Manyflower cotoneaster.	Siberian peashrub, Amur maple, lilac, eastern redcedar, American cranberrybush, gray dogwood, silky dogwood.	Norway spruce-----	Red pine, eastern white pine, jack pine.	---
63C---------- Chelsea	Siberian peashrub, lilac.	Eastern redcedar	Red pine, jack pine, Austrian pine.	Eastern white pine	---
83, 83B, 83C, 83C2---------- Kenyon	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern whitecedar, hackberry, blue spruce, eastern redcedar, Russian-olive, Amur maple.	Eastern white pine, green ash.	---
84---------- Clyde	---	Redosier dogwood, American plum.	Hackberry, Amur maple, northern whitecedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
96---------- Turlin	---	Redosier dogwood, lilac.	Northern whitecedar, Amur maple, blue spruce, white spruce.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
110B, 110C-------- Lamont	Lilac----------	Eastern redcedar, Russian-olive, Siberian peashrub.	Eastern white pine, Norway spruce, hackberry, Amur maple, red pine, honeylocust, green ash.	---	---
135---------- Coland	---	Redosier dogwood, cotoneaster, American plum.	White spruce, hackberry, northern whitecedar, tall purple willow, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
151, 152---------- Marshan	---	Common ninebark, redosier dogwood, silky dogwood, nannyberry viburnum, American cranberrybush, northern whitecedar.	Balsam fir, white spruce.	Green ash, white ash, red maple, silver maple.	---
171, 171B, 171C, 171C2, 171D2----- Bassett	---	Redosier dogwood, gray dogwood, Siberian peashrub, lilac.	Russian-olive, eastern redcedar, northern whitecedar, blue spruce, Amur maple, hackberry.	Green ash, eastern white pine.	---
174, 174B, 174B2, 174C2---------- Bolan	Lilac, Russian-olive, Siberian peashrub.	Eastern redcedar, hackberry, Manchurian crabapple.	Honeylocust, green ash, eastern white pine, bur oak.	---	---
175B, 175C-------- Dickinson	Lilac----------	Eastern redcedar, Russian-olive, Siberian peashrub.	Eastern white pine, green ash, Norway spruce, honeylocust, red pine, Amur maple, hackberry.	---	---
177, 177B, 177C--- Saude	Lilac, Siberian peashrub.	Manchurian crabapple, hackberry, eastern redcedar.	Eastern white pine, bur oak, jack pine, green ash, honeylocust, Russian-olive.	---	---
178, 178B--------- Waukee	Lilac, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, hackberry.	Honeylocust, Russian-olive, green ash, bur oak, jack pine, eastern white pine.	---	---
184---------- Klinger	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
194, 194B, 194C3-- Norville	Manyflower cotoneaster.	Eastern redcedar, silky dogwood, Siberian peashrub, lilac, American cranberrybush, Amur maple, gray dogwood.	Norway spruce-----	Eastern white pine, jack pine, red pine.	---
198, 198B--------- Floyd	---	Redosier dogwood, lilac.	Blue spruce, Amur maple, northern whitecedar, white spruce.	Austrian pine, hackberry, green ash, eastern white pine.	Silver maple.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
201B*: Coland	---	Redosier dogwood, cotoneaster, American plum.	White spruce, hackberry, northern whitecedar, tall purple willow, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.
Terril	---	Gray dogwood, Siberian peashrub, redosier dogwood, lilac.	Honeylocust, Russian-olive, Amur maple, blue spruce, northern whitecedar, eastern redcedar.	Eastern white pine, green ash.	---
213, 213B, 214, 214B, 214C--- Rockton	Cotoneaster, lilac	Eastern redcedar, Siberian peashrub.	Eastern white pine, green ash, hackberry, Manchurian crabapple, Russian-olive, jack pine.	Honeylocust, Siberian elm.	---
214C2--- Rockton	Lilac---	Eastern redcedar, Siberian peashrub.	Eastern white pine, green ash, hackberry, Manchurian crabapple, Russian-olive, jack pine.	Honeylocust, Siberian elm.	---
216B, 217B--- Ripon	Manyflower cotoneaster.	Eastern redcedar, lilac, gray dogwood, silky dogwood, Amur maple, American cranberrybush, Siberian peashrub.	Norway spruce---	Eastern white pine, jack pine, red pine.	---
221B--- Palms	---	Silky dogwood, common ninebark, nannyberry viburnum, American cranberrybush.	Northern whitecedar, Black Hills spruce, Manchurian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
225, 226--- Lawler	---	Lilac, redosier dogwood.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Eastern white pine, hackberry, Austrian pine, green ash.	Silver maple.
284, 284B, 284C--- Flagler	Lilac, Siberian peashrub.	Manchurian crabapple, hackberry, eastern redcedar.	Honeylocust, eastern white pine, jack pine, green ash, Russian-olive, bur oak.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
285B, 285C, 285F--Burkhardt	Manyflower cotoneaster.	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
303----------Pinicon	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Austrian pine, eastern white pine, green ash, hackberry.	Silver maple.
377, 377B---------Dinsdale	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern whitecedar, hackberry, blue spruce, Amur maple, eastern redcedar, Russian-olive.	Eastern white pine, green ash.	---
382----------Maxfield	---	Redosier dogwood, American plum.	Hackberry, Amur maple, northern whitecedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
391B*:					
Clyde----------	---	Redosier dogwood, American plum.	Hackberry, Amur maple, northern whitecedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
Floyd----------	---	Redosier dogwood, lilac.	Blue spruce, Amur maple, northern whitecedar, white spruce.	Austrian pine, hackberry, green ash, eastern white pine.	Silver maple.
394, 394B, 394C, 394C2----------Ostrander	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Hackberry, Russian-olive, Amur maple, blue spruce, eastern redcedar, northern whitecedar.	Eastern white pine, green ash.	---
398----------Tripoli	---	Siberian peashrub, lilac, northern whitecedar.	Hackberry, bur oak, eastern redcedar, white spruce.	Golden willow, green ash, honeylocust.	Eastern cottonwood.
399, 399B---------Readlyn	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
407B---------- Schley	---	Redosier dogwood, lilac.	Northern whitecedar, blue spruce, white spruce, Amur maple.	Green ash, Austrian pine, eastern white pine, hackberry.	Silver maple.
408B---------- Olin	Lilac----------	Russian-olive, eastern redcedar, cotoneaster, Siberian peashrub.	Red pine, green ash, Norway spruce, eastern white pine, Amur maple, hackberry, honeylocust.	---	---
444B---------- Jacwin	---	Northern whitecedar, lilac, Siberian peashrub, eastern redcedar.	Russian-olive, hackberry, bur oak, Austrian pine, white spruce.	Green ash, eastern white pine.	---
457---------- Du Page	---	Northern whitecedar, Siberian peashrub, lilac.	Hackberry, bur oak, eastern redcedar, white spruce.	Green ash, golden willow, honeylocust.	Eastern cottonwood.
471, 471B--------- Oran	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Austrian pine, eastern white pine, green ash, hackberry.	Silver maple.
482, 482B--------- Racine	---	Gray dogwood, Amur maple, American cranberrybush, lilac, northern whitecedar.	Black Hills spruce, Norway spruce, white spruce.	Red maple, white ash, red pine, eastern white pine.	---
485---------- Spillville	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
491B---------- Renova	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Hackberry, northern whitecedar, Amur maple, eastern redcedar, Russian-olive, blue spruce.	Eastern white pine, green ash.	---
507---------- Canisteo	---	Siberian peashrub, cotoneaster, lilac, northern whitecedar.	Hackberry, bur oak, white spruce, eastern redcedar.	Golden willow, honeylocust, green ash.	Eastern cottonwood.
535---------- Shellwood	---	Redosier dogwood, lilac.	Amur maple, blue spruce, white spruce, northern whitecedar.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
536---------- Hanlon	---	Redosier dogwood, lilac.	Amur maple, blue spruce, white spruce, northern whitecedar.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
537*: Du Page----------	---	Northern whitecedar, Siberian peashrub, lilac.	Hackberry, bur oak, eastern redcedar, white spruce.	Green ash, golden willow, honeylocust.	Eastern cottonwood.
Calco----------	---	Lilac, Amur honeysuckle, Siberian peashrub, northern whitecedar.	Hackberry, eastern redcedar, bur oak, white spruce.	Honeylocust, golden willow, green ash.	Eastern cottonwood.
551---------- Calamine	---	Northern whitecedar, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood, common ninebark.	White spruce, balsam fir.	Silver maple, white ash, green ash, red maple.	---
559---------- Talcot	Lilac----------	Siberian peashrub	Hackberry, ponderosa pine, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, golden willow, green ash.	Eastern cottonwood.
595---------- Harpster	---	Lilac, Siberian peashrub, northern whitecedar.	Hackberry, white spruce, bur oak, eastern redcedar.	Hackberry, golden willow, green ash.	Eastern cottonwood.
612C2, 612D2------ Mottland	Russian-olive, Siberian peashrub, lilac.	Hackberry, eastern redcedar, Manchurian crabapple.	Eastern white pine, green ash, bur oak, honeylocust.	---	---
616, 616B, 616C2, 616D2---------- Aureola	Lilac----------	Amur honeysuckle, eastern redcedar, Siberian peashrub.	Jack pine, Manchurian crabapple, Russian-olive, green ash, eastern white pine, hackberry.	Siberian elm, honeylocust.	---
631, 631B, 631C--- Limecreek	Gray dogwood, silky dogwood.	Redosier dogwood, American plum.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Silver maple, eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
651--- Faxon	---	Redosier dogwood, American plum.	Hackberry, tall purple willow, northern whitecedar, Amur maple, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
662B--- Mt. Carroll	---	Northern whitecedar, redosier dogwood, Siberian peashrub, lilac, gray dogwood.	Russian-olive, hackberry, eastern redcedar, Amur maple.	Eastern white pine, green ash, red pine.	---
697--- Rocksan	---	Northern whitecedar, lilac, Siberian peashrub.	Hackberry, bur oak, white spruce, eastern redcedar.	Golden willow, honeylocust, green ash.	Eastern cottonwood.
713, 713B, 714B, 714C--- Winneshiek	Lilac---	Eastern redcedar, Siberian peashrub.	Russian-olive, eastern white pine, green ash, Manchurian crabapple, jack pine, hackberry.	Honeylocust, Siberian elm.	---
725, 726--- Hayfield	---	Redosier dogwood, silky dogwood, nannyberry viburnum, American cranberrybush, lilac, northern whitecedar.	White spruce---	Silver maple, red maple, white ash, red pine, eastern white pine.	---
733--- Calco	---	Lilac, Amur honeysuckle, Siberian peashrub, northern whitecedar.	Hackberry, eastern redcedar, bur oak, white spruce.	Honeylocust, golden willow, green ash.	Eastern cottonwood.
761--- Franklin	---	Redosier dogwood, lilac.	White spruce, northern whitecedar, blue spruce, Amur maple.	Austrian pine, eastern white pine, green ash, hackberry.	Silver maple.
771, 771B--- Waubeek	---	Redosier dogwood, lilac, gray dogwood, Siberian peashrub.	Eastern redcedar, northern whitecedar, blue spruce, Amur maple, hackberry, Russian-olive.	Eastern white pine, green ash.	---
776C--- Lilah	Lilac, Siberian peashrub.	Eastern redcedar	Red pine, Austrian pine, jack pine.	Eastern white pine	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
777, 777B, 777C---Wapsie	Lilac, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, hackberry.	Russian-olive, jack pine, green ash, honeylocust, bur oak, eastern white pine.	---	---
781B, 781C, 781C2-Lourdes	---	Redosier dogwood, lilac, gray dogwood, Siberian peashrub.	Eastern redcedar, northern whitecedar, blue spruce, Amur maple, hackberry, Russian-olive.	Green ash, eastern white pine.	---
782, 782B---------Donnan	---	Redosier dogwood, lilac.	Blue spruce, white spruce, northern whitecedar, Amur maple.	Green ash, Austrian pine, eastern white pine, hackberry.	Silver maple.
783B, 783C--------Cresco	---	Redosier dogwood, gray dogwood, Siberian peashrub, lilac.	Northern whitecedar, eastern redcedar, Russian-olive, blue spruce, Amur maple, hackberry.	Green ash, eastern white pine.	---
784B--------------Riceville	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Austrian pine, eastern white pine, hackberry, green ash.	Silver maple.
789---------------Oakton	Lilac, Siberian peashrub, Russian-olive.	Manchurian crabapple, hackberry, eastern redcedar.	Eastern white pine, honeylocust, bur oak, green ash.	---	---
797---------------Jameston	---	Redosier dogwood, American plum.	Tall purple willow, Amur maple, hackberry, northern whitecedar, white spruce.	Green ash, golden willow.	Silver maple, eastern cottonwood.
798B--------------Protivin	Gray dogwood, silky dogwood.	Redosier dogwood, American plum.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Silver maple, eastern cottonwood.
806B--------------Whalan	Cotoneaster, lilac	Eastern redcedar, Siberian peashrub.	Eastern white pine, jack pine, green ash, Manchurian crabapple, hackberry, Russian-olive.	Honeylocust, Siberian elm.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
936*:					
Coland	---	Redosier dogwood, cotoneaster, American plum.	White spruce, hackberry, northern whitecedar, tall purple willow, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.
Spillville	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
976 Raddle	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
1537*:					
Du Page	---	Northern whitecedar, Siberian peashrub, lilac.	Hackberry, bur oak, eastern redcedar, white spruce.	Green ash, golden willow, honeylocust.	Eastern cottonwood.
Shellwood	---	Redosier dogwood, lilac.	Amur maple, blue spruce, white spruce, northern whitecedar.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
Calco	---	Lilac, Amur honeysuckle, Siberian peashrub, northern whitecedar.	Hackberry, eastern redcedar, bur oak, white spruce.	Honeylocust, golden willow, green ash.	Eastern cottonwood.
1936*:					
Spillville	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
Hanlon	---	Redosier dogwood, lilac.	Amur maple, blue spruce, white spruce, northern whitecedar.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
Coland	---	Redosier dogwood, cotoneaster, American plum.	White spruce, hackberry, northern whitecedar, tall purple willow, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
27 Terril	Slight	Slight	Slight	Slight	Slight.
27B Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
41B Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
63C Chelsea	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
83 Kenyon	Slight	Slight	Slight	Slight	Slight.
83B Kenyon	Slight	Slight	Moderate: slope.	Slight	Slight.
83C, 83C2 Kenyon	Slight	Slight	Severe: slope.	Slight	Slight.
84 Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
96 Turlin	Severe: flooding.	Slight	Slight	Slight	Slight.
110B Lamont	Slight	Slight	Moderate: slope.	Slight	Slight.
110C Lamont	Slight	Slight	Severe: slope.	Slight	Slight.
135 Coland	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
151, 152 Marshan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
171 Bassett	Slight	Slight	Slight	Slight	Slight.
171B Bassett	Slight	Slight	Moderate: slope.	Slight	Slight.
171C, 171C2 Bassett	Slight	Slight	Severe: slope.	Slight	Slight.
171D2 Bassett	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
174 Bolan	Slight	Slight	Slight	Slight	Slight.
174B, 174B2 Bolan	Slight	Slight	Moderate: slope.	Slight	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
174C2---- Bolan	Slight	Slight	Severe: slope.	Slight	Slight.
175B---- Dickinson	Slight	Slight	Moderate: slope.	Slight	Slight.
175C---- Dickinson	Slight	Slight	Severe: slope.	Slight	Slight.
177---- Saude	Slight	Slight	Slight	Slight	Slight.
177B---- Saude	Slight	Slight	Moderate: slope.	Slight	Slight.
177C---- Saude	Slight	Slight	Severe: slope.	Slight	Slight.
178---- Waukee	Slight	Slight	Slight	Slight	Slight.
178B---- Waukee	Slight	Slight	Moderate: slope.	Slight	Slight.
184---- Klinger	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
194---- Norville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
194B---- Norville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
194C3---- Norville	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
198---- Floyd	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
198B---- Floyd	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
201B*:					
Coland----	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Terril----	Slight	Slight	Moderate: slope.	Slight	Slight.
213---- Rockton	Slight	Slight	Slight	Slight	Moderate: depth to rock.
213B---- Rockton	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
214---- Rockton	Slight	Slight	Slight	Slight	Moderate: depth to rock.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
214B Rockton	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
214C, 214C2 Rockton	Slight	Slight	Severe: slope.	Slight	Moderate: depth to rock.
216B, 217B Ripon	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight	Moderate: thin layer, area reclaim.
221B Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
225, 226 Lawler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
284 Flagler	Slight	Slight	Slight	Slight	Slight.
284B Flagler	Slight	Slight	Moderate: slope.	Slight	Slight.
284C Flagler	Slight	Slight	Severe: slope.	Slight	Slight.
285B Burkhardt	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
285C Burkhardt	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
285F Burkhardt	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
303 Pinicon	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
377 Dinsdale	Slight	Slight	Slight	Slight	Slight.
377B Dinsdale	Slight	Slight	Moderate: slope.	Slight	Slight.
382 Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
391B*: Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Floyd	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
394 Ostrander	Slight	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
394B---------- Ostrander	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
394C, 394C2---------- Ostrander	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
398---------- Tripoli	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
399---------- Readlyn	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
399B---------- Readlyn	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
407B---------- Schley	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
408B---------- Olin	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
412C---------- Emeline	Severe: percs slowly, depth to rock.	Severe: percs slowly, depth to rock.	Severe: depth to rock, percs slowly.	Slight----------	Severe: depth to rock.
412E---------- Emeline	Severe: percs slowly, depth to rock.	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock, percs slowly.	Slight----------	Severe: depth to rock.
412G---------- Emeline	Severe: slope, percs slowly, depth to rock.	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock, percs slowly.	Severe: slope.	Severe: slope, depth to rock.
444B---------- Jacwin	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight----------	Moderate: depth to rock.
457---------- Du Page	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
471---------- Oran	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
471B---------- Oran	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
482---------- Racine	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
482B---------- Racine	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
482C, 482C2---------- Racine	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
485---------- Spillville	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
491B Renova	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
507 Canisteo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
535 Shellwood	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
536 Hanlon	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
537*: Du Page	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Calco	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
551 Calamine	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
559 Talcot	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
595 Harpster	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
612C2 Mottland	Slight	Slight	Severe: slope.	Slight	Slight.
612D2 Mottland	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
616 Aureola	Slight	Slight	Slight	Slight	Slight.
616B Aureola	Slight	Slight	Moderate: slope.	Slight	Slight.
616C2 Aureola	Slight	Slight	Severe: slope.	Slight	Slight.
616D2 Aureola	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
631 Limecreek	Slight	Slight	Slight	Slight	Slight.
631B Limecreek	Slight	Slight	Moderate: slope.	Slight	Slight.
631C Limecreek	Slight	Slight	Severe: slope.	Slight	Slight.
651 Faxon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
662B---------- Mt. Carroll	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
697---------- Rocksan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
713, 713B, 714B------- Winneshiek	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight----------	Moderate: depth to rock.
714C---------- Winneshiek	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight----------	Moderate: depth to rock.
725, 726---------- Hayfield	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
733---------- Calco	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
761---------- Franklin	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
771---------- Waubeek	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
771B---------- Waubeek	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
776C---------- Lilah	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: droughty.
777---------- Wapsie	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
777B---------- Wapsie	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
777C---------- Wapsie	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
781B---------- Lourdes	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
781C, 781C2---------- Lourdes	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight.
782, 782B---------- Donnan	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight----------	Slight.
783B---------- Cresco	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
783C---------- Cresco	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight.
784B---------- Riceville	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight----------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
789---------- Oakton	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
797---------- Jameston	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
798B---------- Protivin	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight----------	Slight.
806B---------- Whalan	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Slight----------	Moderate: depth to rock.
936*:					
Coland----------	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Spillville----------	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
976---------- Raddle	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
1537*:					
Du Page----------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Shellwood----------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Calco----------	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
1936*:					
Spillville----------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Hanlon----------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Coland----------	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
27, 27B---------- Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
41B---------- Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
63C---------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
83, 83B---------- Kenyon	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
83C, 83C2---------- Kenyon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
84---------- Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
96---------- Turlin	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
110B---------- Lamont	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
110C---------- Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
135---------- Coland	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
151, 152---------- Marshan	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
171, 171B---------- Bassett	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
171C, 171C2, 171D2- Bassett	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
174, 174B, 174B2--- Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
174C2---------- Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
175B---------- Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
175C---------- Dickinson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
177, 177B---------- Saude	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
177C---------- Saude	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
178, 178B---------- Waukee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
184---------- Klinger	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
194, 194B, 194C3--- Norville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
198, 198B---------- Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
201B*:										
Coland----------	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
Terril----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
213, 213B, 214, 214B, 214C-------- Rockton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
214C2---------- Rockton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
216B, 217B--------- Ripon	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
221B---------- Palms	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
225, 226---------- Lawler	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
284, 284B---------- Flagler	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
284C---------- Flagler	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
285B, 285C--------- Burkhardt	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
285F---------- Burkhardt	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
303---------- Pinicon	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
377, 377B---------- Dinsdale	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
382---------- Maxfield	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
391B*:										
Clyde----------	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
Floyd----------	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
394, 394B---------- Ostrander	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
394C, 394C2-------- Ostrander	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
398---------- Tripoli	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
399, 399B---------- Readlyn	Good	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
407B---------- Schley	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
408B---------- Olin	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
412C, 412E, 412G--- Emeline	Very poor.	Very poor.	Poor	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.
444B---------- Jacwin	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
457---------- Du Page	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
471, 471B---------- Oran	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
482, 482B---------- Racine	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
482C, 482C2-------- Racine	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
485---------- Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
491B---------- Renova	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
507---------- Canisteo	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
535---------- Shellwood	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
536---------- Hanlon	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
537*:										
Du Page----------	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
Calco----------	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair.
551---------- Calamine	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
559---- Talcot	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
595---- Harpster	Fair	Fair	Good	Fair	Fair	Good	Fair	Fair	Fair	Fair.
612C2, 612D2---- Mottland	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Very poor.	Very poor.
616, 616B, 616C2, 616D2---- Aureola	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
631, 631B---- Limecreek	Good	Fair	Good	Good	Fair	Fair	Poor	Good	Good	Fair.
631C---- Limecreek	Fair	Fair	Fair	Good	Fair	Fair	Poor	Good	Good	Fair.
651---- Faxon	Fair	Fair	Fair	Poor	Poor	Good	Fair	Fair	Poor	Fair.
662B---- Mt. Carroll	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
697---- Rocksan	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
713, 713B, 714B---- Winneshiek	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
714C---- Winneshiek	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
725, 726---- Hayfield	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
733---- Calco	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair.
761---- Franklin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
771, 771B---- Waubeek	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
776C---- Lilah	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
777, 777B---- Wapsie	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
777C---- Wapsie	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
781B---- Lourdes	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
781C, 781C2---- Lourdes	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
782, 782B---------- Donnan	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
783B---------- Cresco	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
783C---------- Cresco	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Fair.
784B---------- Riceville	Good	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
789---------- Oakton	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
797---------- Jameston	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Poor	Good.
798B---------- Protivin	Good	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
806B---------- Whalan	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
936*:										
Coland----------	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
Spillville--------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
976---------- Raddle	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1537*:										
Du Page----------	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
Shellwood---------	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
Calco----------	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair.
1936*:										
Spillville--------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Hanlon----------	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
Coland----------	Poor	Fair	Fair	Poor	Poor	Good	Good	Poor	Poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
27, 27B---------- Terril	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
41B---------- Sparta	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
63C---------- Chelsea	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
83, 83B---------- Kenyon	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
83C, 83C2--------- Kenyon	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
84---------- Clyde	Severe: excess humus, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
96---------- Turlin	Severe: cutbanks cave, excess humus.	Severe: flooding, low strength.	Severe: flooding.	Severe: flooding, low strength.	Moderate: low strength, flooding, frost action.	Slight.
110B---------- Lamont	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
110C---------- Lamont	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
135---------- Coland	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
151, 152---------- Marshan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
171, 171B--------- Bassett	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
171C, 171C2------- Bassett	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
171D2---------- Bassett	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
174, 174B, 174B2-- Bolan	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
174C2---------- Bolan	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
175B---------- Dickinson	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
175C---------- Dickinson	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
177, 177B--------- Saude	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
177C---------- Saude	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
178, 178B--------- Waukee	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
184---------- Klinger	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
194, 194B--------- Norville	Moderate: too clayey.	Slight---------	Moderate: shrink-swell.	Slight---------	Severe: low strength, frost action.	Slight.
194C3---------- Norville	Moderate: too clayey.	Slight---------	Moderate: shrink-swell.	Moderate: slope.	Severe: low strength, frost action.	Slight.
198, 198B--------- Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: frost action.	Slight.
201B*: Coland----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Terril----------	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
213, 213B, 214, 214B---------- Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: depth to rock.
214C, 214C2------- Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Moderate: depth to rock.
216B, 217B-------- Ripon	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength, frost action.	Moderate: thin layer, area reclaim.
221B---------- Palms	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
225, 226---------- Lawler	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
284, 284B--------- Flagler	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
284C---------- Flagler	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
285B---------- Burkhardt	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
285C---------- Burkhardt	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
285F---------- Burkhardt	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
303---------- Pinicon	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.	Moderate: wetness.
377, 377B--------- Dinsdale	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
382---------- Maxfield	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
391B*:						
Clyde----------	Severe: excess humus, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Floyd----------	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: frost action.	Slight.
394, 394B--------- Ostrander	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
394C, 394C2------- Ostrander	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
398---------- Tripoli	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
399, 399B--------- Readlyn	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
407B---------- Schley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
408B---------- Olin	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
412C---------- Emeline	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
412E---------- Emeline	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.
412G---------- Emeline	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
444B---------- Jacwin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: depth to rock.
457---------- Du Page	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
471, 471B--------- Oran	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
482, 482B--------- Racine	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
482C, 482C2------- Racine	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
485---------- Spillville	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
491B---------- Renova	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
507---------- Canisteo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
535---------- Shellwood	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
536---------- Hanlon	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
537*: Du Page----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Calco----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
551---------- Calamine	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
559---------- Talcot	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
595---------- Harpster	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
612C2---------- Mottland	Moderate: dense layer, large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: large stones.	Moderate: large stones, droughty.
612D2---------- Mottland	Moderate: dense layer, large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, large stones.	Moderate: large stones, droughty, slope.
616, 616B--------- Aureola	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
616C2---------- Aureola	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
616D2---------- Aureola	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
631, 631B--------- Limecreek	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
631C---------- Limecreek	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
651---------- Faxon	Severe: depth to rock, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, depth to rock.	Severe: flooding, wetness.	Severe: wetness, frost action.	Severe: wetness.
662B---------- Mt. Carroll	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength, frost action.	Slight.
697---------- Rocksan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
713, 713B, 714B--- Winneshiek	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, low strength.	Moderate: depth to rock.
714C---------- Winneshiek	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, low strength.	Moderate: depth to rock.
725, 726---------- Hayfield	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Severe: frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
733--- Calco	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
761--- Franklin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
771, 771B--- Waubeek	Slight---	Moderate: shrink-swell.	Slight---	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
776C--- Lilah	Severe: cutbanks cave.	Slight---	Slight---	Moderate: slope.	Slight---	Moderate: droughty.
777, 777B--- Wapsie	Severe: cutbanks cave.	Slight---	Slight---	Slight---	Slight---	Slight.
777C--- Wapsie	Severe: cutbanks cave.	Slight---	Slight---	Moderate: slope.	Slight---	Slight.
781B--- Lourdes	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
781C, 781C2--- Lourdes	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
782, 782B--- Donnan	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
783B--- Cresco	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: frost action.	Slight.
783C--- Cresco	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: frost action.	Slight.
784B--- Riceville	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
789--- Oakton	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Slight.
797--- Jameston	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
798B--- Protivin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
806B---------- Whalan	Moderate: depth to rock, too clayey.	Slight---------	Moderate: depth to rock.	Slight---------	Severe: low strength.	Moderate: depth to rock.
936*: Coland----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Spillville-------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
976---------- Raddle	Slight---------	Slight---------	Slight---------	Slight---------	Severe: frost action.	Slight.
1537*: Du Page----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Shellwood--------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Calco----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, flooding.
1936*: Spillville-------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Hanlon----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Coland----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
4000*. Urban land						
5010*. Pits, sand and gravel						
5030*. Pits, limestone quarry						
5040*. Orthents						
5060*. Pits, clay						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
27---------- Terril	Slight----------	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
27B---------- Terril	Slight----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
41B---------- Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
63C---------- Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
83---------- Kenyon	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
83B---------- Kenyon	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
83C, 83C2---------- Kenyon	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
84---------- Clyde	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
96---------- Turlin	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: hard to pack.
110B---------- Lamont	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
110C---------- Lamont	Slight----------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
135---------- Coland	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
151, 152---------- Marshan	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
171---------- Bassett	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
171B---------- Bassett	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
171C, 171C2--------- Bassett	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
171D2--------- Bassett	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
174, 174B, 174B2---- Bolan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
174C2--------- Bolan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175B--------- Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175C--------- Dickinson	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
177, 177B---------- Saude	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
177C--------- Saude	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
178, 178B---------- Waukee	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
184--------- Klinger	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
194, 194B---------- Norville	Severe: percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Slight----------	Poor: too clayey, hard to pack.
194C3--------- Norville	Severe: percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Slight----------	Poor: too clayey, hard to pack.
198, 198B---------- Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
201B*: Coland----------	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
201B*: Terril	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
213, 213B, 214, 214B---- Rockton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
214C, 214C2---- Rockton	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
216B, 217B---- Ripon	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
221B---- Palms	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
225, 226---- Lawler	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
284, 284B---- Flagler	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
284C---- Flagler	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
285B---- Burkhardt	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
285C---- Burkhardt	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
285F---- Burkhardt	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
303---- Pinicon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
377---- Dinsdale	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
377B---- Dinsdale	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
382 Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
391B*: Clyde	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
394 Ostrander	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: small stones.
394B Ostrander	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.
394C, 394C2 Ostrander	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Fair: small stones.
398 Tripoli	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
399, 399B Readlyn	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
407B Schley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
408B Olin	Slight	Severe: seepage.	Slight	Severe: seepage.	Good.
412C Emeline	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
412E Emeline	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
412G Emeline	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
444B Jacwin	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, wetness.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
457 Du Page	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding.	Good.
471, 471B Oran	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
482 Racine	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
482B Racine	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
482C, 482C2 Racine	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
485 Spillville	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: wetness.
491B Renova	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
507 Canisteo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
535 Shellwood	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
536 Hanlon	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
537*:					
Du Page	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding.	Good.
Calco	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
551 Calamine	Severe: ponding, percs slowly.	Severe: ponding.	Severe: seepage, ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
559 Talcot	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
595 Harpster	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
612C2 Mottland	Moderate: percs slowly.	Severe: slope.	Severe: seepage.	Moderate: slope.	Moderate: slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
612D2---------- Mottland	Moderate: slope, percs slowly.	Severe: slope.	Severe: seepage.	Severe: slope.	Poor: slope.
616, 616B---------- Aureola	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
616C2, 616D2-------- Aureola	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
631---------- Limecreek	Moderate: wetness, percs slowly.	Moderate: seepage, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
631B---------- Limecreek	Moderate: wetness, percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
631C---------- Limecreek	Moderate: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
651---------- Faxon	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Poor: depth to rock, wetness.
662B---------- Mt. Carroll	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
697---------- Rocksan	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: seepage, wetness.
713, 713B, 714B----- Winneshiek	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
714C---------- Winneshiek	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
725, 726---------- Hayfield	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
733---------- Calco	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
761---------- Franklin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
771---------- Waubeek	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
771B---------- Waubeek	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
776C---------- Lilah	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
777, 777B---------- Wapsie	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
777C---------- Wapsie	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
781B---------- Lourdes	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight----------	Fair: too clayey, wetness.
781C, 781C2--------- Lourdes	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, too clayey.	Slight----------	Fair: too clayey, wetness.
782---------- Donnan	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
782B---------- Donnan	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
783B---------- Cresco	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight----------	Fair: too clayey, wetness.
783C---------- Cresco	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, too clayey.	Slight----------	Fair: too clayey, wetness.
784B---------- Riceville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
789---------- Oakton	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
797---------- Jameston	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
798B---------- Protivin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
806B---------- Whalan	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
936*:					
Coland	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
Spillville	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: wetness.
976 Raddle	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
1537*:					
Du Page	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding.	Good.
Shellwood	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
Calco	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
1936*:					
Spillville	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: wetness.
Hanlon	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
Coland	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
4000*. Urban land					
5010*. Pits, sand and gravel					
5030*. Pits, limestone quarry					
5040*. Orthents					
5060*. Pits, clay					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
27, 27B Terril	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
41B Sparta	Good	Probable	Improbable: too sandy.	Poor: too sandy.
63C Chelsea	Good	Probable	Improbable: too sandy.	Poor: too sandy.
83, 83B, 83C Kenyon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
83C2 Kenyon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
84 Clyde	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
96 Turlin	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
110B, 110C Lamont	Good	Probable	Improbable: too sandy.	Fair: too clayey.
135 Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
151, 152 Marshan	Poor: wetness.	Probable	Probable	Poor: area reclaim, wetness.
171, 171B, 171C, 171C2 Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
171D2 Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
174, 174B, 174B2, 174C2 Bolan	Good	Probable	Improbable: too sandy.	Fair: thin layer.
175B, 175C Dickinson	Good	Probable	Improbable: too sandy.	Fair: thin layer.
177, 177B, 177C Saude	Good	Probable	Probable	Poor: small stones, area reclaim.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
178, 178B Waukee	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
184 Klinger	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
194, 194B, 194C3 Norville	Good	Probable	Improbable: too sandy.	Fair: too clayey, thin layer.
198, 198B Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
201B*: Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Terril	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
213, 213B, 214, 214B, 214C, 214C2 Rockton	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
216B, 217B Ripon	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, thin layer.
221B Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
225, 226 Lawler	Fair: wetness.	Probable	Probable	Poor: area reclaim.
284, 284B, 284C Flagler	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
285B, 285C Burkhardt	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
285F Burkhardt	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
303 Pinicon	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
377, 377B---------- Dinsdale	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
382---------- Maxfield	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
391B*:				
Clyde----------	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Floyd----------	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
394, 394B, 394C, 394C2---------- Ostrander	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
398---------- Tripoli	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
399, 399B---------- Readlyn	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
407B---------- Schley	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
408B---------- Olin	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
412C, 412E---------- Emeline	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
412G---------- Emeline	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
444B---------- Jacwin	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, thin layer.
457---------- Du Page	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
471, 471B---------- Oran	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
482, 482B, 482C, 482C2---------- Racine	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
485---------- Spillville	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
491B Renova	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
507 Canisteo	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
535 Shellwood	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
536 Hanlon	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
537*: Du Page	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Calco	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
551 Calamine	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
559 Talcot	Fair: wetness.	Probable	Probable	Fair: small stones, area reclaim, thin layer.
595 Harpster	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
612C2, 612D2 Mottland	Good	Probable	Probable	Fair: area reclaim, small stones.
616, 616B, 616C2 Aureola	Good	Probable	Improbable: too sandy.	Good.
616D2 Aureola	Good	Probable	Improbable: too sandy.	Fair: slope.
631, 631B, 631C Limecreek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
651 Faxon	Poor: depth to rock, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
662B Mt. Carroll	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
697 Rocksan	Fair: thin layer, wetness.	Improbable: thin layer.	Improbable: too sandy.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
713, 713B, 714B, 714C-- Winneshiek	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
725, 726---------- Hayfield	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: area reclaim.
733---------- Calco	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
761---------- Franklin	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
771, 771B---------- Waubeek	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
776C---------- Lilah	Good----------	Probable----------	Probable----------	Poor: too sandy, small stones, area reclaim.
777, 777B, 777C------- Wapsie	Good----------	Probable----------	Probable----------	Fair: too clayey, small stones, area reclaim.
781B, 781C---------- Lourdes	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
781C2---------- Lourdes	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
782, 782B---------- Donnan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
783B, 783C---------- Cresco	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
784B---------- Riceville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
789---------- Oakton	Fair: wetness.	Probable----------	Improbable: too sandy.	Fair: thin layer.
797---------- Jameston	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
798B---------- Protivin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
806B---------- Whalan	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
936*:				
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
976 Raddle	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1537*:				
Du Page	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Shellwood	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Calco	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1936*:				
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Hanlon	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
4000*. Urban land				
5010*. Pits, sand and gravel				
5030*. Pits, limestone quarry				
5040*. Orthents				
5060*. Pits, clay				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
27---------- Terril	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
27B---------- Terril	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
41B---------- Sparta	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
63C---------- Chelsea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
83---------- Kenyon	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
83B, 83C, 83C2---- Kenyon	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
84---------- Clyde	Severe: seepage.	Severe: thin layer, wetness.	Moderate: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
96---------- Turlin	Severe: seepage.	Severe: piping, excess humus.	Severe: cutbanks cave.	Deep to water	Favorable------	Favorable.
110B, 110C-------- Lamont	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
135---------- Coland	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
151, 152---------- Marshan	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Wetness.
171---------- Bassett	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
171B, 171C, 171C2- Bassett	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
171D2---------- Bassett	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope----------	Slope.
174, 174B, 174B2, 174C2---------- Bolan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy------	Favorable.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
175B, 175C-------- Dickinson	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
177, 177B, 177C--- Saude	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Rooting depth.
178, 178B--------- Waukee	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Rooting depth.
184--------------- Klinger	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action---	Erodes easily, wetness.	Erodes easily, rooting depth.
194, 194B, 194C3-- Norville	Severe: seepage.	Severe: hard to pack.	Severe: no water.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
198, 198B--------- Floyd	Severe: seepage.	Moderate: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness--------	Favorable.
201B*: Coland-----------	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
Terril-----------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
213--------------- Rockton	Moderate: seepage, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
213B-------------- Rockton	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
214--------------- Rockton	Moderate: seepage, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
214B, 214C, 214C2- Rockton	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
216B, 217B-------- Ripon	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, area reclaim.	Erodes easily, depth to rock.
221B-------------- Palms	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily, rooting depth.
225, 226---------- Lawler	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Rooting depth.
284, 284B, 284C--- Flagler	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Rooting depth.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
285B, 285C--------- Burkhardt	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty, rooting depth.
285F--------------- Burkhardt	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
303---------------- Pinicon	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness---------	Favorable.
377---------------- Dinsdale	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.
377B--------------- Dinsdale	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.
382---------------- Maxfield	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness---------	Wetness, rooting depth.
391B*: Clyde-----------	Severe: seepage.	Severe: thin layer, wetness.	Moderate: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
Floyd------------	Severe: seepage.	Moderate: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness---------	Favorable.
394---------------- Ostrander	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
394B, 394C, 394C2- Ostrander	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
398---------------- Tripoli	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness---------	Wetness, rooting depth.
399---------------- Readlyn	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action---	Wetness---------	Favorable.
399B--------------- Readlyn	Moderate: seepage, slope.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Wetness---------	Favorable.
407B--------------- Schley	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness---------	Wetness, rooting depth.
408B--------------- Olin	Severe: seepage.	Slight----------	Severe: no water.	Deep to water	Erodes easily, soil blowing.	Erodes easily.
412C--------------- Emeline	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock, percs slowly.
412E, 412G--------- Emeline	Severe: depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
444B---------- Jacwin	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping, wetness.	Severe: no water.	Percs slowly, depth to rock, frost action.	Depth to rock, wetness.	Depth to rock, percs slowly.
457---------- Du Page	Severe: seepage.	Moderate: thin layer, piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
471---------- Oran	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action---	Wetness--------	Favorable.
471B---------- Oran	Moderate: seepage, slope.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Wetness--------	Favorable.
482---------- Racine	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
482B, 482C, 482C2- Racine	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
485---------- Spillville	Severe: seepage.	Moderate: thin layer, piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
491B---------- Renova	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
507---------- Canisteo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness--------	Wetness.
535---------- Shellwood	Severe: seepage.	Moderate: wetness.	Severe: cutbanks cave.	Deep to water	Soil blowing---	Favorable.
536---------- Hanlon	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Soil blowing---	Favorable.
537*:						
Du Page----------	Severe: seepage.	Moderate: thin layer, piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
Calco----------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
551---------- Calamine	Moderate: seepage.	Severe: ponding, thin layer.	Severe: no water.	Ponding, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily.
559---------- Talcot	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Wetness.
595---------- Harpster	Moderate: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding--------	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
612C2--Mottland	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
612D2--Mottland	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope.
616, 616B--Aureola	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable	Favorable.
616C2--Aureola	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing	Favorable.
616D2--Aureola	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
631--Limecreek	Moderate: seepage.	Moderate: piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable	Favorable.
631B, 631C--Limecreek	Moderate: seepage, slope.	Moderate: piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable	Favorable.
651--Faxon	Moderate: seepage, depth to rock.	Severe: piping, wetness.	Severe: depth to rock.	Depth to rock, frost action.	Depth to rock, wetness.	Wetness, depth to rock.
662B--Mt. Carroll	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
697--Rocksan	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness.
713--Winneshiek	Moderate: seepage, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock, percs slowly.
713B, 714B, 714C--Winneshiek	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock, percs slowly.
725, 726--Hayfield	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Favorable.
733--Calco	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
761--Franklin	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Frost action	Erodes easily, wetness.	Erodes easily, rooting depth.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
771---------- Waubeek	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.
771B---------- Waubeek	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.
776C---------- Lilah	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty, rooting depth.
777, 777B, 777C--- Wapsie	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Rooting depth.
781B, 781C, 781C2- Lourdes	Moderate: slope.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
782---------- Donnan	Moderate: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly.
782B---------- Donnan	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly.	Percs slowly.
783B, 783C-------- Cresco	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
784B---------- Riceville	Slight---------	Moderate: wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Erodes easily, rooting depth.
789---------- Oakton	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, too sandy.	Favorable.
797---------- Jameston	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
798B---------- Protivin	Slight---------	Moderate: wetness.	Severe: slow refill.	Frost action---	Erodes easily, wetness.	Erodes easily.
806B---------- Whalan	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock, percs slowly.
936*: Coland----------	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
Spillville-------	Severe: seepage.	Moderate: thin layer, piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
976---------- Raddle	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
1537*:						
Du Page	Severe: seepage.	Moderate: thin layer, piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable	Favorable.
Shellwood	Severe: seepage.	Moderate: wetness.	Severe: cutbanks cave.	Deep to water	Soil blowing	Favorable.
Calco	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
1936*:						
Spillville	Severe: seepage.	Moderate: thin layer, piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable	Favorable.
Hanlon	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Soil blowing	Favorable.
Coland	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness	Wetness.
4000*. Urban land						
5010*. Pits, sand and gravel						
5030*. Pits, limestone quarry						
5040*. Orthents						
5060*. Pits, clay						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
27, 27B----------	0-15	Loam----------	CL	A-6	0-5	95-100	95-100	70-90	60-80	30-40	10-20
Terril	15-31	Loam, clay loam	CL, CL-ML	A-6, A-7	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	31-60	Clay loam, loam, sandy loam.	CL, SC, SC-SM, CL-ML	A-6, A-4	0-5	95-100	90-100	65-95	35-85	20-40	5-20
41B----------	0-18	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
Sparta	18-36	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
	36-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
63C----------	0-3	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
Chelsea	3-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
83, 83B, 83C, 83C2----------	0-13	Loam----------	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
Kenyon	13-45	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	45-60	Loam----------	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	10-20
84----------	0-21	Silty clay loam	OL, MH, ML, OH	A-7	0-5	95-100	95-100	80-90	55-75	45-60	15-25
Clyde	21-35	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	10-20
	35-39	Sandy loam, loam, sandy clay loam.	SM, SC-SM	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	39-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	10-20
96----------	0-36	Loam----------	OL, ML, CL	A-4, A-6	0	100	100	95-100	60-70	30-40	5-15
Turlin	36-40	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	55-70	25-35	5-15
	40-60	Loam, sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	95-100	90-100	85-95	15-40	15-30	2-10
110B, 110C-------	0-5	Fine sandy loam	SC-SM, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
Lamont	5-45	Fine sandy loam, loamy fine sand.	SM, SC-SM	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	45-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
135----------	0-33	Clay loam--------	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
Coland	33-49	Clay loam, silty clay loam.	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	49-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
151----------	0-21	Clay loam--------	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
Marshan	21-25	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	25-28	Loam, sandy loam	CL, CL-ML, SC, SC-SM	A-6, A-4	0	95-100	75-100	70-90	45-75	25-40	5-15
	28-60	Coarse sand, gravelly coarse sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
152---------- Marshan	0-21	Clay loam--------	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	35-50	15-25
	21-32	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	32-36	Loam, sandy loam	CL, CL-ML, SC, SC-SM	A-6, A-4	0	95-100	75-100	70-90	45-75	25-40	5-15
	36-60	Coarse sand, gravelly coarse sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
171, 171B, 171C, 171C2, 171D2---- Bassett	0-11	Loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	11-45	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
	45-60	Loam----------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
174, 174B-------- Bolan	0-19	Loam----------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	19-33	Loam, fine sandy loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	33-60	Fine sandy loam	SM, SC-SM, SC	A-4	0	100	100	80-90	35-50	15-25	2-8
174B2, 174C2----- Bolan	0-19	Loam----------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	19-33	Loam, fine sandy loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	33-43	Fine sandy loam	SM, SC-SM, SC	A-4	0	100	100	80-90	35-50	15-25	2-8
	43-60	Loamy fine sand, fine sand.	SM, SP-SM	A-2	0	100	100	70-85	10-30	---	NP
175B, 175C------- Dickinson	0-18	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	18-30	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	100	100	85-95	35-50	15-30	NP-10
	30-38	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SC-SM	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
	38-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
177, 177B, 177C-- Saude	0-17	Loam----------	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	17-28	Loam, sandy loam, gravelly sandy loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0-5	85-95	65-95	60-85	45-60	20-30	5-15
	28-60	Loamy sand, gravelly coarse sand, sand.	SW, SM, GP, GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
178, 178B-------- Waukee	0-19	Loam----------	CL	A-6	0	100	90-100	70-90	50-75	30-40	10-20
	19-36	Loam, sandy clay loam.	CL, SC-SM, SC, CL-ML	A-6, A-4	0-5	85-95	80-95	65-85	40-60	20-35	5-15
	36-60	Gravelly sand, loamy coarse sand, sand.	SW, SM, SP-SM, SP	A-1	0-10	60-90	60-85	20-40	3-25	---	NP
184---------- Klinger	0-18	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	18-28	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	28-60	Loam, clay loam	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
194, 194B-------- Norville	0-16	Silty clay loam	CL	A-6	0	100	100	100	80-95	30-40	15-25
	16-28	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	80-95	35-45	15-25
	28-50	Silty clay--------	CL, CH	A-7	0	100	100	100	90-100	45-70	25-45
	50-60	Loam----------	SM, SP-SM, SC-SM	A-2-4, A-3	0	100	95-100	50-80	5-20	<20	NP-5
194C3------------ Norville	0-9	Silt loam--------	CL	A-6	0	100	100	100	80-95	30-40	15-25
	9-50	Silty clay--------	CL, CH	A-7	0	100	100	100	90-100	45-70	25-45
	50-60	Loam----------	SM, SP-SM, SC-SM	A-2-4, A-3	0	100	95-100	50-80	5-20	<20	NP-5
198, 198B-------- Floyd	0-20	Loam----------	OL, ML, CL	A-4, A-6	0	100	100	80-90	55-75	30-40	5-15
	20-32	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	32-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
201B*: Coland----------	0-33	Clay loam--------	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	33-49	Clay loam, silty clay loam.	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	49-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
Terril----------	0-20	Loam----------	CL	A-6	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	20-31	Loam, clay loam	CL, CL-ML	A-6, A-7	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	31-60	Clay loam, loam, sandy loam.	CL, SC, SC-SM, CL-ML	A-6, A-4	0-5	95-100	90-100	65-95	35-85	20-40	5-20
213, 213B-------- Rockton	0-15	Loam----------	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	15-26	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	26-31	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
214, 214B, 214C, 214C2---------- Rockton	0-15	Loam----------	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	15-21	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	21-24	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	24-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
216B------------- Ripon	0-13	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	90-100	85-100	20-30	3-10
	13-24	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-100	30-45	10-25
	24-27	Clay loam, sandy clay loam, loam.	SC, CL	A-6, A-7	0-3	90-100	90-100	75-100	35-80	30-50	10-25
	27-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
217B---------- Ripon	0-15	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	90-100	85-100	20-30	3-10
	15-31	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-100	30-45	10-25
	31-37	Clay loam, sandy clay loam, loam.	SC, CL	A-6, A-7	0-3	90-100	90-100	75-100	35-80	30-50	10-25
	37-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
221B---------- Palms	0-43	Muck----------	PT	A-8	0	---	---	---	---	---	---
	43-60	Clay loam, silty clay loam, gravelly sandy loam.	CL-ML, CL, SC, SC-SM	A-4, A-6, A-7, A-2	0	85-100	60-100	35-95	15-90	20-45	5-20
225---------- Lawler	0-17	Loam----------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	17-29	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	29-60	Gravelly coarse sand, gravelly loamy sand, loamy coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
226---------- Lawler	0-19	Loam----------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	19-38	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	38-60	Gravelly coarse sand, gravelly loamy sand, loamy coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
284, 284B, 284C-- Flagler	0-18	Sandy loam-------	SC, SC-SM	A-2, A-4	0	95-100	90-95	60-70	25-40	15-25	5-10
	18-31	Sandy loam-------	SC, SC-SM	A-2, A-4	0	95-100	90-95	50-70	25-40	15-25	5-10
	31-60	Loamy sand, gravelly sand, sand.	SP-SM, SW, SP, SW-SM	A-1	0-5	70-90	70-85	20-40	3-12	---	NP
285B, 285C, 285F- Burkhardt	0-8	Sandy loam-------	SM, SC-SM	A-2, A-4	0	95-100	90-100	55-70	25-40	<26	2-7
	8-20	Sandy loam, loam	SM, ML, SC, CL	A-2, A-4	0	95-100	85-100	50-95	25-75	15-30	2-10
	20-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1	0	50-85	45-85	20-35	1-5	---	NP
303---------- Pinicon	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-35	5-15
	12-43	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	10-20
	43-60	Loam----------	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	10-20
377, 377B-------- Dinsdale	0-18	Silty clay loam	ML, CL	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	18-29	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	29-60	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
382---------- Maxfield	0-19	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	19-28	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	28-60	Loam----------	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
391B*:											
Clyde	0-21	Silty clay loam	OL, MH, ML, OH	A-7	0-5	95-100	95-100	80-90	55-75	45-60	15-25
	21-35	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	10-20
	35-39	Sandy loam, loam, sandy clay loam.	SM, SC-SM	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	39-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	10-20
Floyd	0-20	Loam	OL, ML, CL	A-4, A-6	0	100	100	80-90	55-75	30-40	5-15
	20-34	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	34-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
394, 394B, 394C, 394C2	0-16	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	90-95	70-90	25-40	5-15
Ostrander	16-38	Loam, silt loam	CL, CL-ML	A-4, A-6	0-1	95-100	95-100	90-95	70-90	25-40	5-15
	38-44	Loam, sandy clay loam, sandy loam.	CL, SC	A-6	2-5	95-100	75-100	65-90	45-65	25-35	10-15
	44-60	Loam	CL	A-6	1-5	95-100	90-100	80-95	50-75	25-40	10-20
398	0-11	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	65-85	35-45	15-25
Tripoli	11-38	Clay loam, loam	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	11-20
	38-60	Loam, sandy clay loam, clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	11-20
399	0-10	Loam	CL	A-6	0	100	100	85-95	55-75	30-40	15-25
Readlyn	10-36	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	10-20
	36-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	25-35	10-20
399B	0-17	Loam	CL	A-6	0	100	100	85-95	55-75	30-40	15-25
Readlyn	17-36	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	10-20
	36-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	25-35	10-20
407B	0-13	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	80-90	55-75	25-40	5-15
Schley	13-37	Loam, sandy loam, silty clay loam.	CL, SC, SC-SM, CL-ML	A-2, A-4	2-8	90-95	70-80	50-70	20-60	20-30	5-10
	37-60	Loam, sandy clay loam, clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-40	10-20
408B	0-29	Sandy loam	SC-SM, SC	A-2, A-4	0	100	95-100	85-95	30-50	20-30	5-10
Olin	29-45	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-95	80-90	45-65	25-35	10-20
	45-60	Loam, clay loam	CL	A-6	2-5	90-95	85-95	80-90	50-65	25-35	10-20
412C, 412E, 412G- Emeline	0-12	Loam	CL	A-6	0-10	85-100	85-100	85-100	70-100	25-40	11-23
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
444B	0-22	Silty clay loam	ML, CL	A-7	0	100	100	90-95	50-80	40-50	15-25
Jacwin	22-34	Silty clay, clay	CL, CH	A-7	0	100	100	95-100	80-95	45-60	20-30
	34-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
457	0-29	Loam	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	11-21
Du Page	29-44	Sandy loam, loam, gravelly sandy clay loam.	CL	A-4, A-6, A-7	0	85-100	75-100	65-100	55-95	25-45	7-20
	44-60	Stratified loam to gravelly sandy clay loam.	CL-ML, SC-SM, CL, SC	A-4, A-6	0	80-100	75-100	65-100	40-95	10-40	5-20
471, 471B	0-17	Loam	CL, CL-ML	A-4, A-6	0	100	100	85-95	55-75	25-35	5-15
Oran	17-40	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	10-20
	40-60	Loam	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	10-20
482	0-14	Loam	ML	A-4, A-6	0	95-100	95-100	90-100	55-85	30-40	5-14
Racine	14-23	Silt loam, clay loam, silty clay loam.	CL	A-6	0	95-100	95-100	90-100	55-85	30-40	10-20
	23-52	Clay loam, sandy clay loam, loam.	CL, SC	A-6	2-5	95-100	75-100	65-90	45-65	25-35	10-15
	52-60	Loam	ML, CL	A-6	1-5	95-100	90-100	80-95	50-75	25-40	10-20
482B, 482C, 482C2	0-14	Loam	ML	A-4, A-6	0	95-100	95-100	90-100	55-85	30-40	5-14
Racine	14-21	Silt loam, clay loam, silty clay loam.	CL	A-6	0	95-100	95-100	90-100	55-85	30-40	10-20
	21-52	Clay loam, sandy clay loam, loam.	CL, SC	A-6	2-5	95-100	75-100	65-90	45-65	25-35	10-15
	52-60	Loam	ML, CL	A-6	1-5	95-100	90-100	80-95	50-75	25-40	10-20
485	0-47	Loam	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
Spillville	47-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SC-SM, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
491B	0-5	Silt loam	ML, CL, CL-ML	A-4	0	100	98-100	90-95	75-90	20-40	NP-10
Renova	5-11	Silty clay loam, silt loam, loam.	CL	A-6	0	100	98-100	90-95	80-95	30-40	10-20
	11-42	Loam, sandy clay loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0-2	95-100	85-95	65-85	45-65	20-35	5-15
	42-60	Loam	CL	A-6	0-1	95-100	85-95	70-85	50-70	25-40	10-20
507	0-16	Silty clay loam	OL, CL	A-7	0	95-100	95-100	85-100	60-100	40-50	15-20
Canisteo	16-40	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	98-100	90-100	85-95	65-85	38-50	25-35
	40-60	Clay loam, loam, sandy loam.	CL, ML, SM, SC	A-6, A-4	0-5	90-100	80-95	60-90	40-80	30-40	5-15
535	0-56	Sandy loam	SC-SM, SC	A-4, A-2	0	100	100	75-80	30-45	20-30	5-10
Shellwood	56-60	Sandy loam, loamy sand.	SC-SM, SC	A-2	0	100	100	75-80	20-35	15-25	5-10

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
536---------- Hanlon	0-43	Fine sandy loam	SC-SM, SC, SM	A-4	0	100	100	75-80	35-50	25-35	5-10
	43-48	Fine sandy loam, sandy loam.	SC-SM, SC, SM	A-4	0	100	100	75-80	35-50	25-35	5-10
	48-60	Sandy loam, fine sandy loam, loamy fine sand.	SC-SM, SC	A-4, A-2	0	100	100	75-80	25-40	15-25	5-10
537*:											
Du Page----------	0-29	Loam----------	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	11-21
	29-44	Sandy loam, loam, gravelly sandy clay loam.	CL	A-4, A-6, A-7	0	85-100	75-100	65-100	55-95	25-45	7-20
	44-60	Stratified loam to gravelly sandy clay loam.	CL-ML, SC-SM, CL, SC	A-4, A-6	0	80-100	75-100	65-100	40-95	10-40	5-20
Calco----------	0-31	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-100	40-60	15-30
	31-48	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	48-60	Silty clay loam, loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	80-100	30-45	10-20
551---------- Calamine	0-20	Silty clay loam	CL	A-6	0	100	100	95-100	90-100	25-40	10-20
	20-28	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	90-100	25-40	10-20
	28-32	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-100	50-60	25-35
	32-54	Silty clay, clay	CH	A-7	0	100	100	95-100	90-100	50-60	25-35
	54-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
559---------- Talcot	0-22	Clay loam--------	CL	A-7	0	100	100	80-90	60-85	40-50	15-25
	22-38	Clay loam, silty clay loam, loam.	CL	A-7	0	95-100	85-100	70-90	60-85	40-50	15-25
	38-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, SW	A-1	0	65-90	50-85	20-50	2-10	---	NP
595---------- Harpster	0-13	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	90-100	45-60	20-35
	13-36	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	85-100	40-60	20-35
	36-50	Silty clay loam, silt loam, loam.	CL, CH	A-6, A-7	0	100	95-100	95-100	70-100	35-55	20-35
	50-60	Stratified sandy loam to clay loam.	CL, CL-ML, SC, SC-SM	A-4, A-6, A-7	0	100	95-100	95-100	45-95	20-50	5-25
612C2, 612D2----- Mottland	0-60	Loam----------	CL, CL-ML	A-6, A-4	3-10	90-95	75-85	70-80	55-65	25-40	5-15
616, 616B-------- Aureola	0-14	Loam----------	CL, ML	A-6, A-4	0	100	100	85-95	60-75	30-40	5-15
	14-19	Loam----------	CL, ML	A-6, A-4	0	100	100	85-95	60-75	30-40	5-15
	19-33	Loam, sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	100	100	70-85	40-55	<25	NP-5
	33-60	Loamy fine sand	SM, SP-SM, SC-SM	A-2-4, A-3	0	100	95-100	50-80	5-20	<20	NP-5
616C2, 616D2----- Aureola	0-8	Sandy loam--------	CL, ML	A-6, A-4	0	100	100	85-95	60-75	30-40	5-15
	8-23	Loam, fine sandy loam.	SC-SM, SM, CL-ML, ML	A-4	0	100	100	70-85	40-55	<25	NP-5
	23-60	Loamy fine sand	SM, SP-SM, SC-SM	A-2-4, A-3	0	100	95-100	50-80	5-20	<20	NP-5

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
631, 631B, 631C--Limecreek	0-13	Silty clay loam	CL	A-7, A-6	0-1	95-100	95-100	90-100	85-95	35-45	15-20
	13-25	Silty clay loam, clay loam.	CL	A-6, A-7	0-1	95-100	85-100	85-95	75-85	30-40	10-20
	25-60	Silty clay loam, loam.	CL	A-6, A-7	0-1	95-100	95-100	85-95	75-85	30-40	10-20
651--Faxon	0-18	Silty clay loam	CL	A-7	0-10	95-100	85-100	85-100	80-95	40-50	15-25
	18-27	Loam, sandy loam, clay loam.	CL, ML, SC, SM	A-7, A-6	0-10	95-100	70-100	65-95	40-85	30-50	10-20
	27-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
662B--Mt. Carroll	0-10	Silt loam	CL	A-4, A-6	0	100	100	100	95-100	25-36	7-18
	10-46	Silt loam	CL	A-6, A-4	0	100	100	100	95-100	27-40	8-20
	46-60	Silt loam	CL	A-4, A-6	0	100	100	100	90-100	26-37	7-17
697--Rocksan	0-17	Silty clay loam	CL, CH	A-7	0	100	100	100	70-90	45-55	20-30
	17-25	Loam, sandy loam	CL, ML, SC-SM, SM	A-4	0	100	100	70-85	35-55	15-30	NP-10
	25-55	Loamy fine sand	SM, SP-SM, SC-SM	A-2-4, A-3	0	100	95-100	50-80	5-20	<20	NP-5
	55-60	Silty clay	CL, CH	A-7	0	100	100	100	90-100	45-70	25-45
713, 713B--Winneshiek	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	55-70	20-30	5-15
	8-29	Loam, clay loam	CL	A-6	2-5	90-95	80-95	80-90	50-65	25-40	11-20
	29-33	Clay, silty clay	CH	A-7	0-10	85-95	80-95	80-90	70-90	55-70	30-45
	33-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
714B--Winneshiek	0-13	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	55-70	20-30	5-15
	13-22	Loam, clay loam	CL	A-6	2-5	90-95	80-95	80-90	50-65	25-40	11-20
	22-24	Clay, silty clay	CH	A-7	0-10	85-95	80-95	80-90	70-90	55-70	30-45
	24-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
714C--Winneshiek	0-10	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	55-70	20-30	5-15
	10-22	Loam, clay loam	CL	A-6	2-5	90-95	80-95	80-90	50-65	25-40	11-20
	22-24	Clay, silty clay	CH	A-7	0-10	85-95	80-95	80-90	70-90	55-70	30-45
	24-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
725--Hayfield	0-16	Loam	CL-ML, CL	A-6, A-4	0	100	100	90-98	70-90	25-40	6-15
	16-27	Loam, silt loam, clay loam.	CL-ML, CL	A-4, A-6	0	95-100	90-100	70-90	65-80	25-40	6-15
	27-60	Coarse sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-3	85-100	50-98	25-50	0-15	---	NP
726--Hayfield	0-16	Loam	CL-ML, CL	A-6, A-4	0	100	100	90-98	70-90	25-40	6-15
	16-37	Loam, silt loam, clay loam.	CL-ML, CL	A-4, A-6	0	95-100	90-100	70-90	65-80	25-40	6-15
	37-60	Coarse sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-3	85-100	50-98	25-50	0-15	---	NP
733--Calco	0-48	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-100	40-60	15-30
	48-60	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
761---------- Franklin	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	8-26	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	26-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	95-100	90-95	75-85	55-65	25-35	10-20
771, 771B-------- Waubeek	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	100	25-35	5-15
	8-29	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	100	40-50	15-25
	29-60	Loam, sandy clay loam, clay loam.	CL	A-6	0-5	90-95	85-95	75-85	50-65	25-35	10-20
776C---------- Lilah	0-6	Sandy loam-------	SC-SM, SC	A-2, A-4	0-5	90-95	80-90	60-70	25-40	<25	5-10
	6-12	Sandy loam, gravelly sandy loam.	SM, SC-SM, SC	A-2-4, A-1-b	0-5	80-95	60-90	40-60	15-30	<25	3-10
	12-60	Gravelly loamy sand, sand, gravelly sand.	SW, SW-SM, SP, SP-SM	A-1-b	0-10	70-90	50-90	30-50	3-12	---	NP
777, 777B, 777C-- Wapsie	0-14	Loam----------	CL, ML, CL-ML	A-4	0	100	90-100	70-90	50-75	25-35	5-10
	14-28	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	85-95	80-95	70-85	40-60	20-35	5-15
	28-60	Gravelly loamy sand, gravelly sand, sand.	SW, SM, SP, SP-SM	A-1	0	60-90	60-85	20-40	3-25	---	NP
781B, 781C, 781C2---------- Lourdes	0-16	Loam----------	CL, ML	A-6, A-7	0	100	100	90-95	65-80	35-45	10-20
	16-32	Loam, clay loam	CL	A-6	0	100	95-100	80-90	50-70	30-40	10-20
	32-52	Clay loam--------	CL	A-6	2-5	90-95	85-95	80-90	55-70	35-40	15-20
	52-60	Clay loam--------	CL	A-6	2-5	90-95	85-95	80-90	55-70	35-40	15-20
782, 782B-------- Donnan	0-7	Loam----------	CL, ML	A-4, A-6	0	100	100	85-95	65-80	30-40	5-15
	7-30	Clay loam, silty clay loam, loam.	CL	A-6	0-5	95-100	90-95	80-90	60-75	30-40	10-20
	30-60	Clay, silty clay	CH	A-7	0-5	95-100	90-95	80-90	60-75	55-70	30-40
783B, 783C------- Cresco	0-16	Loam----------	CL	A-6	0	100	100	90-100	70-80	30-40	10-20
	16-26	Loam, clay loam	CL	A-6	2-5	90-95	85-90	75-85	55-70	30-40	10-20
	26-36	Clay loam--------	CL	A-6	2-5	95-100	85-95	80-90	55-70	30-40	10-20
	36-60	Clay loam--------	CL	A-6	2-5	95-100	85-95	80-90	55-70	30-40	10-20
784B---------- Riceville	0-12	Silt loam--------	CL	A-6, A-7	0	100	100	85-95	60-75	35-45	15-20
	12-18	Loam, clay loam	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	15-20
	18-60	Clay loam--------	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	15-25
789---------- Oakton	0-9	Loam----------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	9-24	Loam----------	CL, SC, SC-SM, CL-ML	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	24-36	Sandy loam-------	SM, SC, ML, CL	A-4, A-2, A-6	0	100	100	80-90	30-70	30-40	5-15
	36-60	Sand, loamy sand	SM, SP-SM	A-2-4	0	100	100	50-85	10-30	---	NP
797---------- Jameston	0-19	Silty clay loam	OL, MH, OH	A-7	0	100	100	85-95	70-80	45-55	15-20
	19-32	Silty clay loam, silt loam, loam.	CL	A-6, A-7	0	100	100	85-95	70-80	30-45	10-20
	32-60	Loam, clay loam	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	15-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
798B---------- Protivin	0-17	Clay loam--------	MH, OH, CL, CH	A-7, A-6	0	100	100	85-95	60-75	35-55	15-25
	17-23	Loam, silt loam, silty clay loam.	CL	A-6	2-5	90-95	85-90	75-85	55-65	35-40	15-20
	23-60	Clay loam--------	CL	A-6	2-5	90-95	85-90	75-85	55-65	30-40	15-25
806B---------- Whalan	0-17	Silt loam--------	ML	A-4	0	100	95-100	85-95	60-90	30-40	5-10
	17-25	Clay loam, loam	CL	A-6	0	95-100	95-100	80-95	70-90	30-40	10-15
	25-29	Clay loam, clay, silty clay.	CL, CH	A-7	0-5	80-100	70-95	65-90	50-85	40-60	20-35
	29-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
936*:											
Coland----------	0-33	Clay loam--------	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	33-49	Clay loam, silty clay loam.	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	49-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
Spillville------	0-20	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	20-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SC-SM, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
976---------- Raddle	0-24	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	4-15
	24-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-35	4-15
1537*:											
Du Page----------	0-30	Loam-------------	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	11-21
	30-60	Sandy loam, loam, gravelly sandy clay loam.	CL	A-4, A-6, A-7	0	85-100	75-100	65-100	55-95	25-45	7-20
Shellwood-------	0-56	Sandy loam-------	SC-SM, SC	A-4, A-2	0	100	100	75-80	30-45	20-30	5-10
	56-60	Sandy loam, loamy sand.	SC-SM, SC	A-2	0	100	100	75-80	20-35	15-25	5-10
Calco----------	0-29	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-100	40-60	15-30
	29-44	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	44-60	Silty clay loam, loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	80-100	30-45	10-20
1936*:											
Spillville------	0-20	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	20-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SC-SM, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
Hanlon----------	0-43	Fine sandy loam	SC-SM, SC, SM	A-4	0	100	100	75-80	35-50	25-35	5-10
	43-48	Fine sandy loam, sandy loam.	SC-SM, SC, SM	A-4	0	100	100	75-80	35-50	25-35	5-10
	48-60	Sandy loam, fine sandy loam, loamy fine sand.	SC-SM, SC	A-4, A-2	0	100	100	75-80	25-40	15-25	5-10

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
1936*:											
Coland	0-33	Clay loam	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	33-49	Clay loam, silty clay loam.	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	49-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
4000*. Urban land											
5010*. Pits, sand and gravel											
5030*. Pits, limestone quarry											
5040*. Orthents											
5060*. Pits, clay											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
27, 27B----------	0-15	18-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.24	5	6
Terril	15-31	24-30	1.40-1.45	0.6-2.0	0.17-0.19	6.1-7.3	Low----------	0.28		
	31-60	15-30	1.45-1.70	0.6-2.0	0.16-0.18	6.1-7.8	Low----------	0.32		
41B----------	0-18	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low----------	0.17	5	2
Sparta	18-36	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-7.3	Low----------	0.15		
	36-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-7.8	Low----------	0.15		
63C----------	0-3	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low----------	0.17	5	2
Chelsea	3-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-6.5	Low----------	0.17		
83, 83B, 83C-----	0-13	18-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	5	6
Kenyon	13-45	20-30	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.28		
	45-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	6.6-8.4	Low----------	0.37		
83C2----------	0-13	18-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	5	6
Kenyon	13-45	20-30	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.28		
	45-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	6.6-8.4	Low----------	0.37		
84----------	0-21	28-32	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-----	0.28	5	7
Clyde	21-35	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.37		
	35-39	10-22	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low----------	0.37		
	39-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	6.6-8.4	Moderate-----	0.37		
96----------	0-36	18-26	1.45-1.55	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.24	5	6
Turlin	36-40	20-28	1.55-1.65	0.6-2.0	0.17-0.19	5.6-7.3	Low----------	0.28		
	40-60	8-18	1.65-1.70	6.0-20	0.08-0.17	6.1-7.3	Low----------	0.24		
110B, 110C-------	0-5	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3
Lamont	5-45	5-15	1.50-1.55	2.0-6.0	0.14-0.16	5.1-7.3	Low----------	0.24		
	45-60	2-10	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low----------	0.17		
135----------	0-33	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6
Coland	33-49	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24		
	49-60	12-26	1.50-1.65	0.6-6.0	0.13-0.17	6.1-7.8	Low----------	0.28		
151----------	0-21	27-35	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	6
Marshan	21-25	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28		
	25-28	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.28		
	28-60	0-5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15		
152----------	0-21	27-35	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	4	6
Marshan	21-32	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28		
	32-36	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.28		
	36-60	0-5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15		
171, 171B, 171C, 171C2, 171D2----	0-11	18-25	1.45-1.50	0.6-2.0	0.19-0.21	5.1-7.3	Low----------	0.28	5	6
Bassett	11-45	20-28	1.55-1.65	0.6-2.0	0.17-0.19	4.5-7.3	Low----------	0.28		
	45-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	5.1-8.4	Low----------	0.37		
174, 174B--------	0-19	20-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	4	6
Bolan	19-33	12-20	1.45-1.50	0.6-2.0	0.17-0.19	5.6-6.5	Low----------	0.24		
	33-60	10-16	1.50-1.60	2.0-6.0	0.11-0.13	5.6-7.3	Low----------	0.24		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
174B2, 174C2-----	0-19	20-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	4	6
Bolan	19-33	12-20	1.45-1.50	0.6-2.0	0.17-0.19	5.6-6.5	Low----------	0.24		
	33-43	10-16	1.50-1.60	2.0-6.0	0.11-0.13	5.6-7.3	Low----------	0.24		
	43-60	2-8	1.60-1.70	6.0-20	0.08-0.10	5.6-7.3	Low----------	0.17		
175B, 175C-------	0-18	10-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.20	4	3
Dickinson	18-30	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low----------	0.17		
	30-38	4-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low----------	0.20		
	38-60	4-10	1.60-1.70	6.0-20	0.02-0.04	5.6-7.3	Low----------	0.15		
177, 177B, 177C--	0-17	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	4	6
Saude	17-28	12-18	1.40-1.50	0.6-6.0	0.15-0.19	5.1-6.0	Low----------	0.28		
	28-60	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.5	Low----------	0.10		
178, 178B--------	0-19	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.24	4	6
Waukee	19-36	18-27	1.40-1.50	0.6-2.0	0.15-0.19	5.1-6.0	Low----------	0.28		
	36-60	2-8	1.50-1.75	>20	0.02-0.06	5.6-6.5	Low----------	0.10		
184---------------	0-18	27-30	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	7
Klinger	18-28	28-35	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	28-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	5.1-7.8	Low----------	0.43		
194, 194B--------	0-16	27-32	1.25-1.35	0.6-2.0	0.20-0.23	5.6-7.3	Low----------	0.32	4	7
Norville	16-28	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Low----------	0.43		
	28-50	55-65	1.40-1.60	0.06-0.2	0.12-0.14	6.6-7.8	Moderate-----	0.43		
	50-60	5-10	1.40-1.45	6.0-20	0.05-0.10	7.4-9.0	Low----------	0.17		
194C3------------	0-9	18-27	1.25-1.35	0.6-2.0	0.20-0.23	5.6-7.3	Low----------	0.32	4	7
Norville	9-50	55-65	1.40-1.60	0.06-0.2	0.10-0.19	6.6-7.8	Moderate-----	0.43		
	50-60	5-10	1.40-1.45	6.0-20	0.05-0.10	7.4-9.0	Low----------	0.17		
198, 198B--------	0-20	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6
Floyd	20-32	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low----------	0.32		
	32-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-8.4	Low----------	0.32		
201B*:										
Coland----------	0-33	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6
	33-49	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24		
	49-60	12-26	1.50-1.65	0.6-6.0	0.13-0.17	6.1-7.8	Low----------	0.28		
Terril----------	0-20	18-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.24	5	6
	20-31	24-30	1.40-1.45	0.6-2.0	0.17-0.19	6.1-7.3	Low----------	0.28		
	31-60	15-30	1.45-1.70	0.6-2.0	0.16-0.18	6.1-7.8	Low----------	0.32		
213, 213B--------	0-15	18-27	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.28	4	6
Rockton	15-26	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28		
	26-31	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28		
	31-60	---	---	2.0-20	---	---	----------	----		
214, 214B, 214C--	0-15	18-27	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.28	4	6
Rockton	15-21	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28		
	21-24	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28		
	24-60	---	---	2.0-20	---	---	----------	----		
214C2------------	0-15	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.28	4-3	6
Rockton	15-21	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28		
	21-24	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28		
	24-60	---	---	2.0-20	---	---	----------	----		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
216B	0-13	10-18	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.8	Low	0.28	4	5
Ripon	13-24	25-35	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	0.43		
	24-27	22-40	1.55-1.70	0.6-2.0	0.14-0.19	6.1-8.4	Moderate	0.32		
	27-60	---	---	0.06-2.0	---	---				
217B	0-15	10-18	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.8	Low	0.28	4	5
Ripon	15-31	25-35	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	0.43		
	31-37	22-40	1.55-1.70	0.6-2.0	0.14-0.19	6.1-8.4	Moderate	0.32		
	37-60	---	---	0.06-2.0	---	---				
221B	0-43	---	0.30-0.40	0.2-6.0	0.35-0.45	5.1-7.8			5	2
Palms	43-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low	0.37		
225	0-17	18-27	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.24	4	6
Lawler	17-29	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low	0.28		
	29-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low	0.10		
226	0-19	18-27	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.24	4	6
Lawler	19-38	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low	0.28		
	38-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low	0.10		
284, 284B, 284C--	0-18	12-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low	0.20	4	3
Flagler	18-31	10-15	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.5	Low	0.20		
	31-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low	0.20		
285B, 285C, 285F-	0-8	5-13	1.35-1.55	2.0-6.0	0.11-0.15	5.1-6.5	Low	0.20	3	3
Burkhardt	8-20	8-18	1.55-1.65	2.0-6.0	0.10-0.19	5.1-6.5	Low	0.24		
	20-60	1-6	1.50-1.80	>6.0	0.02-0.04	5.6-6.5	Low	0.10		
303	0-12	18-22	1.45-1.50	0.6-2.0	0.19-0.21	4.5-7.3	Moderate	0.32	5	6
Pinicon	12-43	24-28	1.50-1.70	0.6-2.0	0.17-0.19	4.5-6.0	Moderate	0.28		
	43-60	22-26	1.65-1.75	0.6-2.0	0.17-0.19	5.6-7.8	Moderate	0.37		
377, 377B	0-18	27-32	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Moderate	0.28	5	7
Dinsdale	18-29	30-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	0.43		
	29-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	5.6-8.4	Low	0.43		
382	0-19	27-35	1.35-1.40	0.6-2.0	0.21-0.23	6.6-7.3	High	0.28	5	7
Maxfield	19-28	25-34	1.40-1.50	0.6-2.0	0.18-0.20	6.1-7.3	High	0.32		
	28-60	20-26	1.65-1.75	0.6-2.0	0.17-0.19	6.1-7.8	Low	0.32		
391B*:										
Clyde	0-21	28-32	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.28	5	7
	21-35	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	0.37		
	35-39	10-22	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low	0.37		
	39-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	6.6-8.4	Moderate	0.37		
Floyd	0-20	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.24	5	6
	20-34	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low	0.32		
	34-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-8.4	Low	0.32		
394, 394B, 394C,										
394C2	0-16	18-27	1.45-1.55	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.28	5	6
Ostrander	16-38	18-27	1.45-1.55	0.6-2.0	0.17-0.20	5.1-7.3	Low	0.28		
	38-44	13-27	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.28		
	44-60	18-27	1.60-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low	0.37		
398	0-11	28-32	1.40-1.45	0.6-2.0	0.19-0.21	6.1-7.3	Moderate	0.28	5	7
Tripoli	11-38	22-28	1.45-1.70	0.6-2.0	0.17-0.19	6.6-7.8	Low	0.24		
	38-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	7.4-8.4	Low	0.28		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
399	0-10	18-24	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.24	5	6
Readlyn	10-36	22-28	1.45-1.70	0.6-2.0	0.17-0.19	5.1-6.5	Low	0.32		
	36-60	18-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Low	0.32		
399B	0-17	18-24	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.24	5	6
Readlyn	17-36	22-28	1.45-1.70	0.6-2.0	0.17-0.19	5.1-6.5	Low	0.32		
	36-60	18-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Low	0.32		
407B	0-13	18-22	1.40-1.45	0.6-2.0	0.19-0.21	4.5-7.3	Moderate	0.28	5	6
Schley	13-37	15-28	1.45-1.65	0.6-2.0	0.12-0.16	4.5-5.5	Low	0.32		
	37-60	20-28	1.65-1.80	0.6-2.0	0.16-0.18	5.1-7.8	Low	0.32		
408B	0-29	12-18	1.45-1.50	2.0-6.0	0.13-0.15	5.6-7.3	Low	0.20	5	3
Olin	29-45	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.37		
	45-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	6.1-8.4	Low	0.37		
412C, 412E, 412G-	0-12	12-27	1.15-1.20	0.6-2.0	0.17-0.22	6.1-8.4	Moderate	0.28	1	4L
Emeline	12-60	---	---	<0.06	---	---	---	----		
444B	0-22	27-32	1.35-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.28	4	7
Jacwin	22-34	45-60	1.50-1.60	<0.06	0.12-0.14	7.4-8.4	Moderate	0.28		
	34-60	---	---	<0.06	---	---	---	----		
457	0-29	18-27	1.40-1.60	0.6-2.0	0.22-0.24	6.6-8.4	Moderate	0.28	5	6
Du Page	29-44	18-27	1.45-1.65	0.6-2.0	0.10-0.20	7.4-8.4	Low	0.28		
	44-60	6-20	1.50-1.70	0.6-6.0	0.08-0.20	7.9-8.4	Low	0.28		
471, 471B	0-17	16-24	1.40-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Low	0.24	5	6
Oran	17-40	22-28	1.45-1.70	0.6-2.0	0.17-0.19	4.5-6.5	Low	0.32		
	40-60	20-26	1.65-1.75	0.6-2.0	0.17-0.19	7.4-7.8	Low	0.37		
482	0-14	18-27	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.32	5	6
Racine	14-23	22-32	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Moderate	0.32		
	23-52	18-32	1.55-1.65	0.6-2.0	0.15-0.19	4.5-6.0	Low	0.32		
	52-60	18-27	1.65-1.80	0.6-2.0	0.16-0.19	6.6-7.8	Moderate	0.32		
482B, 482C,										
482C2	0-14	18-27	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.32	5	6
Racine	14-21	22-32	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Moderate	0.32		
	21-52	18-32	1.55-1.65	0.6-2.0	0.15-0.19	4.5-6.0	Low	0.32		
	52-60	18-27	1.65-1.80	0.6-2.0	0.16-0.19	6.6-7.8	Moderate	0.32		
485	0-47	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate	0.24	5	6
Spillville	47-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low	0.28		
491B	0-5	20-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-6.5	Low	0.37	5	6
Renova	5-11	24-32	1.35-1.45	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.37		
	11-42	20-30	1.55-1.70	0.6-2.0	0.17-0.19	4.5-7.3	Low	0.37		
	42-60	20-27	1.55-1.70	0.6-2.0	0.17-0.19	7.4-7.8	Low	0.37		
507	0-16	27-35	1.25-1.35	0.6-2.0	0.18-0.22	7.4-8.4	Moderate	0.24	5	4L
Canisteo	16-40	20-35	1.35-1.50	0.6-2.0	0.15-0.19	7.4-8.4	Moderate	0.32		
	40-60	10-35	1.30-1.50	0.6-2.0	0.12-0.18	7.4-8.4	Low	0.32		
535	0-56	12-18	1.50-1.70	2.0-6.0	0.14-0.16	7.4-8.4	Low	0.20	5	3
Shellwood	56-60	8-14	1.50-1.70	2.0-6.0	0.10-0.12	7.4-8.4	Low	0.20		
536	0-43	12-18	1.45-1.55	2.0-6.0	0.16-0.18	6.1-7.3	Low	0.20	5	3
Hanlon	43-48	12-18	1.45-1.55	2.0-6.0	0.16-0.18	6.1-7.3	Low	0.20		
	48-60	5-10	1.55-1.70	2.0-6.0	0.11-0.13	5.6-7.3	Low	0.20		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
537*:										
Du Page	0-29	18-27	1.40-1.60	0.6-2.0	0.22-0.24	6.6-8.4	Moderate	0.28	5	6
	29-44	18-27	1.45-1.65	0.6-2.0	0.10-0.20	7.4-8.4	Low	0.28		
	44-60	6-20	1.50-1.70	0.6-6.0	0.08-0.20	7.9-8.4	Low	0.28		
Calco	0-31	28-33	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High	0.28	5	4L
	31-48	30-35	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High	0.28		
	48-60	22-32	1.30-1.45	0.6-2.0	0.18-0.20	7.4-8.4	Moderate	0.32		
551	0-20	27-35	1.30-1.40	0.6-2.0	0.18-0.23	6.1-7.8	Moderate	0.28	4	7
Calamine	20-28	22-35	1.50-1.60	0.06-0.6	0.18-0.22	6.1-7.8	Moderate	0.43		
	28-32	35-50	1.55-1.65	<0.06	0.09-0.20	6.1-7.8	Moderate	0.32		
	32-54	35-50	1.70-1.80	<0.06	0.08-0.12	6.6-8.4	High	0.32		
	54-60	---	---	0.00-0.2	---	---				
559	0-22	30-35	1.20-1.30	0.6-2.0	0.18-0.22	7.4-8.4	Moderate	0.28	4	4L
Talcot	22-38	30-35	1.25-1.35	0.6-2.0	0.17-0.20	7.4-8.4	Moderate	0.28		
	38-60	1-6	1.55-1.65	6.0-20	0.02-0.04	7.4-8.4	Low	0.15		
595	0-13	27-35	1.05-1.25	0.6-2.0	0.21-0.24	7.4-8.4	Moderate	0.28	5	4L
Harpster	13-36	27-35	1.20-1.50	0.6-2.0	0.18-0.22	7.4-8.4	Moderate	0.28		
	36-50	22-35	1.25-1.55	0.6-2.0	0.17-0.22	7.4-8.4	Moderate	0.28		
	50-60	15-30	1.40-1.60	0.6-2.0	0.11-0.22	7.4-8.4	Low	0.28		
612C2, 612D2	0-60	16-22	1.45-1.55	0.6-2.0	0.16-0.18	6.6-8.4	Low	0.28	2	4L
Mottland										
616, 616B	0-14	18-26	1.40-1.45	0.6-2.0	0.21-0.23	5.6-7.3	Low	0.24	4	6
Aureola	14-19	15-25	1.45-1.65	0.6-2.0	0.17-0.19	6.1-7.3	Low	0.24		
	19-33	10-15	1.45-1.55	2.0-6.0	0.12-0.15	6.1-7.3	Low	0.20		
	33-60	5-10	1.40-1.45	6.0-20	0.05-0.10	7.4-8.4	Low	0.17		
616C2, 616D2	0-8	15-20	1.40-1.45	0.6-2.0	0.21-0.23	5.6-7.3	Low	0.20	4	3
Aureola	8-23	10-15	1.45-1.55	2.0-6.0	0.12-0.15	6.1-7.3	Low	0.20		
	23-60	5-10	1.40-1.45	6.0-20	0.05-0.10	7.4-8.4	Low	0.17		
631, 631B, 631C--	0-13	27-30	1.40-1.45	0.6-2.0	0.21-0.23	6.1-7.8	Moderate	0.28	5	7
Limecreek	13-25	22-30	1.45-1.60	0.6-2.0	0.15-0.19	6.1-7.3	Moderate	0.32		
	25-60	20-35	1.50-1.60	0.6-2.0	0.16-0.20	6.6-8.4	Moderate	0.32		
651	0-18	28-30	1.20-1.40	0.6-2.0	0.20-0.24	6.6-7.8	Moderate	0.28	4	7
Faxon	18-27	18-30	1.40-1.60	0.6-2.0	0.12-0.19	6.6-7.8	Moderate	0.28		
	27-60	---	---	2.0-20	---	---				
662B	0-10	15-22	1.10-1.20	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.32	5-4	6
Mt. Carroll	10-46	18-27	1.15-1.30	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.43		
	46-60	16-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-8.4	Low	0.43		
697	0-17	27-32	1.40-1.45	0.6-2.0	0.21-0.23	7.4-8.4	Moderate	0.28	4	4L
Rocksan	17-25	14-18	1.45-1.65	0.6-2.0	0.15-0.19	7.4-8.4	Low	0.28		
	25-55	5-10	1.40-1.65	6.0-20	0.05-0.10	7.4-9.0	Low	0.17		
	55-60	40-65	1.40-1.60	0.06-0.2	0.12-0.14	7.4-9.0	Moderate	0.28		
713, 713B	0-8	18-24	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Low	0.24	4	6
Winneshiek	8-29	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.3	Low	0.28		
	29-33	40-55	1.50-1.60	0.06-0.2	0.12-0.15	5.6-7.3	High	0.32		
	33-60	---	---	<0.06	---	---				

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
714B	0-13	18-24	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Low	0.24	4	6
Winneshiek	13-22	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.3	Low	0.28		
	22-24	40-55	1.50-1.60	0.06-0.2	0.12-0.15	5.6-7.3	High	0.32		
	24-60	---	---	<0.06	---	---		----		
714C	0-10	18-24	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Low	0.24	4	6
Winneshiek	10-22	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.3	Low	0.28		
	22-24	40-55	1.50-1.60	0.06-0.2	0.12-0.15	5.6-7.3	High	0.32		
	24-60	---	---	<0.06	---	---		----		
725	0-16	18-27	1.30-1.50	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.32	4	6
Hayfield	16-27	18-30	1.40-1.55	0.6-2.0	0.17-0.22	5.1-6.0	Low	0.32		
	27-60	<5	1.55-1.65	6.0-20	0.02-0.04	5.6-7.8	Low	0.15		
726	0-16	18-27	1.30-1.50	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.32	4	6
Hayfield	16-37	18-30	1.40-1.55	0.6-2.0	0.17-0.22	5.1-6.0	Low	0.32		
	37-60	<5	1.55-1.65	6.0-20	0.02-0.04	5.6-7.8	Low	0.15		
733	0-48	28-33	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High	0.28	5	4L
Calco	48-60	30-35	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High	0.28		
761	0-8	18-25	1.30-1.35	0.6-2.0	0.21-0.23	4.5-7.3	Moderate	0.28	5	6
Franklin	8-26	30-34	1.35-1.40	0.6-2.0	0.18-0.20	4.5-6.0	Moderate	0.43		
	26-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.1-8.4	Low	0.37		
771, 771B	0-8	18-26	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	0.28	5	6
Waubeek	8-29	25-34	1.25-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.43		
	29-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.37		
776C	0-6	8-16	1.50-1.55	2.0-6.0	0.11-0.13	5.1-7.3	Low	0.20	3	3
Lilah	6-12	10-15	1.55-1.65	2.0-6.0	0.10-0.12	4.5-6.0	Low	0.20		
	12-60	2-10	1.55-1.80	>20	0.02-0.04	4.5-6.0	Low	0.10		
777, 777B, 777C	0-14	12-18	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Low	0.24	4	5
Wapsie	14-28	12-18	1.45-1.50	0.6-2.0	0.15-0.17	5.1-6.0	Low	0.28		
	28-60	2-10	1.50-1.75	>20	0.02-0.06	5.1-7.3	Low	0.10		
781B, 781C, 781C2	0-16	18-27	1.45-1.60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.28	5	6
Lourdes	16-32	24-33	1.45-1.60	0.6-2.0	0.16-0.18	4.5-5.5	Low	0.32		
	32-52	30-35	1.45-1.60	0.2-0.6	0.15-0.17	4.5-7.3	Moderate	0.37		
	52-60	28-33	1.60-1.70	0.2-0.6	0.15-0.17	7.4-7.8	Moderate	0.37		
782, 782B	0-7	20-26	1.45-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.28	4	6
Donnan	7-30	20-30	1.45-1.55	0.6-2.0	0.17-0.19	5.1-5.5	Moderate	0.28		
	30-60	42-55	1.50-1.60	<0.06	0.11-0.14	5.1-6.5	High	0.28		
783B, 783C	0-16	20-29	1.45-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Moderate	0.28	5	6
Cresco	16-26	20-28	1.50-1.60	0.6-2.0	0.15-0.17	5.1-5.5	Moderate	0.32		
	26-36	30-35	1.55-1.65	0.2-0.6	0.17-0.19	4.5-5.5	Moderate	0.37		
	36-60	28-35	1.55-1.65	0.2-0.6	0.17-0.19	6.1-8.4	Moderate	0.37		
784B	0-12	22-27	1.45-1.50	0.6-2.0	0.18-0.20	4.5-7.3	Moderate	0.28	5	6
Riceville	12-18	24-33	1.50-1.60	0.2-0.6	0.17-0.19	4.5-6.0	Moderate	0.32		
	18-60	30-35	1.70-1.85	0.2-0.6	0.05-0.10	4.5-7.8	Moderate	0.37		
789	0-9	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.24	4	6
Oakton	9-24	10-18	1.40-1.50	0.6-2.0	0.18-0.20	5.1-6.0	Low	0.28		
	24-36	10-14	1.50-1.60	2.0-6.0	0.12-0.14	5.1-6.0	Low	0.24		
	36-60	2-8	1.60-1.70	6.0-20	0.08-0.10	5.1-6.5	Low	0.20		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
797	0-19	26-30	1.40-1.45	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.37	5	7
Jameston	19-32	26-35	1.40-1.45	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.37		
	32-60	26-36	1.50-1.70	0.2-0.6	0.17-0.19	6.6-7.8	Moderate	0.37		
798B	0-17	27-30	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	0.28	5	6
Protivin	17-23	20-30	1.50-1.60	0.2-0.6	0.17-0.19	5.1-6.5	Moderate	0.37		
	23-60	28-35	1.60-1.70	0.2-0.6	0.15-0.17	5.6-7.8	Moderate	0.37		
806B	0-17	18-25	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.32	4	6
Whalan	17-25	18-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Low	0.32		
	25-29	35-60	1.35-1.45	0.06-0.6	0.15-0.19	5.6-7.8	High	0.32		
	29-60	---	---	2.0-20	---	---				
936*:										
Coland	0-33	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.24	5	6
	33-49	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.24		
	49-60	12-26	1.50-1.65	0.6-6.0	0.13-0.17	6.1-7.8	Low	0.28		
Spillville	0-20	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate	0.24	5	6
	20-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low	0.28		
976	0-24	18-24	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.32	5	6
Raddle	24-60	18-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.43		
1537*:										
Du Page	0-30	18-27	1.40-1.60	0.6-2.0	0.22-0.24	6.6-8.4	Moderate	0.28	5	6
	30-60	18-27	1.45-1.65	0.6-2.0	0.10-0.20	7.4-8.4	Low	0.28		
Shellwood	0-56	12-18	1.50-1.70	2.0-6.0	0.14-0.16	7.4-8.4	Low	0.20	5	3
	56-60	8-14	1.50-1.70	2.0-6.0	0.10-0.12	7.4-8.4	Low	0.20		
Calco	0-29	28-33	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High	0.28	5	4L
	29-44	30-35	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High	0.28		
	44-60	22-32	1.30-1.45	0.6-2.0	0.18-0.20	7.4-8.4	Moderate	0.32		
1936*:										
Spillville	0-20	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate	0.24	5	6
	20-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low	0.28		
Hanlon	0-43	12-18	1.45-1.55	2.0-6.0	0.16-0.18	6.1-7.3	Low	0.20	5	3
	43-48	12-18	1.45-1.55	2.0-6.0	0.16-0.18	6.1-7.3	Low	0.20		
	48-60	5-10	1.55-1.70	2.0-6.0	0.11-0.13	5.6-7.3	Low	0.20		
Coland	0-33	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.24	5	6
	33-49	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.24		
	49-60	12-26	1.50-1.65	0.6-6.0	0.13-0.17	6.1-7.8	Low	0.28		
4000*. Urban land										
5010*. Pits, sand and gravel										
5030*. Pits, limestone quarry										
5040*. Orthents										

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
5060*. Pits, clay										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
27, 27B---- Terril	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
41B---- Sparta	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
63C---- Chelsea	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
83, 83B, 83C, 83C2---- Kenyon	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
84---- Clyde	B/D	None	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High	High	Low.
96---- Turlin	B	Rare	---	---	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High	Moderate.
110B, 110C---- Lamont	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
135---- Coland	B/D	Occasional	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.
151, 152---- Marshan	B/D	None	---	---	0.5-2.5	Apparent	Oct-Jun	>60	---	High	High	Moderate.
171, 171B, 171C, 171C2, 171D2---- Bassett	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
174, 174B, 174B2, 174C2---- Bolan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
175B, 175C---- Dickinson	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
177, 177B, 177C---- Saude	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
178, 178B---- Waukee	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
184---------- Klinger	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
194, 194B, 194C3-- Norville	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Low.
198, 198B---------- Floyd	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
201B*:												
Coland----------	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
Terril----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
213, 213B, 214, 214B, 214C, 214C2---------- Rockton	B	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Low------	Low.
216B, 217B-------- Ripon	B	None---------	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate	Moderate.
221B---------- Palms	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
225, 226---------- Lawler	B	None---------	---	---	2.0-4.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
284, 284B, 284C--- Flagler	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
285B, 285C, 285F-- Burkhardt	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
303---------- Pinicon	B	None---------	---	---	1.5-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
377, 377B---------- Dinsdale	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
382---------- Maxfield	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
391B*:												
Clyde	B/D	None	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High	High	Low.
Floyd	B	None	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High	High	Low.
394, 394B, 394C, 394C2 Ostrander	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
398 Tripoli	B/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
399, 399B Readlyn	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
407B Schley	B	None	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	High.
408B Olin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
412C, 412E, 412G Emeline	D	None	---	---	>6.0	---	---	4-12	Hard	Moderate	Low	Low.
444B Jacwin	B	None	---	---	2.0-4.0	Perched	Nov-Jun	30-40	Soft	High	High	Low.
457 Du Page	B	Occasional	Brief	Feb-Nov	4.0-6.0	Apparent	Feb-Jun	>60	---	Moderate	Low	Low.
471, 471B Oran	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
482, 482B, 482C, 482C2 Racine	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
485 Spillville	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High	Moderate.
491B Renova	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
507 Canisteo	B/D	None	---	---	1.0-3.0	Apparent	Oct-Jul	>60	---	High	High	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
535---------- Shellwood	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Low.
536---------- Hanlon	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Low.
537*:												
Du Page----------	B	Occasional	Brief-----	Feb-Nov	4.0-6.0	Apparent	Feb-Jun	>60	---	Moderate	Low------	Low.
Calco----------	B/D	Occasional	Brief-----	Feb-Nov	0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
551---------- Calamine	D	None--------	---	---	+.5-1.0	Perched	Nov-May	40-60	Soft	Moderate	High-----	Moderate.
559---------- Talcot	B/D	None--------	---	---	1.0-2.5	Apparent	Apr-Jul	>60	---	High-----	High-----	Low.
595---------- Harpster	B/D	None--------	---	---	+.5-2.0	Apparent	Feb-Jun	>60	---	High-----	High-----	Low.
612C2, 612D2------ Mottland	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
616, 616B, 616C2, 616D2---------- Aureola	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
631, 631B, 631C--- Limecreek	B	None--------	---	---	4.0-6.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Low.
651---------- Faxon	B/D	Rare--------	---	---	0-1.0	Apparent	Nov-May	20-40	Hard	High-----	High-----	Low.
662B---------- Mt. Carroll	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
697---------- Rocksan	C	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Low.
713, 713B, 714B, 714C---------- Winneshiek	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
725, 726---------- Hayfield	B	None--------	---	---	2.5-5.0	Apparent	Nov-Jun	>60	---	High-----	Low------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
733---------- Calco	B/D	Occasional	Brief-----	Feb-Nov	0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
761---------- Franklin	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
771, 771B---------- Waubeek	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
776C---------- Lilah	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
777, 777B, 777C--- Wapsie	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
781B, 781C, 781C2- Lourdes	C	None--------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
782, 782B---------- Donnan	C	None--------	---	---	2.0-3.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
783B, 783C-------- Cresco	C	None--------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
784B---------- Riceville	C	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
789---------- Oakton	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Moderate.
797---------- Jameston	C/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
798B---------- Protivin	C	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
806B---------- Whalan	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Low.
936*:												
Coland----------	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
Spillville-------	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
976---------- Raddle	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1537*:												
Du Page	B	Frequent	Brief	Feb-Nov	4.0-6.0	Apparent	Feb-Jun	>60	---	Moderate	Low	Low.
Shellwood	B	Frequent	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Low.
Calco	B/D	Frequent	Brief	Feb-Nov	0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.
1936*:												
Spillville	B	Frequent	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High	Moderate.
Hanlon	B	Frequent	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jun	>60	---	Moderate	Moderate	Low.
Coland	B/D	Frequent	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.
4000*.												
Urban land												
5010*.												
Pits, sand and gravel												
5030*.												
Pits, limestone quarry												
5040*.												
Orthents												
5060*.												
Pits, clay												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that one or more of the map units of this series is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
*Aureola	Coarse-loamy, mixed, mesic Typic Hapludolls
Bassett	Fine-loamy, mixed, mesic Mollic Hapludalfs
*Bolan	Coarse-loamy, mixed, mesic Typic Hapludolls
Burkhardt	Sandy, mixed, mesic Typic Hapludolls
Calamine	Fine, mixed, mesic Typic Argiaquolls
Calco	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
*Canisteo	Fine-loamy, mixed (calcareous), mesic Typic Haplaquolls
Chelsea	Mixed, mesic Alfic Udipsamments
Clyde	Fine-loamy, mixed, mesic Typic Haplaquolls
Coland	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Cresco	Fine-loamy, mixed, mesic Typic Argiudolls
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Dinsdale	Fine-silty, mixed, mesic Typic Argiudolls
Donnan	Fine-loamy over clayey, mixed, mesic Aquollic Hapludalfs
Du Page	Fine-loamy, mixed, mesic Cumulic Hapludolls
Emeline	Loamy, mixed, mesic Lithic Hapludolls
Faxon	Fine-loamy, mixed, mesic Typic Haplaquolls
Flagler	Coarse-loamy, mixed, mesic Typic Hapludolls
Floyd	Fine-loamy, mixed, mesic Aquic Hapludolls
Franklin	Fine-silty, mixed, mesic Udollic Ochraqualfs
Hanlon	Coarse-loamy, mixed, mesic Cumulic Hapludolls
Harpster	Fine-silty, mesic Typic Calciaquolls
Hayfield	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquollic Hapludalfs
*Jacwin	Fine-loamy over clayey, mixed, mesic Aquic Hapludolls
Jameston	Fine-loamy, mixed, mesic Typic Argiaquolls
*Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Klinger	Fine-silty, mixed, mesic Aquic Hapludolls
Lamont	Coarse-loamy, mixed, mesic Typic Hapludalfs
Lawler	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Hapludolls
Lilah	Sandy, mixed, mesic Psammentic Hapludalfs
Limecreek	Fine-loamy, mixed, mesic Typic Hapludolls
Lourdes	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Maxfield	Fine-silty, mixed, mesic Typic Haplaquolls
*Mottland	Coarse-loamy, carbonatic, mesic Entic Hapludolls
Mt. Carroll	Fine-silty, mixed, mesic Mollic Hapludalfs
*Norville	Fine-silty over clayey, mixed, mesic Typic Hapludolls
Oakton	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Olin	Coarse-loamy, mixed, mesic Typic Hapludolls
Oran	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Orthents	Fine-loamy, mixed, mesic Typic Udorthents
Ostrander	Fine-loamy, mixed, mesic Typic Hapludolls
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pinicon	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Protivin	Fine-loamy, mixed, mesic Aquic Argiudolls
Racine	Fine-loamy, mixed, mesic Mollic Hapludalfs
Raddle	Fine-silty, mixed, mesic Typic Hapludolls
Readlyn	Fine-loamy, mixed, mesic Aquic Hapludolls
Renova	Fine-loamy, mixed, mesic Typic Hapludalfs
Riceville	Fine-loamy, mixed, mesic Udollic Ochraqualfs
*Ripon	Fine-silty, mixed, mesic Typic Argiudolls
Rocksan	Coarse-loamy, mixed (calcareous), mesic Typic Haplaquolls
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Saude	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Schley	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Shellwood	Coarse-loamy, mixed, mesic Cumulic Hapludolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls

TABLE 18.--CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
Talcot	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic Typic Haplaquolls
Terril	Fine-loamy, mixed, mesic Cumulic Hapludolls
Tripoli	Fine-loamy, mixed, mesic Typic Haplaquolls
Turlin	Fine-loamy, mixed, mesic Cumulic Hapludolls
Wapsie	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Waubeek	Fine-silty, mixed, mesic Mollic Hapludalfs
Waukee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Whalan	Fine-loamy, mixed, mesic Typic Hapludalfs
Winneshiek	Fine-loamy, mixed, mesic Mollic Hapludalfs

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