SOIL SURVEY OF

Rock County, Wisconsin

United States Department of Agriculture
Soil Conservation Service

In cooperation with

University of Wisconsin Department of
Soil Science

Wisconsin Geological and Natural History Survey

And the

Wisconsin Agricultural Experiment Station

Issued July 1974

Major fieldwork for this soil survey was done in the period 1965 to 1969. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1970. This survey was made cooperatively by the Soil Conservation Service and the University of Wisconsin, Department of Soil Science, the Wisconsin Geological and Natural History Survey, and the Wisconsin Agricultural Experiment Station. It is part of the technical assistance furnished to the Rock County Soil and Water Conservation District.

The fieldwork that is the basis for this soil survey was partly financed by the Rock County Board of Supervisors.

Either enlarged or reduced copies of the printed soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Rock County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the page where each is described. It also shows the capability grouping, woodland suitability group, wildlife group, shrub and vine group, and recreation group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and woodland groups.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the subsections "Town and Country Planning" and "Recreational Uses of the Soils."

Engineers and builders can find, under "Use of the Soils in Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Rock County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Cover: **Sheep grazing on Rockton and Whalan soils. This area would be attractive for homesites, but the soils are not suited to use for septic tank filter fields, because they are underlain by crevassed dolomite at depths of 20 to 40 inches.**

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SOIL SURVEY OF ROCK COUNTY, WISCONSIN

FIELDWORK BY ROBERT J. ENGEL, HOWARD F. GUNDLACH, KEITH O. SCHMUDE, CARL L. GLOCKER, EDWARD L. WEBER, AND FRANK L. ANDERSON, SOIL CONSERVATION SERVICE[1]

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF WISCONSIN, DEPARTMENT OF SOIL SCIENCE, THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, AND THE WISCONSIN AGRICULTURAL EXPERIMENT STATION

ROCK COUNTY is on the southern border of Wisconsin (fig. 1). It extends about 24 miles from north to south and 30 miles from east to west. The total land area is 721 square miles, or 461,440 acres. The population of the county was 131,970 in 1970. Janesville, located in about the center of the county, is the county seat and largest city. Beloit, located in the south-central part of the county, is nearly as large as Janesville. Rock County is a part of a rapidly urbanizing area that includes most of southeastern Wisconsin and northern Illinois. Seven out of ten Rock County residents lived in incorporated cities or villages in 1970, and 85 percent of the urban residents lived in Janesville or Beloit. About 44 percent of the workers are engaged in manufacturing, 39 percent in other services, 8 percent in activities related to farming, 5 percent in construction, and about 5 percent in transportation and utilities (*4*).[2]

Approximately 90 percent of the acreage in the county was in farms in 1967, and most of the land suitable for cultivation is now used for field crops or pasture. About 6 percent of the acreage is wooded. Despite the high degree of industrialization, Rock County is an extremely productive agricultural county. Because of its location in the northern corn belt, the output is more diversified than in the typical Wisconsin county. The county ranks in the highest quarter for sales of whole milk, swine, cattle, and eggs, and this is duplicated by only three other counties in Wisconsin (*15*, *16*).

On the basis of surface features, the county can be divided into three physiographic areas. One area comprises the hills and kettles in the northern part of the county where the landforms are almost entirely caused by glacial deposition. The Johnstown moraine forms the southern boundary of this area (fig. 2). Most of the soils of this area have a silt loam or loam surface layer and are underlain by glacial till or stratified sand and gravel outwash.

South of this area, a belt of flat outwash extends from east to west across the county and southward along the

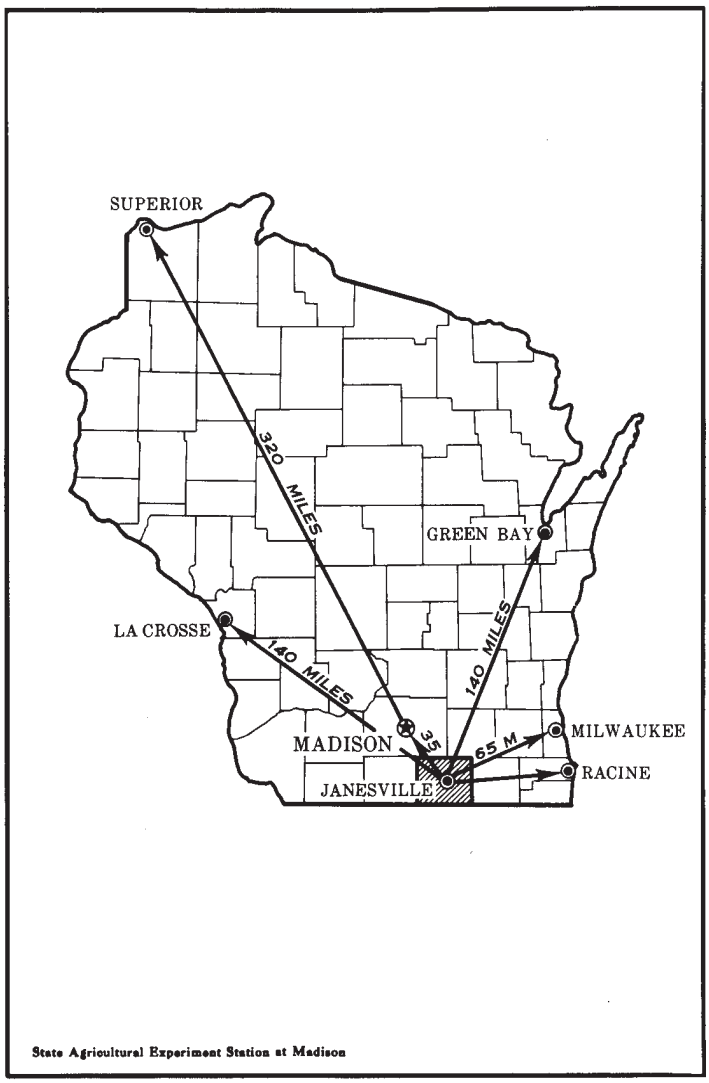

Figure 1.—Location of Rock County in Wisconsin.

[1] Other soil scientists who assisted in the mapping are OWEN R. DEMO, RANDALL L. DECKER, S. MICHAEL SHIVERS, ROBERT A. PATZER, DAVID A. MEDIN, JERRY J. GENSON, MARION M. BLEVINS, JR., and BRUCE E. FRAZIER.

[2] Italicized numbers in parentheses refer to Literature Cited, p. 157

Figure 2.—The Johnstown moraine in the northern part of Rock County. This moraine marks the farthest advance of the last glacier in this area. Most of this hilly moraine has never been cleared.

Rock River. The soils of this area have a silt loam or loam surface layer and are underlain by stratified sand and gravel outwash.

In the extreme southwestern part of the county, the glacial cover is thin or lacking and the topography is almost entirely caused by differential erosion of bedrock. The terrain in this area is characterized by deep valleys cut into sandstone and ridges underlain by dolomite (fig. 3). The soils in much of this area have a loam or sandy loam surface layer and are relatively shallow to bedrock. The Sugar River flood plain in this area has a mantle of sand from the weathering and erosion of the surrounding sandstone. Loose sand blown from this flood plain since glacial times has moved north and east onto the adjacent uplands and adds a noticeable sand content to the soils of Newark and Beloit Townships.

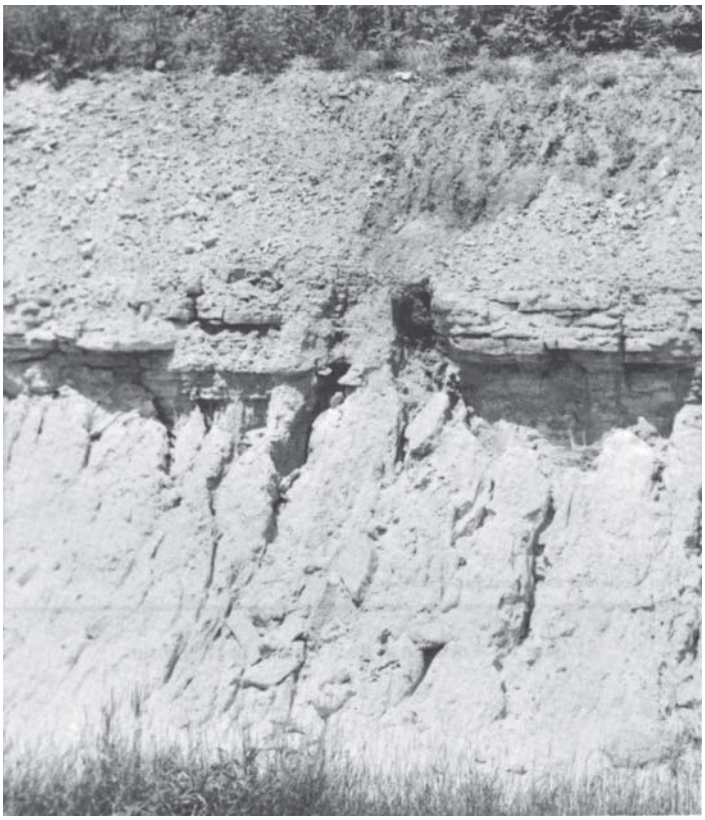

Figure 3—Road cut showing Whalan soils, which have formed over dolomite that is underlain by sandstone at some depth below 12 feet. Farther down the slope, where sandstone is near the surface, Eleva soils have formed. The dolomite is harder and more resistant to erosion than the sandstone. Where the protecting cap of dolomite has been cut, the sandstone is deeply incised.

This county has a large acreage of soils suitable for farming. Examples are the deep, nearly level, silty soils of the Plano and St. Charles series, on till and outwash plains in the northern and central parts of the county, that are well suited to intensive crop production. These soils respond to a high level of management, such as heavy fertilization and a high population of plants. Soils of the Warsaw and Dresden series in this area are moderately deep, have medium available water capacity, and are more limited in their response to management than the deeper soils, generally because of lower available water capacity. The soils in much of the northern part of the county are gently sloping to moderately steep and are subject to erosion. In many areas the slopes are so irregular that stripcropping and contour cultivation generally are not practical. These areas are well suited to the raising of livestock because the crop rotation includes close-growing hay and pasture plants that reduce erosion.

Soils of the Rockton and Whalan series, which are moderately deep over dolomite, are common in the western and southwestern parts of the county. These soils have medium available water capacity and are well suited to general livestock farming. Soils of the Edmund series in this same area are shallow over dolomite and have very low available water capacity. The eroded Edmund soils are also more clayey in the surface layer than Whalan or Rockton soils and are more difficult to cultivate. Most areas of these soils are gently sloping to moderately steep and are subject to erosion if cultivated. The slopes are quite long and uniform, however, and lend themselves to contour stripcropping and other erosion control practices.

In Rock County there is a demand for information on soils for nonfarm uses. This is especially true for building sites as the urban and rural nonfarm population increases. Many of the soils are well suited to these uses, but some are not. The construction of homes with private sewage disposal systems is controlled by local and State ordinances that minimize the danger of ground-water pollution. To effectively filter the effluent, a deep, silty or loamy, well-drained soil is desired. Soils of the Rockton, Whalan, Edmund, and Sogn series, which formed over dolomite, are hazardous for onsite sewage disposal systems because natural fissures or crevices in the bedrock permit rapid downward movement of unfiltered effluent.

Many of the soils of Rock County have potential for more intensive production of specialty crops. Examples are the deep silty soils of the Plano and St. Charles series, which are suited to vegetables and other truck crops. Nearly level and gently sloping soils of the Warsaw and Dresden series are suited to irrigation and could be used for intensive production of vegetables and truck crops if irrigated. Many of these soils that should be used for farming also are well suited to most other uses and lie in the corridor of urban expansion in the Janesville-Beloit area. The outwash deposits in this area are also the most productive source of ground water in the county. These deposits are several hundred feet

thick in the buried Rock River Valley and have great saturated thickness, high permeability, and high storage capacity. These glacial deposits are recharged directly by precipitation and by ground water moving into these unconsolidated deposits from the bedrock aquifers. Any development in this area should protect this valuable resource.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Rock County, where they are located, and how they can be used (*11*). The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Kidder and Plano, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Lorenzo loam, 0 to 2 percent slopes, is one of several phases within the Lorenzo series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit, soil complexes, is shown on the soil map of Rock County.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Rodman-Lorenzo complex, 6 to 12 percent slopes, eroded.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rock land is a land type in Rock County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Rock County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The nine soil associations in Rock County are discussed in the following pages.

1. Kidder-St. Charles association

Deep, well drained and moderately well drained, nearly level to steep soils that have a sandy clay loam to silty clay loam subsoil; over sandy loam glacial till

This association consists of soils on till plains that have a

few hills and kettles. It covers about 19 percent of the county.

The Kidder soils make up about 26 percent of this association; the St. Charles soils, 17 percent; and minor soils, the remaining 57 percent (fig. 4).

The Kidder soils are on till plains, are nearly level to steep, and are well drained. The surface layer is silt loam. The subsoil is loam and clay loam in the upper part and sandy clay loam and sandy loam in the lower part. The substratum is gravelly sandy loam glacial till and is at a depth of about 30 inches.

The St. Charles soils are on till plains, are nearly level to moderately steep, and are well drained and moderately well drained. The surface layer is silt loam. The subsoil is silt loam and silty clay loam in the upper part, silt loam in the middle part, and sandy clay loam in the lower part. The substratum is gravelly sandy loam glacial till and is at a depth of about 65 inches.

Among the minor soils in this association are the Casco, Dresden, Griswold, Lorenzo, Oshtemo, Plano, Ringwood, Rodman, and Rotamer soils. Other soils, in drainageways and depressions, are the Brookston, Colwood, Elburn, Houghton, Locke, Mahalasville, and Palms soils. In addition, the association contains a small area of well-drained soils that are underlain by sand and gravel outwash. On the general soil map of the published soil survey for Walworth County, these well-drained soils are shown as extending to the Rock County line, but the area is too small to be shown on the general soil map for Rock County.

In the northern part of Rock County, where the Kidder-St. Charles association adjoins Dane County, there is a narrow strip that consists mainly of Dresden and Warsaw soils. These soils are similar to the Kegonsa and Batavia, gravelly substratum, soils that have been mapped in Dane County and are underlain by similar material; that is, sand and gravel. At three points along the Dane County line, soils in that county that are underlain by glacial till extend into the Kidder-St. Charles association, which also consists mainly of soils underlain by glacial till.

Most of this association is cultivated and used to grow corn, soybeans, small grains, and legumes. Much of the acreage is used for dairy farming. Many areas of the steeper soils, especially on the Johnstown Mocaine, are in woods.

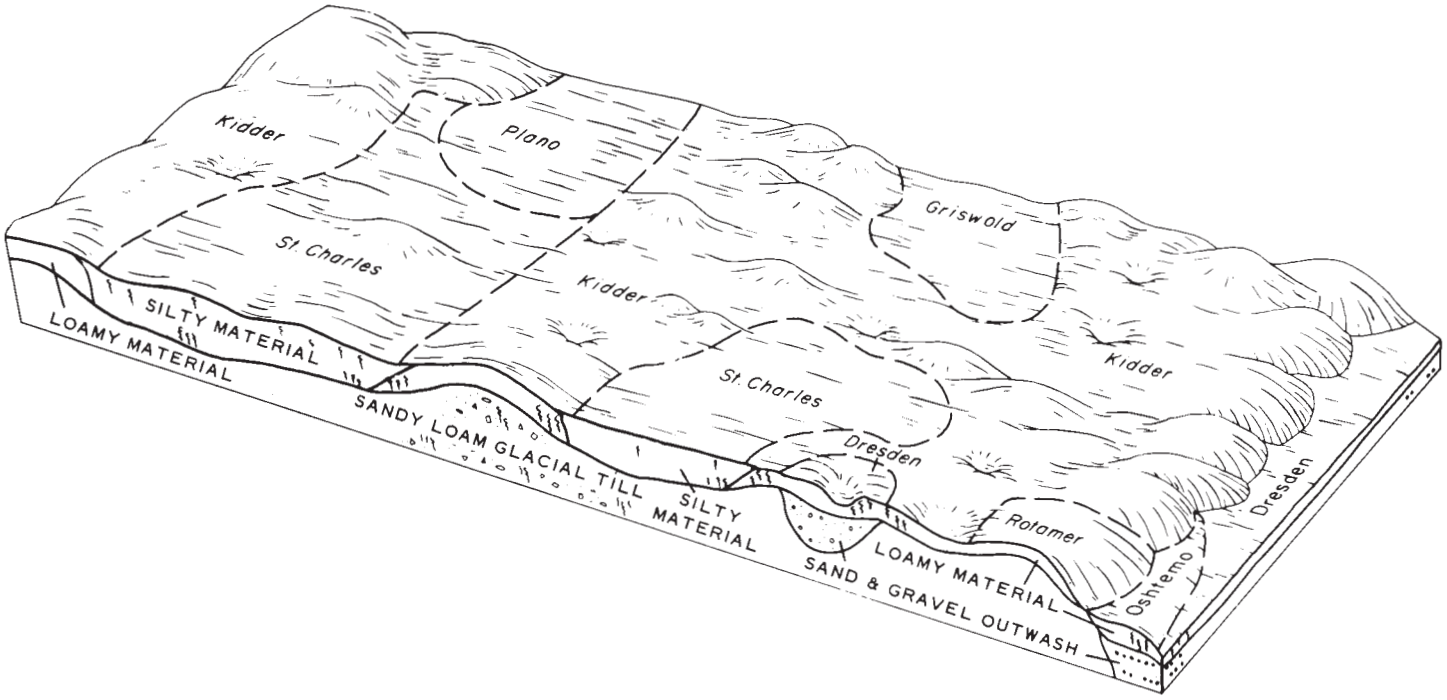

Figure 4.—Relationship of soils and underlying material in association 1.

Controlling erosion and maintaining good tilth and available water are the main concerns in managing the dominant soils for cultivation (fig. 5). The wet soils, which generally are in drainageways and depressions, need drainage for dependable crop production.

The major soils in this association that have slopes of less than 6 percent have no serious limitations for use as homesites and septic tank filter fields.

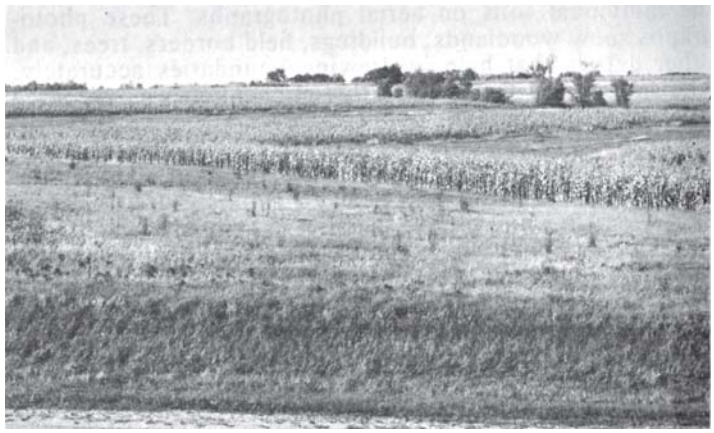

Figure 5.—Stripcropping on gently sloping Kidder soils of association 1.

2. Dresden-St. Charles-Warsaw association

Moderately deep and deep, well drained and moderately well drained, nearly level to steep soils that have a sandy clay loam to silty clay loam subsoil; over stratified sand and gravel

Among the minor soils in this association are the Casco, Hebron, Kidder, Lorenzo, Oshtemo, Plano, Rodman, Rotamer, Sisson, and Zurich soils. Other minor soils, in drainageways and depressions, are the Adrian, Houghton, Kane, Otter, Palms, and Sebewa soils.

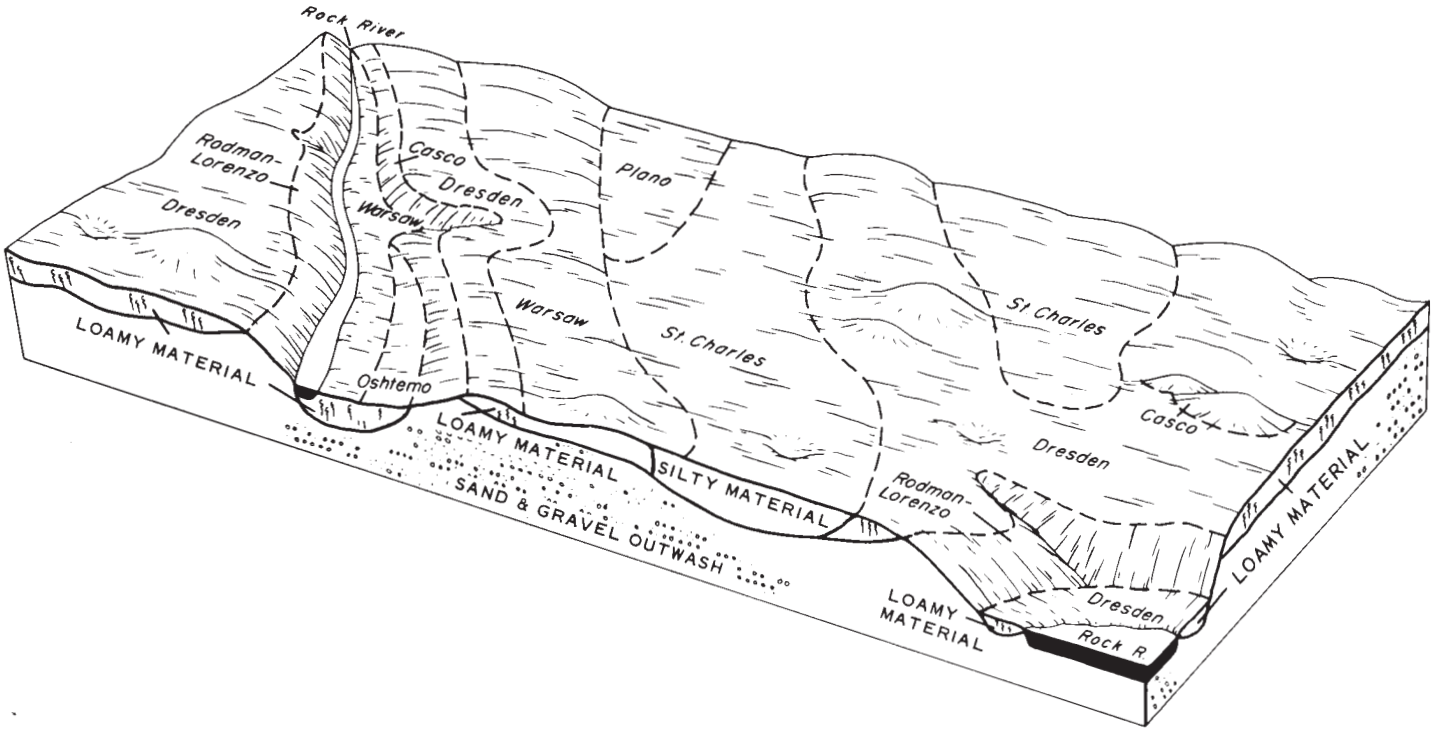

Figure 6.—Relationship of soils and parent material in association 2.

This association consists of soils on outwash plains that have a few hills and kettle holes (fig. 6). It is especially steep along the Rock River drainage basin. It covers about 6 percent of the county.

The Dresden soils make up about 40 percent of the association; the St. Charles soils, 20 percent; the Warsaw soils, 10 percent; and minor soils, the remaining 30 percent.

The Dresden soils are on outwash plains and terraces, are nearly level to steep, and are well drained. The surface layer is silt loam. The subsoil is loam in the upper part, clay loam in the middle part, and gravelly sandy clay loam in the lower part. Stratified sand and gravel is at a depth of about 34 inches.

The St. Charles soils are on outwash plains and terraces, are nearly level to sloping, and are well drained and moderately well drained. The surface layer is silt loam. The subsoil is silt loam in the upper part, silty clay loam in the middle part, and loamy sand and gravelly loamy sand in the lower part. Stratified sand and gravel is at a depth of about 52 inches.

The Warsaw soils are on outwash plains and terraces, are nearly level to sloping, and are well drained. The surface layer is silt loam in the upper part and loam in the lower part. The subsoil is loam and clay loam in the upper part and sandy clay loam and gravelly sandy clay loam in the lower. Stratified sand and gravel is at a depth of about 36 inches.

Most of this association is cultivated and used to grow corn, soybeans, small grains, and legumes. Much of the acreage is used for dairy farming. Many areas of the steeper soils are in woods. Controlling erosion and maintaining good tilth and available water are the main concerns in managing the better drained soils. Soils of the Dresden and Warsaw series are well suited to irrigation and if irrigated, have potential for intensive production of vegetables and truck crops. Soils of the St. Charles series are also well suited to truck crops. There are good sources of sand and gravel in this association (fig. 7). The wet soils, which generally are in drainageways and depressions, need drainage for dependable crop production.

Because of the porous substratum, there is danger of ground water pollution by effluent from septic tanks.

3. Plano-Warsaw-Dresden association

Deep and moderately deep, well drained and moderately well drained, nearly level to sloping soils that have a silty clay loam to sandy clay loam subsoil; over stratified sand and gravel

This association consists of soils on broad, mostly flat

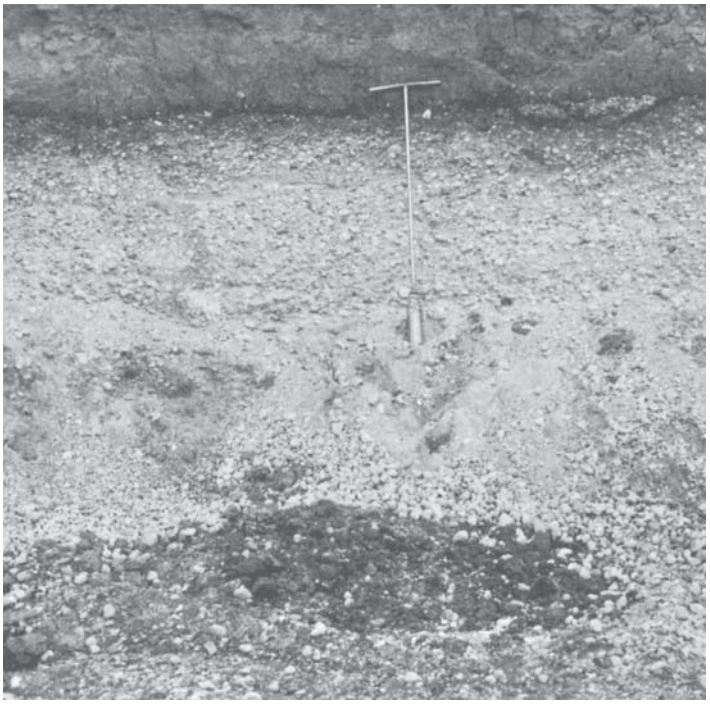

Figure 7.—Profile of a Dresden soil of association 2, exposed in a gravel pit, showing the substratum of stratified sand and gravel.

outwash plains and stream terraces (fig. 8). It covers about 24 percent of the county.

The Plano soils make up about 35 percent of the association; the Warsaw soils, 22 percent; the Dresden soils, 8 percent; and minor soils, the remaining 35 percent.

The Plano soils are on outwash plains and terraces, are nearly level to sloping, and are well drained and moderately well drained. The surface layer is silt loam. The subsoil is silt loam in the upper part, silty clay loam in the middle part, and gravelly sandy clay loam and gravelly sandy loam in the lower part. Stratified sand and gravel is at a depth of about 57 inches.

The Warsaw soils are on outwash plains and terraces, are nearly level to sloping, and are well drained. The surface layer is silt loam in the upper part and loam in the lower part. The subsoil is loam and clay loam in the upper part and sandy clay loam and gravelly sandy clay loam in the lower part. Stratified sand and gravel is at a depth of about 36 inches.

The Dresden soils are on outwash plains and terraces, are nearly level to sloping, and are well drained. The surface layer is silt loam. The subsoil is loam in the upper part, clay loam in the middle part, and gravelly sandy clay loam in the lower part. Stratified sand and gravel is at a depth of about 34 inches.

Among the minor soils in this association are the Casco, Elburn, Kidder, Lorenzo, Mahalasville, Oshtemo, Plano, loamy variant, Rodman, St. Charles, Troxel, and Worthen soils, as well as the Oshtemo soils, dark variant. Alluvial land, wet, also is in this association.

Most of this association is cultivated and used to grow corn, soybeans, small grains, and legumes (fig. 9). Much of the acreage is used for the production of corn. Dairy farming is not so common here as in the more rolling parts of the county. The less sloping soils can be cropped intensively if the organic-matter content and good tilth are maintained.

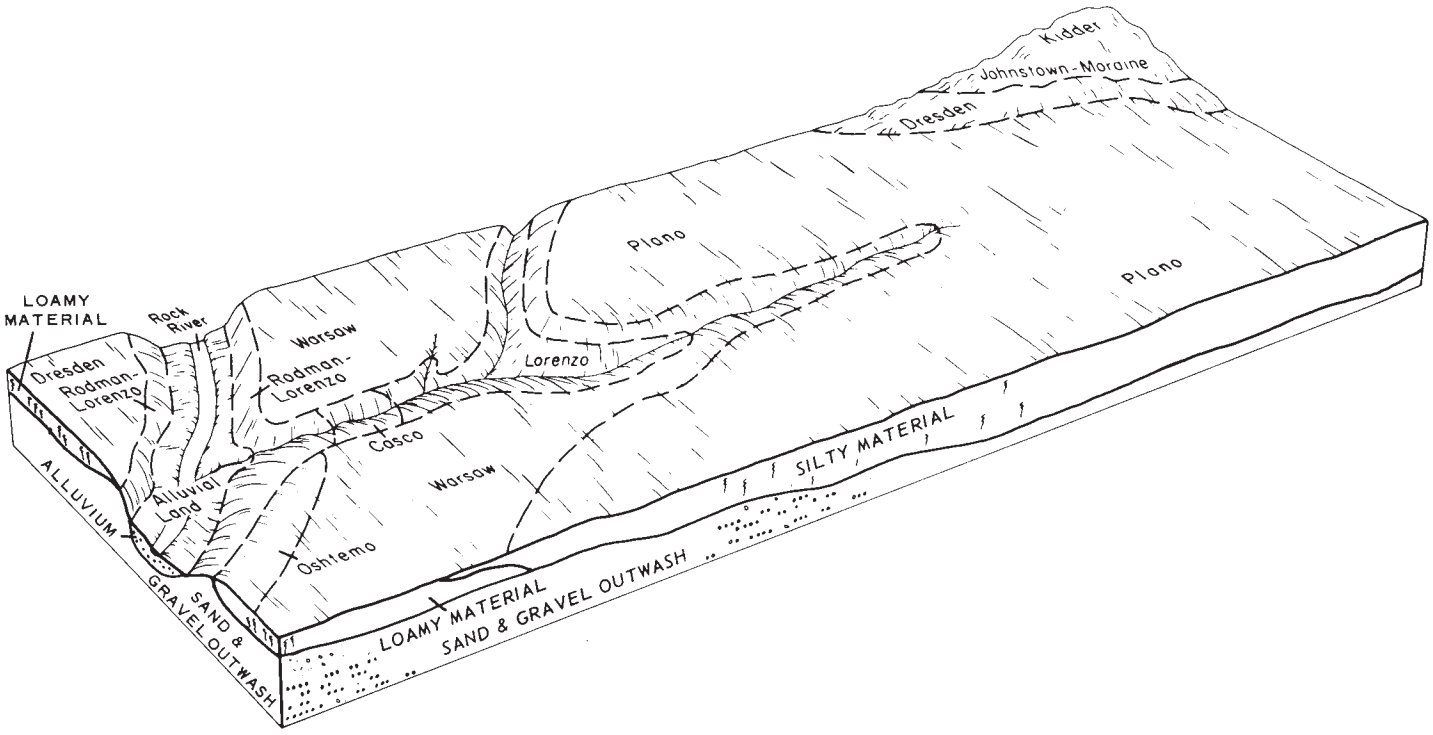

Figure 8.—Relationship of soils and underlying material in association 3.

The more sloping soils are subject to erosion. Both Dresden and Warsaw soils are well suited to irrigation and have potential for intensive production of vegetable and truck crops if irrigated. Soils of the Plano series are also suited to truck crop production. There are many good sources of sand and gravel in this association, and there are numerous large gravel pits in the Janesville and Beloit areas (fig. 10). The wet soils, which generally are in drainageways and depressions, need drainage for dependable crop production.

Because of the porous substratum, there is some danger of ground water pollution by effluent from septic tank filter fields.

4. Sebewa-Kane association

Moderately deep, poorly drained and somewhat poorly drained, nearly level and gently sloping soils that have a mainly clay loam to loam subsoil; over stratified sand and gravel

This association consists of soils on broad outwash plains and terraces. It covers about 5 percent of the county.

The Sebewa soils make up about 30 percent of the association; the Kane soils, 25 percent; and minor soils, the remaining 45 percent.

The Sebewa soils are on outwash plains and terraces, are nearly level, and are poorly drained. The surface layer is silt loam in the upper part and clay loam in the lower part. The subsoil is clay loam in the upper part and gravelly clay loam in the lower part. Stratified sand and gravel is at a depth of about 30 inches.

The Kane soils are on outwash plains and terraces, are nearly level to gently sloping, and are somewhat poorly drained. The surface layer is loam. The subsoil is loam in the upper part, clay loam in the middle part, and sandy loam in the lower part. Stratified sand and gravel is at a depth of about 34 inches.

Among the minor soils in this association are the Adrian, Aztalan, Colwood, Dresden, Houghton, Mahalasville, Maumee, Navan, Otter, and Westville soils. This association contains large areas of muck soils near Hanover and Evansville.

Most of this association is cultivated and used to grow corn, soybeans, small grains, and legumes. Wet soils in this association that have not been drained are in pasture or wildlife habitat. Proper drainage is the main concern in managing the wet soils for dependable crop production. The loose sand that underlies the Kane and Sebewa soils can clog tile lines unless precautions are taken to prevent the sand from entering the tile. Open-ditch drainage is common in these soils. If excessively drained, the major soils of this association lose the beneficial effects of free water in the lower part of the soil. Proper control of the water level in drainage ditches provides subsurface irrigation for general farm crops during dry periods and for specialty crops susceptible to foliage diseases from the wetness caused by overhead irrigation.

Figure 9.—Large area of Plano and Warsaw soils of association 3. Few trees grow on this natural grassland, and farming is intensive.

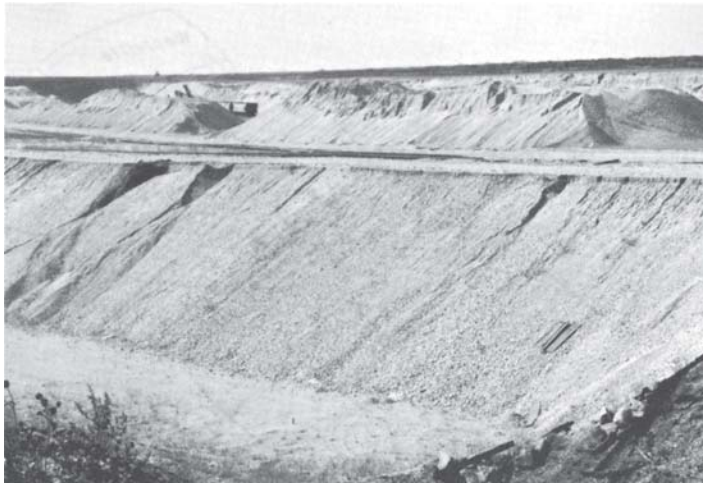

Figure 10.—Large gravel pit near Janesville. The gravel is of good quality. It underlies some of the Plano soils of association 3.

5. Pecatonica-Ogle-Durand association

Deep, well drained and moderately well drained, nearly level to sloping soils that have a silty clay loam to sandy clay loam subsoil; over sandy loam glacial till

This association consists of soils on till plains (fig. 11). It covers about 12 percent of the county.

The Pecatonica soils make up about 15 percent of this association; the Ogle soils, 14 percent; the Durand soils, 11 percent; and minor soils, the remaining 60 percent.

The Pecatonica soils are on till plains, are nearly level to sloping, and are well drained and moderately well drained. The surface layer is silt loam. The subsoil is silty clay loam in the upper part, clay loam in the middle part, and sandy clay loam in the lower part. Gravelly sandy loam glacial till is at a depth of about 66 inches.

The Ogle soils are on till plains, are nearly level and gently sloping, and are well drained. The surface layer is silt loam. The subsoil is silt loam and silty clay loam in the upper part, clay loam in the middle part, and sandy clay loam in the lower part. Gravelly sandy loam glacial till is at a depth of more than 96 inches.

The Durand soils are on till plains, are nearly level to sloping, and are well drained and moderately well drained. The surface layer is silt loam. The subsoil is silty clay loam in the upper part, clay loam in the middle part, and sandy clay loam in the lower part. Gravelly sandy loam glacial till is at a depth of about 68 inches.

Among the minor soils in this association are the Edmund, Flagg, Griswold, Kidder, Ringwood, Rockton, West-

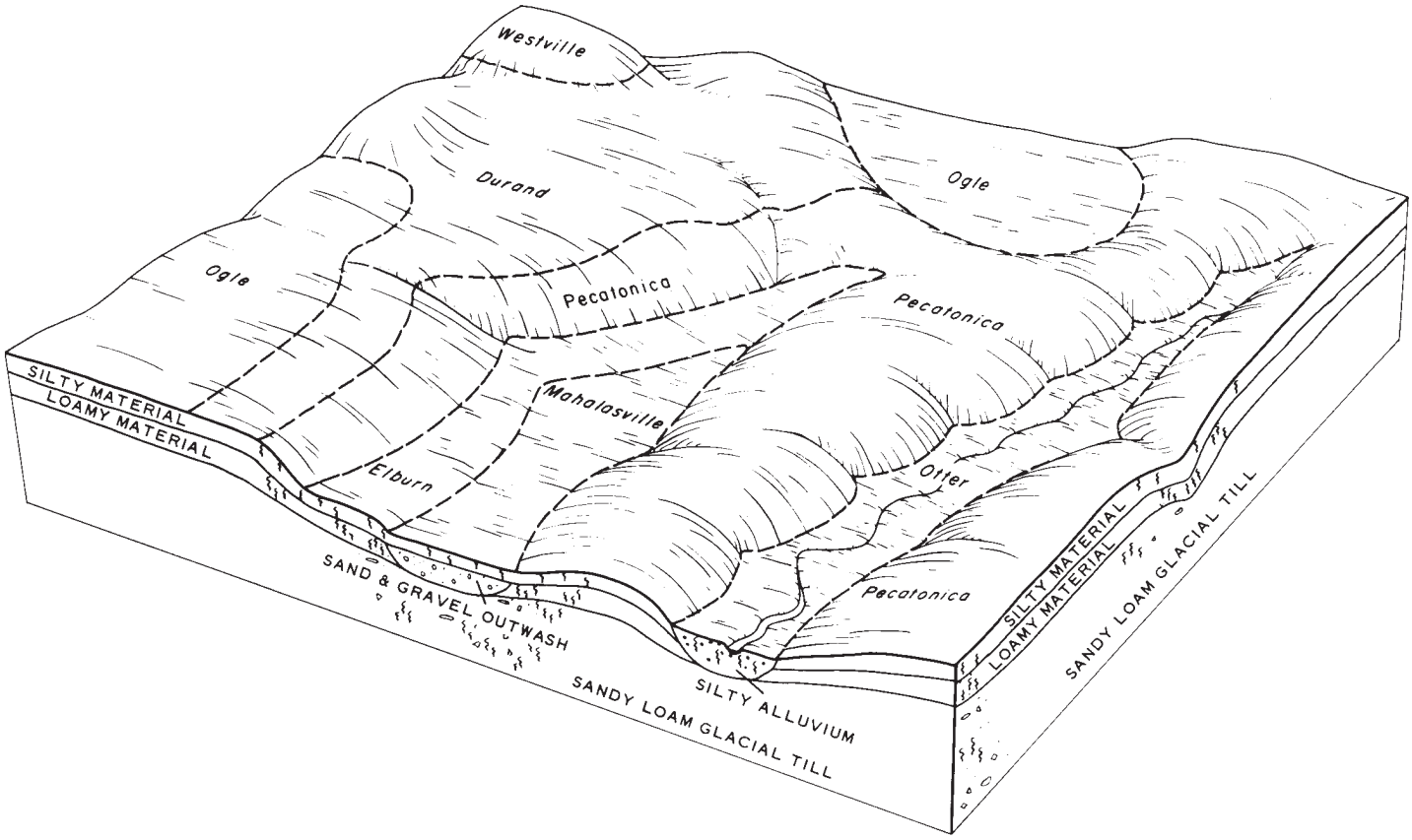

Figure 11.—Relationship of soils and parent material in association 5.

ville, and Winnebago soils. Other minor soils, in drainageways and depressions, are the Elburn, Mahalasville, and Otter soils. In addition, the association contains a small area of poorly drained soils along Turtle Creek. On the general soil map of the published soil survey for Walworth County these poorly drained soils are shown as extending to the Rock County line, but the area is too small to be shown on the general soil map for Rock County.

The soils in the northern part of this association have a thick, dark-colored surface layer, and this area was probably natural grassland before settlement. The soils in the southern part of the association have a thinner, dark-colored surface layer, and this area was probably wooded before being cleared.

Most of this association is cultivated and used to grow corn, soybeans, small grains, and legumes. Much of the acreage is used for dairy farming. Controlling erosion and maintaining good tilth and available water are the main concerns in managing the better drained soils for cultivation. The wet soils, which generally are in drainageways and depressions, need drainage for dependable crop production. These soils also have potential for more intensive production of vegetable and truck crops.

The major soils in this association that have slopes of less than 6 percent have no serious limitations for use as homesites and septic tank filter fields.

6. Edmund-Rockton-Whalan association

Shallow and moderately deep, well-drained, nearly level to very steep soils that have a mainly clay and clay loam subsoil; over dolomite bedrock

This association consists of soils on ridgetops and side slopes in areas of the county that have been most deeply incised by natural drainageways (fig. 12). It covers about 23 percent of the county.

The Edmund soils make up about 18 percent of this association; the Rockton soils, 12 percent; the Whalan soils, 10 percent; and minor soils, the remaining 60 percent.

The Edmund soils are on ridgetops and side slopes, are gently sloping to very steep, and are well drained. The surface layer is loam. The subsoil is clay loam in the upper part and clay in the lower part. Dolomite is at a depth of about 17 inches.

The Rockton soils are on ridgetops and side slopes, are gently sloping to moderately steep, and are well drained. The surface layer is loam. The subsoil is loam in the upper part and clay loam in the lower part. Dolomite is at a depth of about 27 inches.

The Whalan soils are on ridgetops and side slopes, are nearly level to moderately steep, and are well drained. The surface layer is loam. The subsoil is loam in the upper part, clay loam in the middle part, and clay in the lower part. Dolomite is at a depth of about 36 inches.

Among the minor soils in this association are the Dresden, Durand, Eleva, Gotham, Griswold, Ogle, Oshtemo, Sogn, Westville, and Winnebago soils, as well as soils of the Gotham series, bedrock variant. Other minor soils, in drain-

ageways and depressions, are the Elburn, Kane, Mahalasville, Otter, Sebewa, Troxel, and Worthen soils. Kidder soils commonly occur on side slopes in association with Edmund, Rockton, and Whalan soils.

The soils in the southern part of this association are more sandy in the surface layer and upper part of the subsoil than are the soils in the rest of the association.

Much of this association is cultivated and used to grow corn, small grains, and legumes. Much of the acreage is used for dairy farming. Many of the moderately steep, steep, and very steep areas and areas where the soils are thin over bedrock are wooded. Controlling erosion and maintaining good tilth and available water are the main concerns in managing the better drained soils for cultivation. The wet soils, which generally are in drainageways and depressions, need drainage and protection from flooding for dependable crop production. There are numerous dolomite quarries in this soil association (fig. 13).

The major soils of this association are not suitable for septic tank filter fields. There is a danger of ground water contamination by unfiltered effluent moving through natural fissures and crevasses in the dolomite.

7. Mahalasville-Elburn association

Deep, poorly drained and somewhat poorly drained, nearly level and gently sloping soils that have a mainly silty clay loam and silt loam subsoil; over sandy loam and sand and gravel

This association consists of soils in drainageways, depressions, and old lake basins. It covers about 3 percent of the county.

The Mahalasville soils make up about 40 percent of this association; the Elburn soils, 25 percent; and minor soils, the remaining 35 percent.

The Mahalasville soils are in drainageways, depressional areas, and old lake basins. They are nearly level and are poorly drained. The surface layer is silt loam in the upper part and silty clay loam in the lower part. The subsoil is silty clay loam in the upper part and silt loam in the lower part. The substratum, which begins at a depth of about 60 inches, is silt loam in the upper part and stratified sand and gravel in the lower part.

The Elburn soils are in drainageways, depressional areas, and old lake basins. These soils are nearly level and gently sloping and are somewhat poorly drained. The surface layer is silt loam. The subsoil is silty clay loam in the upper part, silt loam in the middle part, and loam and sandy loam in the lower part. Gravelly sandy loam glacial till is at a depth of about 70 inches.

Among the minor soils in this association are the Adrian, Durand, Hayfield, Houghton, Marshan, Ogle, Palms, Pecatonica, St. Charles, and Sebewa soils.

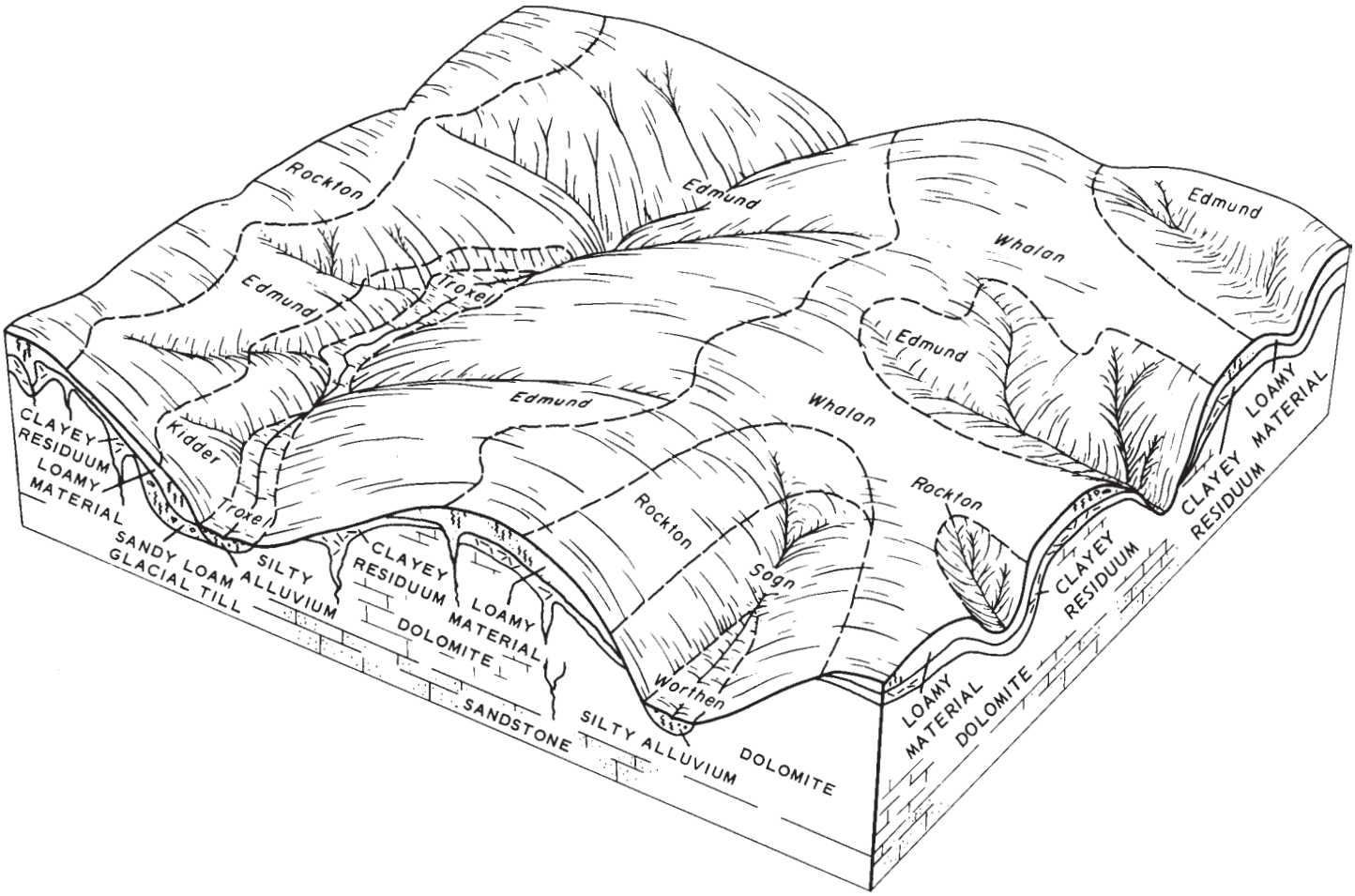

Figure 12.—Relationship of soils and underlying material in association 6.

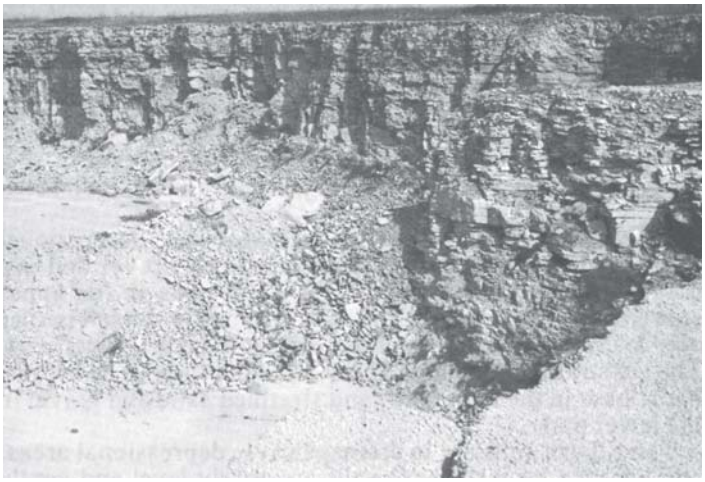

Figure 13.—Dolomite quarry in soil association 6. This quarry is in an area of Sogn soils, which are shallow over dolomite.

Most of this association is cultivated and used to grow corn, soybeans, small grains, and legumes. Wet soils in this association that have not been drained are in pasture or wildlife habitat. Proper drainage is the main concern in managing the wet soils for dependable crop production (fig. 14).

8. Colwood-Sebewa association

Moderately deep and deep, poorly drained, nearly level soils that have a mainly clay loam subsoil; over stratified silt and fine sand lacustrine deposits and sand and gravel outwash deposits

This association consists of soils on broad outwash plains, terraces, and old lake basins. It covers about 4 percent of the county.

The Colwood soils make up about 20 percent of this association; the Sebewa soils, 17 percent; and minor soils, the remaining 63 percent.

The Colwood soils are on old lake basins, are nearly level, and are poorly drained. The surface layer is silt loam in the upper part and loam in the lower part. The subsoil is clay loam in the upper part and sandy loam in the lower part. Stratified silt and fine sand is at a depth of about 35 inches.

The Sebewa soils are on outwash plains and terraces, are nearly level, and are poorly drained. The surface layer is silt loam in the upper part and clay loam in the lower part. The subsoil is clay loam in the upper part and gravelly clay loam

Figure 14.—View of part of soil association 7 near the flood plains of the Sugar River. Nearly level Mahalasville and Elburn soils are in the background.

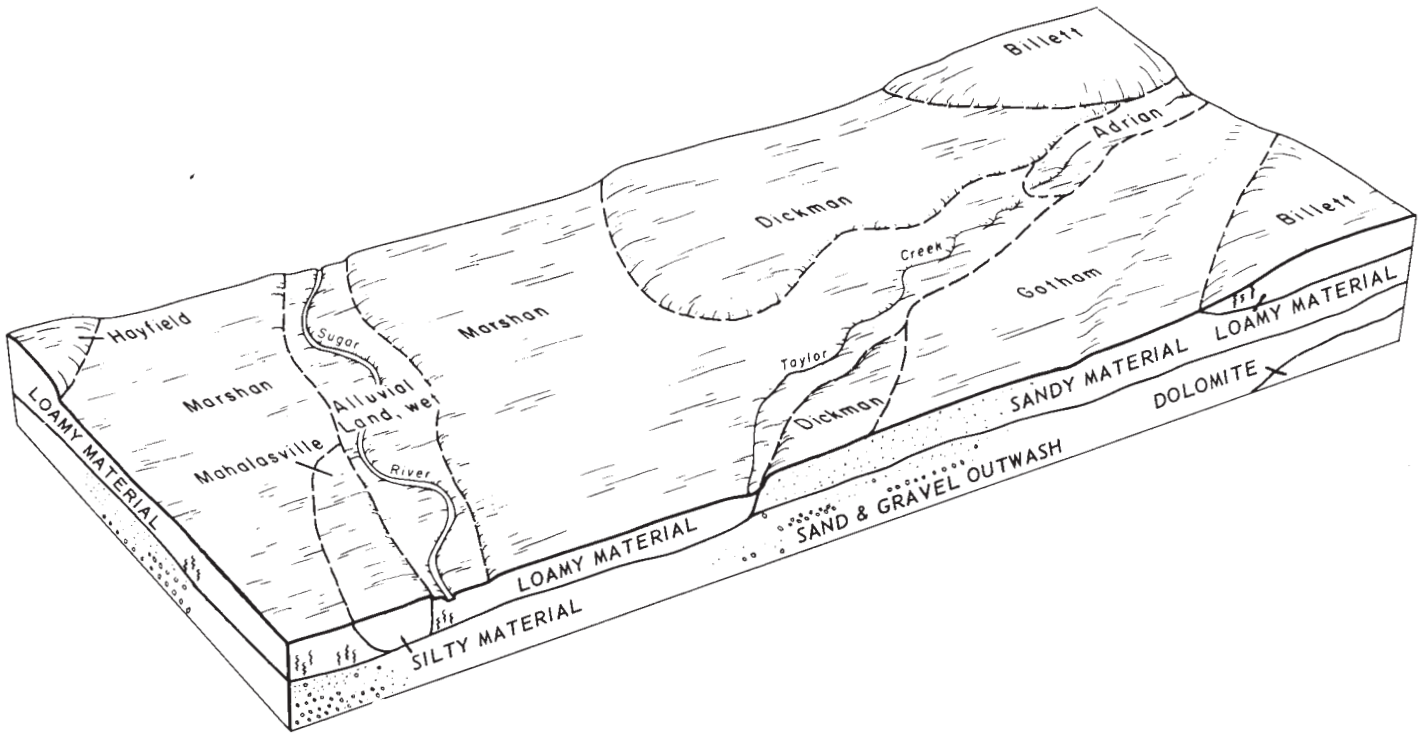

Figure 15.—Relationship of soils and parent material in association 9.

in the lower part. Stratified sand and gravel is at a depth of about 30 inches.

Among the minor soils in this association are the Adrian, Aztalan, Darroch, Hebron, Houghton, Jasper, Kane, Kidder, Mahalasville, Otter, Palms, Sisson, Wauconda, Westville, and Zurich soils.

Most of this association is cultivated and used to grow corn, soybeans, small grains, and legumes. Wet soils in this association that have not been drained are in pasture or wildlife habitat. Proper drainage is the main concern in managing the wet soils for dependable crop production. The lacustrine soils, such as Colwood soils, are underlain by silt and fine sand that have a tendency to flow when wet or under pressure. Such soils have a limitation for tile drainage and for use as building sites and road beds. The loose sand that underlies the Sebewa soils also clogs tile lines unless precautions are taken to prevent the sand from entering the tile. Open-ditch drainage is common in these soils.

9. Marshan-Gotham-Dickman association

Moderately deep and deep, somewhat excessively drained and poorly drained, nearly level and gently sloping soils that have a mainly clay loam and loamy sand subsoil; over sand or stratified sand and gravel

This association consists of soils on outwash plains and broad terraces (fig. 15). It covers about 4 percent of the county.

The Marshan soils make up about 22 percent of this association; the Gotham soils, 18 percent; the Dickman soils, 13 percent; and minor soils, the remaining 47 percent.

The Marshan soils are in the lowest parts of outwash plains and terraces, are nearly level, and are poorly drained. The surface layer is loam in the upper part and clay loam in the lower part. The subsoil is clay loam in the upper part and sandy clay loam in the lower part. Loose sand that has some gravel is at a depth of about 37 inches.

The Gotham soils are on outwash plains and terraces, are nearly level and gently sloping, and are somewhat excessively drained. The surface layer is loamy sand. The subsoil is loamy sand in the upper part and loose sand in the lower part. Loose sand is at a depth of about 38 inches.

The Dickman soils are on terraces, are nearly level and gently sloping, and are somewhat excessively drained. The surface layer is sandy loam. The subsoil is loamy sand in the upper part and loose sand in the lower part. Loose sand is at a depth of about 36 inches.

Among the minor soils in this association are the Adrian, Billett, Hayfield, Mahalasville, and Watseka soils and the Billett soils, mottled subsoil variant. Alluvial land, wet, also occurs in this association. In addition, the association contains a small area of well-drained soils that are underlain by glacial till and another area of poorly drained, silty soils along the Sugar River. On the general soil map of the published soil survey for Green County, these areas are shown as extending to the Rock County line, but these areas are too small to be shown on the general soil map for Rock County.

Most of this association is cultivated and used to grow corn and soybeans. Some of the acreage is in pasture.

The Dickman and Gotham soils are subject to soil blowing. They have low natural fertility and low available water capacity but are suitable for irrigation. If irrigated these soils are suited to more intensive production of crops, including certain vegetable crops. The Marshan soils need drainage for dependable crop production and are subject to ponding and flooding.

Use and Management of the Soils

This section contains information about the use and management of the soils of Rock County for crops and pasture, woodland, recreation, wildlife, and engineering. It explains the system of capability classification used by the Soil Conservation Service and gives predicted yields of the principal crops grown in the county under improved management.

This section also groups the soils according to their suitability for woodland and wildlife habitat. It contains tables that give ratings of the soils for farm and nonfarm uses and for recreation, and it contains a subsection that gives information about soils that is significant in engineering.

Management for Crops and Pasture

Minimum tillage, the addition of organic matter to the soil, and the use of grasses and legumes in the cropping system help to maintain or improve soil tilth. Overtillage and traffic with farm machinery compact the soil and alter tilth, especially when the soils are wet. Also, seedbeds that have been raked too smooth are susceptible to soil blowing during dry periods and to puddling and crusting after rain. Sandy soils and muck soils are especially susceptible to soil blowing if cultivated. Plow planting, a practice in which the field is plowed and planted in one operation, is a good way to minimize tillage. Chemical weed control also is helpful.

Any given field may contain several soils that differ in acidity. Generally, the deep, well-drained, permeable soils, such as those of the Flagg, Plano, and St. Charles series, need the heaviest applications of lime. Shallow soils, such as those of the Casco and Lorenzo series, need lesser amounts. Some of the soils, such as those of the Rodman series and the Rotamer series, thin variant, are very shallow and do not need lime. Generally, poorly drained soils, such as those of the Millington and Otter series, need little or no lime.

The amount and kind of fertilizer to apply depend on the supply of plant nutrients in the soil, the ability of the soil to hold nutrients, the amount of available water, the kinds of crops to be grown, and the crop rotation. Where the need for lime and fertilizer is indicated in the suggestions for management, the amount of lime and the kind and amount of fertilizer to apply should be determined by soil tests. Indirect benefits from higher levels of fertility are the production of more plant litter and organic matter, which reduce erosion and promote good soil tilth.

An adjective rating of available water capacity to a depth of 5 feet of soil or to bedrock is given for each series in the capability unit descriptions. These ratings are defined in the Glossary. These ratings and the actual inches of available water also are listed for each series in the section "Descriptions of the Soils." As an example, assuming that alfalfa and corn require 0.3 inch of water per day during their period of peak use, the number of days that a given soil will support these crops without rainfall can be determined. Thus, the soils that have a high available water capacity (between 9 and 12 inches) will support these crops for 30 to 40 days without rain, if the moisture content of the soils is at field capacity at the start of this period.

In contrast, soils that have a low available water capacity (between 3 and 6 inches) will support these crops for only 10 to 20 days without rain under similar conditions. This is an important consideration in determining levels of fertilization and population of plants where no irrigation is planned. A high level of fertilization is generally not justified on soils that have very low or low available water capacity, because crop growth is limited by the available water capacity. In addition, the soils that have very low and low available water capacity are coarse textured or have a thin solum. Excessive nitrate fertilizer added to these soils may be quickly leached from the soil and contaminate the ground water.

In planning a cropping system, the soils of the entire farm must be considered. Soils that have few or only slight limitations can be cropped intensively; that is, row crops can be grown year after year, or frequently in rotation with small grains. The cropping system should be planned to protect the soil and minimize damage. For example, the plant cover is generally thinner on Lorenzo soils than on Warsaw soils and provides less protection against erosion and returns less organic matter to the soil. To overcome this deficiency, a cropping system for Lorenzo soils should include a larger proportion of grasses and legumes than one used on Warsaw soils. Wet soils, such as Millington and Otter soils, that in many places cannot be adequately drained are generally better suited to forage crops than to cultivated crops.

Practices that effectively control water erosion are terracing, grassed waterways, stripcropping, contour tillage, minimum tillage, growing sod crops or cover crops in rotations, and returning crop residue to the soil.

Practices that help to control soil blowing are stripcropping at right angles to the direction of prevailing winds, stubble mulching, leaving crop residue on the surface, growing cover crops or meadow crops, establishing shelterbelts, and controlling drainage in organic soils and soils underlain by loose sands. These practices are effective on such soils as the Dickman, Gotham, and Houghton soils. Many of these practices also help to catch snow and add moisture to the soil.

Drainage can be improved on most of the wet soils if there are suitable outlets. Soils, such as those of the Brookston, Elburn, and Mahalasville series, respond well to both tile and surface drainage. Soils such as those of the Kane, Marshan, and Sebewa series generally are not suited to tile drainage, but they respond well to surface and open-ditch drainage. Soils on flood plains need protection from flooding, in addition to surface drainage.

Most upland pastures on well-drained soils of classes II, III, IV, and VI need renovating. A good seedbed should be prepared, and a suitable mixture of grasses and legumes seeded. Examples of suitable mixtures for seeding are alfalfa with bromegrass or timothy and birdsfoot trefoil with bromegrass or timothy

Large amounts of phosphorus and potassium are needed at the time of seeding. Nitrogen should be applied as a top-dressing, especially if grasses are dominant in the pasture. Annual applications of fertilizer, or renovation of permanent pasture every 5 years, helps to maintain forage of good quality. Rotation of grazing protects and extends the life of the forage plants.

In Rock County the only soil in class V has a high water table and is subject to flooding. Tillage is not practical, and renovation is not feasible. Soils such as this are generally kept in reed canarygrass or bromegrass. The areas should be grazed only in dry seasons; hummocks, which hinder surface drainage, develop if the soil is grazed when wet.

Pastures on soils of class VI are difficult to renovate, and soils of class VII are not suitable for renovation. Tillage is not practical, and these soils are generally kept in native vegetation. Control of grazing and addition of commercial fertilizer are ways to maintain fertility and plant cover.

Topdressing these soils with fertilizer each year is better than renovating the pasture because the sod does not need to be plowed when applying the fertilizer.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, 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, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture or range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, but not in Rock County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

For additional information about capability grouping, see Agriculture Handbook No. 210, "Land Capability Classification" (*13*).

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-7. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages, the capability units in Rock County are described and suggestions for use and management of the soils in each unit are given. The capability units are not numbered consecutively, because not all of the units used in Wisconsin are in this county. The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all soils of a given series are in the unit. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I-2

This unit consists of deep, nearly level and gently sloping soils of the Juneau, Troxel, and Worthen series. These are well drained and moderately well drained, silty soils that formed in alluvium and colluvium. They are moderately permeable. Available water capacity is high or very high, and natural fertility is high. These soils are subject to occasional flooding of short duration. They are saturated with water at depths of 3 to 5 feet in wet periods. These soils are easily worked and are easy to keep in good tilth. They have few limitations.

These soils can be used intensively for corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture. Response is good to heavy applications of fertilizer, and the soils can support a large population of plants. If these soils are properly fertilized and if minimum tillage is used to return the crop residue, row crops can be grown year after year without deterioration of soil tilth and without the organic-matter content seriously decreasing.

CAPABILITY UNIT I-3

This unit consists of deep, nearly level soils of the Flagg, Ogle, Plano, St. Charles, and Zurich series. These well drained and moderately well drained, silty soils are underlain by gravelly sandy loam, stratified sand and gravel, or stratified silt and fine sand. They generally are moderately permeable, but the Plano and St. Charles soils that have a gravelly substratum are rapidly permeable in the substra-

tum. In all the soils of this unit, available water capacity is high and natural fertility is moderate or high. Plano, St. Charles, and Zurich soils are saturated with water at depths of 3 to 5 feet in wet periods. These soils are easily worked and have few limitations. The Ogle and Plano soils have a higher organic-matter content than the other soils and are easier to keep in good tilth.

Soils in this unit can be used intensively for corn, soybeans, small grains, hay, and vegetable crops (fig. 16). They also are well suited to pasture. Response is good to heavy applications of fertilizer, and the soils can support a large population of plants. If these soils are properly fertilized, if minimum tillage is used, and if crop residue is returned, row crops can be grown year after year without damaging soil tilth and depleting organic matter.

Figure 16.—Field of nearly level Plano soils, which are in capability unit I-3. If properly managed, these soils can be cropped intensively.

CAPABILITY UNIT I-4

This unit consists of deep, nearly level soils of the Durand, Griswold, Jasper, Kidder, Pecatonica, Plano, loamy variant, Sisson, Westville, and Winnebago series. These are well drained and moderately well drained, silty and loamy soils that are underlain by gravelly sandy loam, stratified sand and gravel, or stratified silt and fine sand. They are moderately permeable, though the Plano soil, loamy variant, is rapidly permeable in the substratum. In all the soils of this unit, available water capacity is medium or high and natural fertility is moderate or high. These soils are easily worked and have few limitations. Soils of the Durand, Pecatonica, and Winnebago series and the Plano series, loamy variant, are saturated with water at depths of 3 to 5 feet during wet periods. The Durand, Griswold, Jasper, Plano, loamy variant, and Winnebago soils have higher organic-matter content than the other soils and are easier to keep in good tilth.

These soils can be used intensively for corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture. Response to fertilizer is good, and the soils can support a large population of plants. The Griswold and Kidder soils do not respond as well as the other soils, because of their medium available water capacity. If the soils in this unit are properly fertilized, if minimum tillage is used, and if crop residue is returned, row crops can be grown year after year without tilth of the soil deteriorating and without the organic-matter content seriously decreasing.

CAPABILITY UNIT IIe-1

This unit consists mainly of deep, gently sloping soils of the Durand, Flagg, Griswold, Jasper, Kidder, Ogle, Pecatonica, Plano, Ringwood, Rotamer, St. Charles, Sisson, Westville, Winnebago, and Zurich series and the Plano series, loamy variant. Nearly level soils of the Hebron series also are in this unit. All the soils are well drained and moderately well drained, are silty and loamy, and are underlain by gravelly sandy loam, stratified sand and gravel, or stratified silt and fine sand. They are moderately permeable, except for the Hebron soils, which are moderately slowly permeable. In addition, Plano soils, loamy variant, and the Plano and St. Charles soils that have a loamy substratum are rapidly permeable in the substratum.

In all the soils of this unit, available water capacity is medium or high and natural fertility is moderate or high. The soils are easily worked where they have not been eroded. They are only slightly susceptible to erosion, but some areas that have been cropped have lost as much as 6 inches of the original surface layer through erosion. Soils of the Durand, Hebron, Pecatonica, Plano, St. Charles, Winnebago, and Zurich series and the Plano series, loamy variant, are saturated with water at depths of 3 to 5 feet in wet periods. The Durand, Griswold, Jasper, Ogle, Plano, Ringwood, and Winnebago soils and the Plano soils, loamy variant, have a higher organic-matter content than the other soils in this unit and are easier to keep in good tilth.

Under proper management, the soils in this unit are suited to corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture. A cropping system that includes contour farming, stripcropping, diversions, terraces, minimum tillage, and good management of residue helps to control erosion and to keep the soils in good tilth. Response is good to heavy applications of fertilizer, and the soils can support a large population of plants.

CAPABILITY UNIT IIe-2

This unit consists of moderately deep, gently sloping soils of the Dresden, Rockton, Warsaw, and Whalan series. These are well-drained, silty and loamy soils that are underlain by stratified sand and gravel or dolomite. They are moderately permeable. The Dresden and Warsaw soils are rapidly permeable in the substratum. Available water capacity is medium, and natural fertility is moderate. These soils are not saturated with water for periods long enough to affect crop growth. They are only slightly susceptible to erosion, but some areas that have been cropped have lost as much as 6 inches of the original surface layer through erosion. These soils are easily worked if they are not eroded. The Rockton and Warsaw soils have a higher organic-matter content than the other soils in this unit and are easier to keep in good tilth.

Under proper management, the soils in this unit are suited to corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture. A cropping system that includes contour stripcropping, diversions, terraces, minimum tillage, and good management of residue helps control erosion and maintain tilth. The Dresden and Warsaw soils are suited to irrigation, especially in the less sloping areas. If irrigated, these soils can be used for intensive production of truck crops.

CAPABILITY UNIT IIs-1

This unit consists of moderately deep, nearly level soils of the Dresden, Warsaw, and Whalan series. These well-drained, silty and loamy soils are underlain by stratified sand and gravel or dolomite. They are moderately permeable. The Dresden and Warsaw soils are rapidly permeable in the substratum. In all the soils in this unit, available water capacity is medium and natural fertility is moderate. The Rockton and Warsaw soils have a higher organic-matter content than the other soils in this unit and are easier to keep in good tilth. These soils are not saturated with water for periods long enough to affect crop growth. They are easily worked. Minimum tillage and good management of residue help to keep the soils in good tilth and to increase water infiltration.

These soils are suited to corn, soybeans, small grains, hay, vegetable crops, and pasture. The Dresden and Warsaw soils are well suited to irrigation. If irrigated, these soils are suited to intensive production of truck crops.

CAPABILITY UNIT IIw-1

This unit consists of deep, nearly level soils of the Brookston, Colwood, Mahalasville, Millington, Navan, and Otter series. These soils are poorly drained, silty and loamy, and are underlain by gravelly sandy loam, stratified silt and fine sand, stratified loam and sandy loam, or silty clay loam. They are moderately permeable, except for the Navan soils which are moderately slowly permeable. In all the soils of this unit, available water capacity is high and natural fertility is moderate or high. Ground water is at or near the surface throughout the year unless the soils are drained. These soils receive runoff from adjoining areas, and the Mahalasville, Millington, and Otter are subject to stream overflow unless protected.

If drained and protected from flooding, these soils are well suited to corn, soybeans, small grains, legumes, and vegetable crops. Tile drainage and deep ditches can be used to lower the water table if a suitable outlet is available. If tile drains are installed in the Colwood soil and in some areas of the Otter soil, precautions must be taken to prevent loose sand from entering and clogging the tile lines. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Adequate surface drainage removes surface water and prevents ponding. Response is good to heavy applications of fertilizer, and the soils can support a large population of plants. If these soils are properly fertilized, if they are cultivated at the proper moisture content, if minimum tillage is used, and if crop residue is returned, row crops can be grown year after year without destroying soil tilth and depleting organic matter. Undrained areas are suited to pasture.

CAPABILITY UNIT IIw-2

This unit consists of deep, nearly level and gently sloping soils of the Aztalan, Darroch, Elburn, Locke, and Wauconda series. These are somewhat poorly drained, silty and loamy soils that are underlain by stratified silt and clay, stratified silt and fine sand, stratified sand and gravel, or gravelly sandy loam. They are moderately permeable, except for the Aztalan soils, which are moderately slowly permeable. In all the soils of this unit, available water capacity is medium or high and natural fertility is moderate or high. These soils are saturated with water at depths of 1 to 3 feet in wet periods unless they are drained. These soils receive runoff from adjoining areas, and some areas are subject to ponding and flooding in wet periods and after heavy rain.

If drained and protected from flooding, these soils are well suited to corn, soybeans, small grains, legumes, and vegetable crops. Tile drainage and deep ditches can be used to remove excess water if a suitable outlet is available. If tile drains are installed in the Darroch, Elburn, gravelly substratum, and Wauconda soils, precautions must be taken to prevent loose sand from entering and clogging the tile lines. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Surface drainage can be used to remove surface water and prevent ponding.

Response is good to heavy applications of fertilizer, and the soils can support a large population of plants. If these soils are properly fertilized, if they are cultivated at the right moisture content, and if tillage is kept to a minimum, and if crop residue is returned, row crops can be grown year after year without damaging soil tilth and seriously lowering the organic-matter content. Undrained areas can be used for crop production, but wetness often delays planting in spring and harvesting in fall. Poor seedbed preparation because of wetness and the shallow rooting zone caused by the seasonal saturation with water generally result in crop yields that are considerably lower than for drained soils. Undrained areas are suited to pasture.

CAPABILITY UNIT IIw-5

This unit consists of moderately deep, level to gently sloping soils of the Hayfield, Kane, Marshan, and Sebewa series. These are somewhat poorly drained or poorly drained, loamy soils that are underlain by sand or stratified sand and gravel. They are moderately permeable in the subsoil and are rapidly permeable in the substratum. Available water capacity is medium, and natural fertility is moderate. Ground water is at or near the surface in the Marshan and Sebewa soils, unless these soils are drained, and at depths of 1 to 3 feet in wet periods in the Hayfield and Kane soils unless drained. Soils in this unit receive runoff from adjoining soils and, in some areas, are subject to flooding and ponding in wet periods and after heavy rain.

If drained and protected from flooding, these soils are suited to corn, soybeans, small grains, legumes, and vegetable crops. Deep ditches can be used to lower the water table if a suitable outlet is available (fig. 17). Use of tile drainage is questionable, but if the soils are tiled, precautions must be taken to prevent loose sand from entering and clogging the tile lines. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Surface drainage can be used to remove surface water and prevent ponding. Excessive lowering of the water table by drainage removes the beneficial effects of free water in the lower part of these soils.

If these soils are properly fertilized and are cultivated at the proper moisture content, if minimum tillage is used, and if crop residue is returned, row crops can be grown year after year without loss of good tilth and depletion of organic matter. Undrained areas of Kane and Hayfield soils can be used for production of crops, but wetness often delays planting in spring and harvest in fall. Poor seedbed preparation because of wetness and the shallow rooting zone caused by the seasonal high water table generally result in crop yeilds that are considerably lower than for drained soils. Undrained soils are suited to pasture.

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Figure 17.—Ditch used to drain Hayfield and Marshan soils of capability unit IIw-5. The Hayfield soil is in the foreground, and the Marshan soil is in the background.

CAPABILITY UNIT IIw-8

The only soil in this unit is Palms muck. This deep, very poorly drained, nearly level soil is 16 to 45 inches thick and is underlain by a loamy substratum. It is moderately rapidly permeable in the muck layer and moderately permeable in the substratum. Available water capacity is very high, and natural fertility is low. Ground water is at or near the surface throughout the year unless the soil is drained. This soil receives runoff from adjoining slopes and, in some areas, is subject to ponding and stream overflow. If drained, it is subject to soil blowing, burning, and subsidence.

If drained and protected from flooding and soil blowing, this soil is well suited to corn, pasture, and certain vegetable crops. Tile drainage and deep ditches can be used to lower the water table if suitable outlets are available. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Surface drainage can be used to remove surface water and prevent ponding. Response is good to applications of fertilizer, and the soil can support a large population of plants. If it is properly fertilized and well managed, row crops can be grown year after year. Undrained areas can be used for pasture, but they are better suited to use as wildlife habitat.

CAPABILITY UNIT IIIe-1

This unit consists of deep and moderately deep, sloping soils of the Durand, Griswold, Kidder, Pecatonica, Plano, Ringwood, Rotamer, St. Charles, Sisson, Westville, Winnebago, and Zurich series. These are well drained and moderately well drained, silty and loamy soils that are underlain by gravelly sandy loam, stratified sand and gravel, or stratified silt and fine sand. They are moderately permeable, except that the St. Charles soils that have a gravelly substratum are rapidly permeable in the substratum. In all the soils of this unit, available water capacity is medium or high and natural fertility is moderate or high. These soils are not saturated with water for periods long enough to affect crop growth. They are moderately susceptible to erosion, and many areas that have been cropped have lost as much as 6 inches of the original surface layer through erosion. The Durand, Griswold, Plano, Ringwood, and Winnebago soils have higher organic-matter content than the other soils in this unit and are easier to keep in good tilth.

Under proper management, the soils in this unit are suited to corn, soybeans, small grains, and legumes. A cropping system that includes close-growing crops, contour farming, stripcropping, diversions, terraces, grassed waterways, minimum tillage, and good management of residue helps to control erosion and to keep the soils in good tilth. Response is good to applications of fertilizer. These soils are well suited to pasture.

CAPABILITY UNIT IIIe-2

This unit consists of moderately deep, sloping soils of the Dresden, Rockton, Warsaw, and Whalan series. These well-drained, silty and loamy soils are underlain by stratified

sand and gravel or by dolomite. They are moderately permeable in the subsoil, and the Dresden and Warsaw soils are rapidly permeable in the substratum. In all the soils of this unit, available water capacity is medium and natural fertility is moderate. These soils are not saturated with water for periods long enough to affect crop growth. They are moderately susceptible to erosion, and many areas have lost as much as 6 inches of the original surface layer through erosion. The Rockton and Warsaw soils have higher organic-matter content than the other soils in this unit and are easier to keep in good tilth.

Under proper management, the soils in this unit are suited to corn, soybeans, small grains, and legumes. A cropping system that includes close-growing crops, contour farming, stripcropping, diversions, terraces, grassed waterways, minimum tillage, and good management of residue helps in controlling erosion and keeping the soils in good tilth (fig. 18). These soils are well suited to pasture.

CAPABILITY UNIT IIIe-3

This unit consists of shallow, gently sloping soils of the Casco, Edmund, and Lorenzo series. These are well-drained, loamy soils that are underlain by stratified sand and gravel or by dolomite. They are moderately permeable in the subsoil, and the Casco and Lorenzo soils are rapidly permeable in the substratum. In all the soils of this unit, available water capacity is low or very low, and natural fertility is moderate. These soils are not saturated with water for periods long enough to affect crop growth. They are slightly susceptible to erosion, but some areas that have been cropped have lost as much as 6 inches of the original surface layer through erosion.

Under proper management, the soils in this unit are suited to corn, soybeans, small grains, and hay. A cropping system that includes contour farming, stripcropping, diversions, terraces, grassed waterways, minimum tillage, and good management of residue helps to control erosion, to increase infiltration, and to maintain good tilth. Eroded areas have poor tilth, and tillage is further limited in the Edmund soil by dolomite fragments in some areas. The suitability of these soils for crops is limited by low or very low available water capacity, and heavy fertilization is not economical. The Casco and Lorenzo soils are suited to irrigation, especially in the less sloping areas. If irrigated, these soils can be used for production of truck crops. The soils in this unit are suited to pasture.

CAPABILITY UNIT IIIe-7

This unit consists of deep and moderately deep, sloping soils of the Eleva and Oshtemo series and the Oshtemo series, dark variant. These well-drained, loamy soils are underlain by sand, stratified sand and gravel, or sandstone bedrock. They are moderately rapidly permeable. Available water capacity is low, and natural fertility is moderate.

Figure 18.—Contour stripcropping used to help control erosion on sloping Whalan soils of capability unit IIIe-2.

These soils are not saturated for periods long enough to affect crop growth. They are moderately susceptible to erosion, and many areas that have been cropped have lost as much as 6 inches of the original surface layer through erosion. The soils also are subject to soil blowing.

Under proper management, these soils are suited to corn, soybeans, small grains, and hay. A cropping system that includes close-growing crops, contour farming, stripcropping, diversions, terraces, windbreaks, minimum tillage, and good management of residue helps to control erosion and soil blowing and to maintain available water and organic-matter content. The suitability of these soils for crops is limited by low available water capacity, and heavy fertilization is not generally economical. These soils are suited to pasture.

CAPABILITY UNIT IIIs-4

This unit consists of deep to shallow, nearly level and gently sloping soils of the Billett, Eleva, Lorenzo, and Oshtemo series and the Oshtemo series, dark variant. These well-drained, loamy soils are underlain by sandstone bedrock, sand, or stratified sand and gravel. They are moderately rapidly permeable, except for the Lorenzo soil which is moderately permeable in the subsoil and rapidly permeable in the substratum. In all the soils of this unit, the available water capacity is low and natural fertility is moderate. These soils are not saturated with water for periods long enough to affect crop growth. Most of the soils are subject to soil blowing. The gently sloping ones are slightly susceptible to erosion.

These soils are suited to row crops, small grains, and hay. A cropping system that includes close-growing crops, contour farming, stripcropping, windbreaks, minimum tillage, good management of residue, and cover crops helps to control soil blowing and to maintain available water and organic-matter content. Contour farming helps control erosion on gently sloping soils. The suitability of these soils for crops is limited by low available water capacity, and heavy fertilization is not generally economical. They are suited to irrigation and, if irrigated, are suited to production of truck crops. These soils are suited to pasture.

CAPABILITY UNIT IIIw-9

The only soil in this unit is Houghton muck. This is a deep, very poorly drained, nearly level muck soil. This soil has moderately rapid permeability. Available water capacity is very high, and natural fertility is low. Ground water is at or near the surface throughout the year, unless this soil is drained. This soil receives runoff from adjoining areas, and some areas are subject to ponding and stream overflow.

If properly drained and protected from flooding and soil blowing, this soil is well suited to corn, pasture, and certain vegetable crops. Tile drainage and deep ditches can be used to lower the water table if a suitable outlet is available. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Adequate surface drainage removes surface water and prevents ponding. If drained, this soil is subject to soil blowing, burning, and subsidence. If the water table is lowered excessively, this soil is subject to rapid subsidence. Response is good to applications of fertilizer, and the soil can support a large population of plants. If it is properly fertilized and if good management practices are used, row crops can be grown year after year. Undrained areas can be used for pasture but are more suitable for wildlife habitat.

CAPABILITY UNIT IVe-1

This unit consists of moderately deep and deep, moderately steep soils of the Griswold, Kidder, Rotamer, and St. Charles series. These well-drained, silty and loamy soils are underlain by gravelly sandy loam. They are moderately permeable. Available water capacity is medium or high and natural fertility is moderate or high. These soils are not saturated with water for periods long enough to affect crop growth. The soils are highly susceptible to erosion. They are hard to work because of slope and because eroded areas are in poor tilth. Most areas that have been cultivated have lost as much as 6 inches of the original surface layer through erosion. The Griswold soil generally has a higher organic-matter content than the other soils in this unit and is easier to keep in good tilth.

Under proper management, the soils in this unit are suited to a cropping system that includes small grains, legumes, and some corn or soybeans. The cropping system ought to include close-growing crops, contour farming, stripcropping, diversions, grassed waterways, minimum tillage, and good management of residue. These practices help to control erosion and to maintain good tilth. Response is good to applications of fertilizer. These soils are well suited to pasture.

CAPABILITY UNIT IVe-2

This unit consists of moderately deep, moderately steep and steep soils of the Dresden, Rockton, and Whalan series. These well-drained, silty and loamy soils are underlain by stratified sand and gravel or by dolomite. They are moderately permeable, though the Dresden soil is rapidly permeable in the substratum. In all the soils of this unit, available water capacity is medium and natural fertility is moderate. These soils are not saturated with water for periods long enough to affect crop growth. They are highly or very highly susceptible to erosion, and most areas that have been cultivated have lost up to 6 inches of the original surface layer through erosion. The soils are difficult to work because of slope and because eroded areas are in poor tilth.

Under proper management, the soils in this unit are suited to a cropping system that includes small grains, legumes, and some corn or soybeans. A cropping system that includes close-growing crops, contour farming, stripcropping, grassed waterways, minimum tillage, and good management of residue helps to control erosion, increase infiltration, and maintain good tilth. These soils are suited to pasture.

CAPABILITY UNIT IVe-3

This unit consists of shallow, sloping soils of the Casco, Edmund, and Lorenzo series. These well-drained, loamy soils are underlain by stratified sand and gravel or by dolomite. They are moderately permeable in the subsoil, and the Casco and Lorenzo soils are rapidly permeable in the substratum. In all the soils of this unit, available water capacity is low or very low and natural fertility is moderate. These soils are not saturated with water for periods long enough to affect crop growth. They are moderately susceptible to erosion, and most areas that have been cultivated have lost up to 6 inches of the original surface layer through erosion. The eroded areas are in poor tilth, and tillage is further limited in the Edmund soils by dolomite fragments in some areas. Eroded areas of Casco and Lorenzo soils generally have some pebbles in the surface layer.

Under proper management, the soils in this unit are suited to a cropping system that includes small grains, hay, corn,

and soybeans. A cropping system that includes close-growing crops, contour farming, stripcropping, grassed waterways, minimum tillage, and good management of residue helps to control erosion and maintain good tilth. The suitability of these soils for crops is limited by low or very low available water capacity, and heavy fertilization is not generally economical. These soils are also suited to pasture.

CAPABILITY UNIT IVe-7

This unit consists of moderately deep, moderately steep soils of the Eleva series and deep, moderately steep and steep soils of the Oshtemo series. These well-drained, loamy soils are underlain by stratified sand and gravel or by sandstone bedrock. They have moderately rapid permeability. Available water capacity is low, and natural fertility is moderate. These soils are not saturated with water for periods long enough to affect crop growth. They are subject to soil blowing; they are highly or very highly susceptible to erosion; and many areas that have been cropped have lost up to 6 inches of the original surface layer through erosion.

Under proper management, the moderately steep areas of these soils are suited to small grains, legumes, and some corn or soybeans. A cropping system that includes close-growing crops, contour farming, stripcropping, windbreaks, minimum tillage, and good management of residue helps to control erosion and soil blowing and to maintain available water and the organic-matter content. The suitability of these soils for crops is limited by low or very low available water capacity, and heavy fertilization is not generally economical. These soils are also suited to pasture.

CAPABILITY UNIT IVs-3

This unit consists of moderately deep and deep, nearly level to sloping soils of the Dickman and Gotham series and the Gotham series, bedrock variant. These somewhat excessively drained, sandy and loamy soils are underlain by sand or by dolomite. Gotham and Dickman soils are rapidly permeable. Gotham soils, bedrock variant, are moderately rapidly permeable. In all the soils of this unit, available water capacity and natural fertility are low. These soils are not saturated with water for periods long enough to affect crop growth. They are subject to soil blowing, and sloping areas are subject to erosion.

Under proper management, the soils in this unit are suited to a cropping system that includes row crops, small grains, and hay. A cropping system that includes close-growing crops, contour farming, stripcropping, windbreaks, minimum tillage, good management of residue, and cover crops helps to control soil blowing and to maintain the organic-matter content and available water. Contour farming and contour stripcropping help control erosion on sloping soils. Adequate fertility reduces soil blowing and erosion by helping to maintain the plant cover, but heavy fertilization is not generally economical, because crop growth is limited by low available water capacity. Pollution of ground water by leaching of fertilizer elements, especially nitrates, is a danger in these sandy soils. Crops should be planted as early in spring as possible to avoid summer drought. The nearly level and gently sloping areas of Dickman and Gotham soils are suited to irrigation and more intensive crop production. The soils in this unit are suited to pasture.

CAPABILITY UNIT IVw-5

This unit consists of shallow to deep, nearly level and gently sloping soils of the Maumee and Watseka series and the Billett series, mottled subsoil variant. These somewhat poorly drained and poorly drained, sandy and loamy soils are underlain by sand or stratified sand and gravel. The Billett soil, mottled subsoil variant, is moderately rapidly permeable. Maumee and Watseka soils are rapidly permeable. In all the soils in this unit, available water capacity is low. In the Maumee and Watseka soils, natural fertility is low, and in the Billett soil, mottled subsoil variant, natural fertility is moderate. Ground water is at depths of 1 to 3 feet in wet periods unless the soils are drained, except the Maumee soil where it is at or near the surface throughout the year unless the soil is drained. Soils in this unit receive runoff from adjoining areas. Some areas are subject to flooding and ponding in wet periods and after heavy rains.

If adequately drained and properly managed, these soils are suited to row crops, small grains, and hay. Except for the Maumee soil, undrained areas can be used for production of crops, but wetness often delays planting in spring and harvest in fall. Poor seedbed preparation because of wetness and shallow root zone caused by the seasonal high water table generally result in considerably lower crop yields than for drained soils. Deep ditches can be used to lower the water table if a suitable outlet is available. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas, and surface drainage can be used to remove surface water and prevent ponding. If drained, these soils are subject to soil blowing. If excessively drained, they lose the beneficial effects of free water in the lower part of the soil. The Maumee soil is too wet for cropping without artificial drainage. Undrained areas of the Maumee soil are suited to pasture.

A cropping system that includes windbreaks, minimum tillage, and good management of residue helps to control soil blowing and to maintain the organic-matter content and available water. Adequate fertility helps to control soil blowing by maintaining plant cover, but heavy fertilization generally is not economical, because crop growth is limited by low or very low available water capacity. Pollution of ground water by leaching of fertilizer elements, especially nitrates, is a danger in these sandy soils

CAPABILITY UNIT IVw-7

This unit consists of shallow to deep, nearly level soils of the Adrian and Rollin series. These very poorly drained, muck soils are underlain by sand or marl. They are moderately rapidly permeable in the muck layer. The Adrian soils are rapidly permeable in the substratum, and the Rollin soils are slowly permeable in the substratum. In all the soils of this unit, available water capacity is high or very high and natural fertility is low. Ground water is at or near the surface throughout the year unless these soils are drained. These soils receive runoff from adjoining areas, and some areas are subject to ponding and stream overflow. If drained, these soils are subject to soil blowing, burning, and subsidence.

Where these soils are drained and protected from flooding and soil blowing, they are suited to corn and certain vegetable crops. Deep ditches can be used to lower the water table if a suitable outlet is available. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Surface drainage will remove surface water and prevent ponding. Undrained areas of these soils are suited to pasture but are better suited to wildlife habitat.

CAPABILITY UNIT Vw-14

This unit consists only of Alluvial land, wet. This nearly level, poorly drained land type is on flood plains. The meandering stream channels, oxbows, sloughs, and frequent flooding limit the use of this land. These sediments are too variable to rate for permeability, natural fertility, and available water capacity. Ground water is at or near the surface throughout the year unless this land is drained.

Drainage and protection from flooding generally are impractical, and many areas are wooded or in pasture. This land type is suited to pasture, woodland, or wildlife habitat.

CAPABILITY UNIT VIe-1

The only soil in this unit is Kidder silt loam, 20 to 30 percent slopes. This deep, well-drained, loamy soil is underlain by gravelly sandy loam. It is moderately permeable. Available water capacity is medium, and natural fertility is moderate. This soil is not saturated with water for periods long enough to affect plant growth. It is very highly susceptible to erosion.

Under proper management, this soil is suited to pasture. Controlled grazing and fertilization of pasture help maintain adequate plant cover and control erosion.

CAPABILITY UNIT VIe-3

This unit consists of shallow, moderately steep soils of the Casco, Edmund, and Lorenzo series. These well-drained, loamy soils are underlain by stratified sand and gravel or by dolomite. They are moderately permeable in the subsoil, and the Casco and Lorenzo soils are rapidly permeable in the substratum. In all the soils of this unit, available water capacity is low or very low and natural fertility is moderate. These soils are not saturated with water for periods long enough to affect plant growth. They are highly susceptible to erosion, and most areas that have been cultivated have lost up to 6 inches of the original surface layer through erosion. The soils in this unit are difficult to cultivate because of slope and because eroded areas are in poor tilth. In some areas the surface layer of the Edmund soil contains dolomite fragments, and the surface layer of Casco and Lorenzo soils contains gravel that further limits tillage.

Because of the severe erosion hazard, shallow root zone, and low or very low available water capacity, these soils are not suited to cultivated crops. Under proper management, they are suited to hay and pasture.

CAPABILITY UNIT VIe-7

This unit consists of moderately deep, moderately steep to very steep soils of the Eleva and Gotham series. These well-drained and somewhat excessively drained, sandy and loamy soils are underlain by sand or sandstone bedrock. The Eleva soil is moderately rapidly peremeable, and the Gotham soil is rapidly permeable. In both soils of this unit, available water capacity is low and natural fertility is low or moderate. These soils are not saturated with water for periods long enough to affect plant growth. They are highly or very highly susceptible to erosion and are subject to soil blowing. Most areas are wooded or in pasture and have been eroded only slightly. Areas of these soils that have been cropped have lost up to 6 inches of the original surface layer through erosion.

Because of low available water capacity and the very severe hazard of erosion, these soils are not suited to cultivated crops. Under proper management, they are suited to hay and pasture.

CAPABILITY UNIT VIs-5

This unit consists of shallow and very shallow, gently sloping to moderately steep soils of the Lorenzo, Rodman, and Sogn series. These somewhat excessively drained and excessively drained, loamy soils are underlain by dolomite or stratified sand and gravel. The Sogn soils are moderately permeable, and the Rodman soils are rapidly permeable. In all the soils of this unit, available water capacity is very low and natural fertility is low. These soils are not saturated with water for periods long enough to affect plant growth. The gently sloping soils are slightly susceptible to erosion, the sloping soils are moderately susceptible, and the moderately steep soils are severely susceptible. Some areas of these soils that have been cultivated have lost up to 6 inches of the original surface layer through erosion. Many areas of Sogn soils have dolomite fragments in the surface layer, and most areas of Rodman soils are gravelly.

Because of very low available water capacity, the erosion hazard, shallow root zone, and the rocky or gravelly nature of these soils, they are not suited to cultivated crops. Under proper management, they are suited to hay and pasture.

CAPABILITY UNIT VIIe-4

This unit consists of shallow and moderately deep, steep and very steep soils of the Casco and Edmund series and the Rotamer series, thin variant. These well-drained, loamy soils are underlain by gravelly sandy loam, stratified sand and gravel, or dolomite. The Edmund and Rotamer soils are moderately permeable. The Casco soils are moderately permeable in the subsoil and rapidly permeable in the substratum. Rotamer soils, thin variant, are moderately rapidly permeable. In all the soils of this unit, available water capacity is medium, low, or very low and natural fertility is moderate or low. These soils are not saturated with water for periods long enough to affect plant growth. They are very highly susceptible to erosion. In some areas the surface layer is gravelly or stony.

Because of a very severe hazard of erosion, low or very low available water capacity, and stoniness, these steep and very steep soils are not suited to cultivated crops. Under proper management, some of the less sloping areas are suited to pasture.

CAPABILITY UNIT VIIs-5

This unit consists of shallow and very shallow, steep and very steep soils of the Lorenzo, Rodman, and Sogn series. These somewhat excessively drained and excessively drained, loamy soils are underlain by stratified sand and gravel or by dolomite. Also included in this unit is Rock land, a land type that is well drained to excessively drained and sloping to very steep. The Sogn soils are moderately permeable, and the Rodman soils are rapidly permeable. In all the soils of this unit, available water capacity is very low, and natural fertility is low. These soils are not saturated with water for periods long enough to affect plant growth.

These soils are very highly susceptible to erosion. Rock land is too variable to be rated for permeability, available water capacity, and natural fertility. Sloping areas of Rock land are moderately susceptible to erosion, moderately steep areas are highly susceptible to erosion, and steep and very steep areas are very highly susceptible to erosion.

Some areas of Rodman and Sogn soils and Rock land that have been grazed are eroded. Most areas of Rodman soils are gravelly. Many areas of Sogn soils and Rock land have rock fragments in the surface layer and contain bedrock outcrops.

Because of very low available water capacity, shallow root zone, the rocky or gravelly nature, and the erosion hazard, the soils and land type in this unit are not suited to cultivated crops. Under proper management, some of the less sloping areas are suited to pasture.

CAPABILITY UNIT VIIIw-15

This unit consists only of Marsh land, a land type that is wet and in depressions and in areas bordering lakes. These areas are flooded most of the year. They are covered by cattails, bulrushes, and other plants that grow in shallow water.

Marsh is too wet for the growth of common farm crops and pasture, and generally it is not suitable for drainage because of its low position on the landscape. Marsh is suitable for the production of wildlife food and cover. In dry seasons these areas need protection from grazing. Areas that have completely filled with sediments and that are entirely grown over with cattails can be blasted out with dynamite to form potholes for waterfowl and other wildlife. In dry seasons these areas need protection from fire.

Predicted yields

Table 1 gives predicted average yields per acre for the principal crops grown in Rock County. Predictions are based on results obtained by the agricultural experiment station on experimental test plots and on observations made by soil scientists and other agricultural workers who are familiar with the soils (*2*). All yields are based on averages obtained over a long period of time and on average amounts of rainfall. By using improved crop varieties and management, higher yields than those shown in the table are being obtained by many farmers. This trend can be expected to continue. This table also gives an idea of the relative productivity of the soils that can be useful in the future as the general level of crop yields increases. It must be remembered, however, that improvements in technology in the future may affect some soils more than others. Also, some soils that produce low to medium yields because of low available water capacity may be well suited to intensive production of specialty crops if irrigated.

Yield values for corn shown in table 1 can be converted to their equivalents in tons of corn silage by dividing bushels per acre by six. The yield of oats refers to that crop seeded with a legume-grass mixture. Yields of oats higher than those shown in the table result in a poor stand of grass-legume mixture.

Yields for alfalfa-brome hay in table 1 refer to those from well-established, first-year and second-year stands of these plants. Yields of native bluegrass pasture under prevailing management are included in the table because bluegrass is commonly grown on many soils that are too strongly sloping for renovation or the production of row crops.

In table 1 the management needed to obtain the yields shown is considerably above average for the county. Under this level of management, acid soils are limed to about pH 6.5, according to recommendations resulting from soil tests. Fertilizer is also applied according to recommendations based on soil tests. Adequate surface or internal drainage is provided, and soils are protected from flooding if necessary. Seedbed preparation is adequate and timely. Proper planting methods are used. Harvesting of crops is timely and carefully performed. Necessary erosion control practices are installed and maintained. Cropping systems are adapted to soil and slope conditions. Annual and perennial weeds are controlled by timely use of mechanical and chemical methods. Insects that damage crops are controlled.

Use of the Soils as Woodland [3]

Originally, slightly more than half of Rock County was wooded. The forest stand was mostly oak and hickory, but there also were some aspen, maple, elm, and other hardwoods. Prairie grasses covered the rest of the county. Intermingled with these grasses were scattered, open-grown oak trees, generally bur oak.

Less than 6 percent of the county is now wooded, and forestry is only a minor supplement to farming. Some trees are harvested for veneer and saw logs, and a few fence posts are produced. Many soils well suited to wood crops are presently used for farm crops.

Woodland suitability groups

The soils of Rock County have been placed in woodland groups to assist owners in planning use of their woodland. Each woodland group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management to produce these trees when the existing woodland conditions are similar, and that have about the same potential productivity for trees. The woodland groups in this county are among those recognized in a statewide system of grouping and identification. The woodland group for each soil mapping unit is shown in the "Guide to Mapping Units" at the end of this survey.

Each woodland group is identified by a three-part symbol. The first part of the symbol is a numeral that refers to the relative productivity of the soils: 1, *very high;* 2, *high;* 3, *moderately high;* 4, *moderate;* and 5, *low*. The second part of the symbol is a lowercase letter of the alphabet, either *c, d, f, o, r, s, t, w,* or *x*. These letters have the following meaning: *c,* clay in the upper part of the soil is a limitation; *d,* depth to which roots can grow is restricted; *f,* soil contains large amount of coarse fragments; *o,* soil has no significant limitations to woodland use; *r;* soil has steep slopes; *s,* soil is sandy; *t,* toxic substances in the soil are a limitation; *w,* excessive water in the soil is a limitation; and *x*, stones or rocks in the soil are a limitation. The third part of the symbol is a numeral that separates the groups according to difficulty in applying woodland management. A numeral *3,* for example, means that woodland management is more difficult to apply than if the numeral were *1,* or *2*. Factors considered in grouping the soils for woodland use are discussed in the following paragraphs.

Natural plant communities. The native vegetation that grew on a soil before fire, logging, and clearing disturbed the environment is a good indicator of suitability for use as woodland.

Potential soil productivity. Productivity can be determined by measuring the height, in feet, of the dominant and codominant trees in a stand. The tallest trees generally grow on the better soils. The height to which the tallest trees grow in 50 years is called the site index (*5, 6, 7*). The site index

[3] By *GEORGE W. ALLEY,* Woodland conservationist, Soil Conservation Service.

TABLE 1.—*Predicted average yields per acre of principal crops*

[Yields are those that can be expected under improved management. Absence of yield value indicates that the soil is not suited or is not used extensively for the crop specified]

Soil	Corn	Oats	Alfalfa-brome hay[1]	Native bluegrass pasture[1]
	Bu.	Bu.	Tons	Tons
Adrian muck[2,3]	90			
Alluvial land, wet[4]				
Aztalan silt loam, 0 to 3 percent slopes[3]	105	65	4.5	1.5
Billett sandy loam, 0 to 2 percent slopes	70	50	2.7	.7
Billett sandy loam, 2 to 6 percent slopes	65	50	2.5	.7
Billett sandy loam, mottled subsoil variant, 0 to 3 percent[3]	75	60	3.0	
Brookston silt loam[3]	115	65	4.0	
Casco loam, 2 to 6 percent slopes, eroded	70	55	2.8	.8
Casco loam, 6 to 12 percent slopes, eroded	70	55	2.4	.8
Casco loam, 12 to 20 percent slopes, eroded		45	2.2	.7
Casco loam, 20 to 35 percent slopes				.6
Colwood silt loam[3]	95	65	4.0	
Darroch loam[3]	95	65	4.0	.8
Dickman sandy loam, 0 to 2 percent slopes	70	55	2.5	.7
Dickman sandy loam, 2 to 6 percent slopes	70	55	2.5	.6
Dickman sandy loam, 6 to 12 percent slopes, eroded	65	55	2.2	.5
Dresden silt loam, 0 to 2 percent slopes	85	60	3.0	1.3
Dresden silt loam, 2 to 6 percent slopes	85	65	3.0	1.3
Dresden silt loam, 6 to 12 percent slopes, eroded	80	65	2.8	1.0
Dresden silt loam, 12 to 25 percent slopes, eroded	70	60	2.5	.8
Durand silt loam, 0 to 2 percent slopes	125	75	4.8	1.5
Durand silt loam, 2 to 6 percent slopes, eroded	110	70	4.5	1.5
Durand silt loam, 6 to 12 percent slopes, eroded	90	70	3.7	1.3
Edmund loam, 2 to 6 percent slopes, eroded	70	55	3.5	1.8
Edmund loam, 6 to 12 percent slopes, eroded	65	55	3.0	.8
Edmund loam, 12 to 20 percent slopes, eroded		45	1.8	.7
Edmund loam, 20 to 35 percent slopes				
Elburn silt loam, 0 to 3 percent slopes[3]	120	65	4.7	1.6
Elburn silt loam, gravelly substratum, 0 to 3 percent slopes[3]	125	70	4.0	1.6
Elburn silt loam, overwash, 0 to 3 percent slopes[2,3]	120	65	4.7	1.6
Eleva sandy loam, 2 to 6 percent slopes	65	50	2.5	.7
Eleva sandy loam, 6 to 12 percent slopes, eroded	60	45	2.3	.6
Eleva sandy loam, 12 to 20 percent slopes				.5
Eleva sandy loam, 20 to 35 percent slopes				
Flagg silt loam, 0 to 2 percent slopes	115	80	4.8	1.5
Flagg silt loam, 2 to 6 percent slopes	105	75	4.5	1.5
Gotham loamy sand, 0 to 2 percent slopes	60	50	2.5	.4
Gotham loamy sand, 2 to 6 percent slopes	60	50	2.5	.3
Gotham loamy sand, 6 to 12 percent slopes, eroded	60	50	2.2	.3
Gotham loamy sand, 12 to 20 percent slopes				.2
Gotham loamy sand, bedrock variant, 2 to 6 percent slopes, eroded	70	50	2.5	.3
Gotham loamy sand, bedrock variant, 6 to 12 percent slopes, eroded	70	50	2.5	.3
Griswold loam, 0 to 2 percent slopes	105	70	4.5	1.5
Griswold loam, 2 to 6 percent slopes, eroded	90	70	4.0	1.3
Griswold loam, 6 to 12 percent slopes, eroded	80	70	3.2	1.0
Griswold loam, 12 to 20 percent slopes, eroded	70	55	3.0	1.0
Hayfield loam[3]	90	65	4.0	1.3
Hebron loam, 0 to 3 percent slopes	110	70	4.5	1.5
Houghton muck[2,3]	110			
Jasper loam, 0 to 2 percent slopes	105	70	4.5	1.5
Jasper loam, 2 to 6 percent slopes	90	70	4.0	1.3
Juneau silt loam, 0 to 3 percent slopes[2]	125	75	4.5	1.5
Kane loam, 0 to 3 percent slopes[2,3]	90	65	3.5	1.3
Kidder sandy loam, 2 to 6 percent slopes	90	70	3.8	1.2
Kidder sandy loam, 6 to 12 percent slopes, eroded	80	70	3.2	.9
Kidder sandy loam, 12 to 20 percent slopes	70	55	3.0	.9
Kidder silt loam, 0 to 2 percent slopes		70	4.5	1.5
Kidder silt loam, 2 to 6 percent slopes, eroded	90	70	4.0	1.3
Kidder silt loam, 6 to 12 percent slopes, eroded	80	70	3.2	1.0

See footnotes at end of table.

TABLE 1.—Predicted average yields per acre of principal crops—Continued

Soil	Corn	Oats	Alfalfa-brome hay[1]	Native bluegrass pasture[1]
	Bu.	Bu.	Tons	Tons
Kidder silt loam, 12 to 20 percent slopes, eroded	70	55	3.0	1.0
Kidder silt loam, 20 to 30 percent slopes				.9
Locke loam, 0 to 3 percent slopes[3]	115	65	4.0	1.3
Lorenzo loam, 0 to 2 percent slopes	75	55	2.8	.8
Lorenzo loam, 2 to 6 percent slopes	70	55	2.8	.8
Lorenzo loam, 6 to 12 percent slopes, eroded	60	55	2.4	.7
Lorenzo loam, 12 to 20 percent slopes		45	2.2	.7
Mahalasville silt loam[3]	120	65	4.0	
Mahalasville silt loam, overwash[2,3]	120	65	4.0	
Marsh[4]				
Marshan loam[2,3]	90	65	4.0	
Maumee loamy sand[2,3]	75	60	3.0	
Millington silt loam[2,3]	120	75	4.8	1.5
Navan silt loam[3]	115	65	4.0	.5
Ogle silt loam, 0 to 2 percent slopes	125	75	4.8	1.5
Ogle silt loam, 2 to 6 percent slopes	110	75	4.5	1.5
Oshtemo sandy loam, 0 to 2 percent slopes	70	55	2.6	.8
Oshtemo sandy loam, 2 to 6 percent slopes	65	50	2.5	.7
Oshtemo sandy loam, 6 to 12 percent slopes, eroded	60	50	2.3	.5
Oshtemo sandy loam, 12 to 25 percent slopes, eroded			2.0	.5
Oshtemo sandy loam, dark variant, 0 to 2 percent slopes	70	55	2.6	.8
Oshtemo sandy loam, dark variant, 2 to 6 percent slopes	65	50	2.5	.7
Oshtemo sandy loam, dark variant, 6 to 12 percent slopes, eroded	60	50	2.3	.5
Otter silt loam[2,3]	120	65	4.0	.5
Palms muck[2,3]	110			
Pecatonica silt loam, 0 to 2 percent slopes	120	75	4.8	1.6
Pecatonica silt loam, 2 to 6 percent slopes, eroded	110	70	4.5	1.5
Pecatonica silt loam, 6 to 12 percent slopes, eroded	90	70	3.7	1.3
Plano silt loam, 0 to 2 percent slopes	125	75	4.8	1.5
Plano silt loam, 2 to 6 percent slopes	110	70	4.5	1.5
Plano silt loam, 6 to 12 percent slopes, eroded	90	70	3.7	1.3
Plano silt loam, gravelly substratum, 0 to 2 percent slopes	125	75	4.8	1.5
Plano silt loam, gravelly substratum, 2 to 6 percent slopes	110	70	4.5	1.5
Plano loam, loamy variant, 0 to 2 percent slopes	125	75	4.8	1.5
Plano loam, loamy variant, 2 to 6 percent slopes	110	70	4.5	1.5
Ringwood silt loam, 2 to 6 percent slopes, eroded	100	70	3.7	1.5
Ringwood silt loam, 6 to 12 percent slopes, eroded	90	70	3.5	1.5
Rock land[4]				
Rockton loam, 2 to 6 percent slopes	80	60	3.5	1.3
Rockton loam, 6 to 12 percent slopes, eroded	75	60	3.2	1.0
Rockton loam, 12 to 20 percent slopes, eroded	70	55	3.0	1.0
Rodman-Lorenzo complex, 6 to 12 percent slopes, eroded	50	50	2.2	.7
Rodman-Lorenzo complex, 20 to 30 percent slopes				.4
Rodman-Lorenzo complex, 30 to 45 percent slopes				
Rollin muck[2,3]	80			
Rotamer loam, 2 to 6 percent slopes, eroded	95	65	3.8	1.5
Rotamer loam, 6 to 12 percent slopes, eroded	90	60	3.4	1.3
Rotamer loam, 12 to 20 percent slopes	80	55	3.0	1.0
Rotamer complex, 20 to 30 percent slopes				.4
Rotamer complex, 30 to 45 percent slopes				
St. Charles silt loam, 0 to 2 percent slopes	115	75	4.8	1.5
St. Charles silt loam, 2 to 6 percent slopes	115	70	4.5	1.5
St. Charles silt loam, 6 to 12 percent slopes, eroded	85	70	3.7	1.3
St. Charles silt loam, 12 to 20 percent slopes	80	70	3.2	1.3
St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes	120	75	4.8	1.5
St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes	105	70	4.5	1.5

See footnotes at end of table.

TABLE 1—*Predicted average yields per acre of principal crops—Continued*

Soil	Corn	Oats	Alfalfa-brome hay[1]	Native bluegrass pasture[1]
	Bu.	Bu.	Tons	Tons
St. Charles silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	85	70	3.7	1.3
Sebewa silt loam[2,3]	90	65	4.0	
Sisson loam, 0 to 2 percent slopes	100	70	4.5	1.3
Sisson loam, 2 to 6 percent slopes	95	70	4.5	1.0
Sisson loam, 6 to 12 percent slopes, eroded	80	70	3.2	1.0
Sogn loam, 2 to 6 percent slopes		45	2.0	.5
Sogn loam, 6 to 12 percent slopes, eroded		40	1.5	.5
Sogn loam, 12 to 20 percent slopes				.4
Sogn loam, 30 to 45 percent slopes				
Troxel silt loam, 0 to 3 percent slopes[2]	120	75	4.8	1.5
Warsaw silt loam, 0 to 2 percent slopes	95	70	4.0	1.3
Warsaw silt loam, 2 to 6 percent slopes	90	70	4.0	1.3
Warsaw silt loam, 6 to 12 percent slopes, eroded	80	70	3.2	1.0
Watseka loamy fine sand[2,3]	65	65	2.5	.8
Wauconda silt loam, 0 to 3 percent slopes[3]	120	70	4.0	1.6
Westville sandy loam, 0 to 2 percent slopes	115	75	4.8	1.4
Westville sandy loam, 2 to 6 percent slopes	105	70	4.5	1.4
Westville sandy loam, 6 to 12 percent slopes, eroded	85	70	3.7	1.2
Westville loam, 0 to 2 percent slopes	115	75	4.8	1.5
Westville loam, 2 to 6 percent slopes, eroded	110	70	4.5	1.5
Westville loam, 6 to 12 percent slopes, eroded	90	70	3.7	1.3
Whalan sandy loam, 2 to 6 percent slopes, eroded	80	70	3.8	1.2
Whalan sandy loam, 6 to 12 percent slopes, eroded	75	65	3.0	.9
Whalan loam, 0 to 2 percent slopes	85	70	4.0	1.3
Whalan loam, 2 to 6 percent slopes, eroded	85	70	4.0	1.0
Whalan loam, 6 to 12 percent slopes, eroded	80	70	3.2	1.0
Whalan loam, 12 to 20 percent slopes, eroded	70	65	3.0	.8
Winnebago silt loam, 0 to 2 percent slopes	125	75	4.8	1.5
Winnebago silt loam, 2 to 6 percent slopes, eroded	110	70	4.5	1.5
Winnebago silt loam, 6 to 12 percent slopes, eroded	90	70	3.7	1.3
Worthen silt loam, 0 to 3 percent slopes[2]	120	75	4.5	1.5
Zurich silt loam, 0 to 2 percent slopes	110	70	4.5	1.5
Zurich silt loam, 2 to 6 percent slopes	100	70	4.0	1.3
Zurich silt loam, 6 to 12 percent slopes, eroded	85	70	3.2	1.0

[1]Dry weight basis.

[2]Predicted yields can be obtained where soil is protected from stream overflow.

[3]Predicted yields can be obtained where soil has excellent artificial drainage.

[4]Land type too variable for predictions to be made.

can also be used in conjunction with available tables of normal yeields, supplied by research foresters, to predict yields from wooded tracts.

Soil-associated hazards. Among these are hazards to seedling survival and establishment; tendency of trees to windthrow; limitations on the use of wheel-type equipment; erosion of soil; and damage to trees by insects, diseases, and animals.

The kinds of trees suitable for planting in woodlands and in windbreaks are shown in the discussion of each woodland group. A "Tree Selection Guide" for landscape and windbreak plantings and a "Shrub and Vine Selection Guide" are provided in tables 2 and 3, respectively.

WOODLAND GROUPS 2o1 AND 2o2

These groups consist of deep, moderately well drained and well drained, silty and loamy soils. These soils are underlain by gravelly sandy loam, stratified silt and fine sand, stratified sand and gravel, or stratified silt and clay. They have high or very high available water capacity and moderate or high natural fertility. Woodland suitability group 2o1 consists of soils of the Flagg, Hebron, Kidder, Pecatonica, St. Charles, Sisson, Westville, and Zurich series that have slopes of less than 12 percent. Woodland suitability group 2o2 consists of soils of the Juneau and Worthen series. These soils have properties similar to those in group 2o1, but they are subject to occasional flooding.

The native vegetation on these soils is generally black, white, and red oaks mixed with hickory. Some black cherry, aspen, and sugar maple are in the stand. Much of the acreage has been cleared and is now used for farming.

The potential for tree growth is generally high but is variable. The measured site index for red oak in eight plots on soils of these groups ranged from 45 to 86 and averaged 64± 15.8. The site index for sugar maple in three plots was 65, 65, and 68. This index is high, but sugar maple is not plentiful on these soils. The site index for black cherry in two plots was 69 and 72; for aspen in one plot, the index was 82; and for hickory in one plot it was 74. The wide variation in tree growth on these soils is difficult to explain. In some places growth appears to be related to the topographic position occupied by an individual tree. The moisture regime of the site is generally an important factor in the growth of trees.

The hazard to seedling survival is moderate to severe because of competition for moisture from weeds and brush.

Red pine and white pine are species suitable for woodland planting on these soils. Red and white pines, white and Norway spruces, northern white-cedar, and many shrubs are suitable plants for establishing windbreaks.

WOODLAND GROUP 2d2

This group consists of moderately deep, well-drained soils of the Dresden and Whalan series. These soils have slopes of less than 12 percent. They are silty or loamy soils underlain by stratified sand and gravel or dolomite. They have medium available water capacity and moderate natural fertility.

The native vegetation on these soils is dominantly oak-hickory forest.

The potential for tree growth is good on these soils. A single plot, measured on Whalan silt loam, had a site index of 74 for red oak and hickory, and 69 for black cherry.

The hazard to seedling survival is moderate to severe because of competition for moisture from weeds and brush.

Red pine and white pine are species suitable for woodland planting. Red and white pine, white and Norway spruce, northern white-cedar, and many shrubs are suitable for establishing windbreaks.

WOODLAND GROUP 2r1

This group consists of moderately deep and deep, moderately well drained and well drained soils of the Dresden, Kidder, St. Charles, and Whalan series. These soils have slopes of 12 percent or more. They are silty or loamy soils underlain by gravelly sandy loam, stratified sand and gravel, or dolomite. They have medium or high available water capacity and moderate or high natural fertility.

The hazard to seedling survival is moderate to severe because of competition for moisture from weeds and brush. Slope is a moderate limitation on the use of equipment. The erosion hazard is moderate because of slope.

Red pine and white pine are species suitable for woodland planting. Red and white pine, white and Norway spruce, northern white-cedar, and many shrubs are suitable for establishing windbreaks.

WOODLAND GROUP 3s1

This group consists of moderately deep and deep, somewhat excessively drained soils of the Dickman and Gotham series and of the Gotham series, bedrock variant. These soils have slopes of less than 12 percent. They are sandy or loamy soils underlain by sand or dolomite. They have low available water capacity and low natural fertility.

The native vegetation on these soils is oak-hickory forest.

Site index measurements taken on Gotham soils and similar soils of other series indicate that the soils of this group are fairly good sites for pine and fair to poor sites for hardwoods. The site index for white pine in three plots was 53, 59, and 65. The site index for red pine in one plot was 48. Four plots showed a site index for jack pine ranging from 54 to 66 and averaging 58. A plot in a plantation of white pine had a site index of 80, and one in a plantation of red pine measured 75. The site index for black oak in two plots was 48 and 60, and for northern pine and oak in two plots, it measured 29 and 52, respectively.

The limitation on the use of equipment is slight to moderate. The hazard to seedling survival is moderate because of low available water capacity.

Red pine, white pine, and jack pine are species suitable for woodland and windbreak planting. Such shrubs as Siberian peashrub and cotoneaster are suitable also for establishing windbreaks.

WOODLAND GROUP 3s2

This group consists of shallow to deep, well-drained soils of the Billett, Eleva, Oshtemo, and Rotamer series. These soils have slopes of less than 12 percent. They are loamy soils underlain by sand, sandstone, stratified sand and gravel, or gravelly sandy loam. These soils have medium or low available water capacity and moderate natural fertility.

The native vegetation on these soils is either oak-hickory forest or prairie grasses and scattered oak trees.

The potential for tree growth is generally poor for hardwoods and medium for pine. The measured site index for black oak in two plots was 44 and 56. Measured site indexes in pine plantations were as follows: red pine, 67, 69, and 78; white pine, 67; and jack pine, 75. These figures appear to indicate good potential for growing pine. However, plots measured in older stands of pine (all plantations measured were less than 30 years old) have yielded site indexes as follows: red pine, 37, 39, and 47; white pine, 49; and jack pine, 76. The jack pine in the measured plot was young. More measurements of site index are needed in pine stands so that the productivity of these soils can be determined more accurately.

The hazard to seedling survival is slight to moderate because of low available water capacity. The limitations on the use of equipment are slight to moderate.

Red pine, white pine, and jack pine are species suitable for woodland and windbreak planting. Such shrubs as cotoneaster and Siberian peashrub also are suitable for use in windbreaks.

WOODLAND GROUP 3r2

This group consists of shallow to deep, well-drained and somewhat excessively drained soils of the Eleva, Gotham, Oshtemo, and Rotamer series and the Rotamer series, thin variant. These soils have slopes of 12 percent or more. They are sandy or loamy soils underlain by sand, sandstone, stratified sand and gravel, or gravelly sandy loam. They have low or medium available water capacity and low or moderate natural fertility.

The native vegetation on these soils is either oak-hickory forest or prairie grasses and scattered oak trees. The potential for tree growth generally is poor for hardwoods and medium for pine.

TABLE 2.—*Tree selection guide for*

Woodland suitability group and brief discription of soils	Trees suitable for[1]—			
	Shade		Streets	
	Sunny sites	Partly shaded sites	Sunny sites	Partly shaded sites
Groups 2o1, 2o2, 2d2, and 4o1: Deep and moderately deep, well drained and moderately well drained, silty and loamy soils.	American beech (LO), sugar maple (LO), red maple (MO), red oak (LR), white oak (LR), basswood (LO), hackberry (MR), white ash (LO), sycamore (LO), bur oak (LR), Norway maple (MR), silver maple (LO), thornless honeylocust (MO).	American beech (LO), sugar maple (LO), red maple (MO), red oak (LR), hackberry (MR), white ash (LO), basswood (LO).	Norway maple (MR), southern pin oak (MP), thornless honeylocust (MO), basswood (LO), white ash (LO), sugar maple (LO), hackberry (MR), red maple (MO).	Norway maple (MP), white ash (LO), basswood (LO), sugar maple (LO).
Group 3s2: Deep, moderately deep, and shallow, well-drained, loamy soils.	Scarlet oak (MO), bur oak (LR), hackberry (MR), black oak (LR), silver maple (LO), green ash (MO), thornless honeylocust (MO).	Hackberry (MR)_____	Green ash (MO), white ash (LO), hackberry (MR), southern pin oak (MP), thornless honeylocust (MO).	Hackberry (MR)_____
Group 3s1: Deep and moderately deep, somewhat excessively drained, sandy and loamy soils.	Black oak (LR), scarlet oak (MO), hackberry (MR), green ash (MO), silver maple (LO).	Hackberry (MR)_____	Hackberry (MR), green ash (MO).	Hackberry (MR)_____
Group 3d1: Shallow, well-drained, loamy soils.	Northern red oak (LR), (LO), white oak (LR), bur oak (LR), sugar maple (LO), red maple (MO), silver maple (LO).	Red oak (LR), sugar maple (LO), American beech (LO), red maple (MO).	Norway maple (MR), green ash (MO), red maple (MO), sugar maple (LO), thornless honeylocust (MO).	Norway maple (MP), sugar maple (LO), red maple (MO).
Group 4f1: Very shallow and shallow, well-drained, loamy soils.	None_____	None_____	None_____	None_____
Groups 3w1 and 4w1: Moderately deep and deep, somewhat poorly drained and poorly drained, silty and loamy soils.	Swamp white oak (LR), hackberry (MR), red maple (MO), basswood (LO), green ash (MO), white ash (LO), silver maple (LO), cottonwood (LO).	Swamp white oak (LR), hackberry (MR), red maple (MO), basswood (LO), green ash (MO), white ash (LO).	Green ash (MO), basswood (LO), red maple (MO), southern pin oak (MP).	Green ash (MO), basswood (LO), red maple (MO).
Group 3w2: Shallow to deep, somewhat poorly drained and poorly drained, sandy and loamy soils.	Black ash (MC), silver maple (LO), cottonwood (LO), red maple (MO).	Red maple (MO)_____	Black ash (MC), red maple (MO), green ash (MO).	Red maple (MO)_____
Group 4w2: Deep, poorly drained, silty soils.	Swamp white oak (LR), red maple (MO), basswood (LO), hackberry (MR), green ash (MO), sycamore (LO), cottonwood (LO).	Swamp white oak (LR), hackberry (MR), red maple (MO), basswood (LO), green ash (MO).	Southern pin oak (MP), red maple (MO), green ash (MO), basswood (LO).	Red maple (MO), basswood (LO), green ash (MO).
Group 5w3: Shallow, moderately deep and deep, very poorly drained muck soils.	Silver maple (LO), red maple (MO).	Red maple (MO)_____	Red maple (MO), laurel willow (MO).	None_____

[1]Letters in parentheses following tree names indicate general height and shape of tree at maturity. The first letter refers to height: S, less than 30 feet high at maturity; M, 30 to 60 feet; and L, more than 60 feet. The second letter refers to shape: C, tree has columnar shape; O, oval; P, pyramidal; Pe, pendulus; and R, round.

landscape and windbreak plantings

Trees suitable for[1]—Continued			
Lawns		Hedges, screens, and windbreaks	
Sunny sites	Partly shaded sites	Sunny sites	Partly shaded sites
Flowering crab (SR), mountain ash (SO), blue beech (SR), paper birch (MO) river birch (MO), Russian-olive (SR), southern pin oak (MP), serviceberry (SR), horsechestnut (LR), Norway spruce (LP), red pine (LP), white pine (LP), white spruce (MP), black cherry (LO), blue spruce (LP), Norway spruce (LP), hawthorn (SR).	Blue beech (SP), serviceberry (SR), white pine (LP), white spruce (MP) blue spruce (LP, Norway spruce (LP).	Redcedar (SP), white-cedar (MC,P), white pine (LP), white spruce (MP), Lombardy poplar (LC), Russian-olive (SR), upright yew (SP).	White-cedar (MC), white pine (LP), white spruce (MP), upright yew (SP).
Flowering crab (SR), paper birch (MO), redcedar (SP), white pine (LP), white spruce (MP), red pine (LP), Russian-olive (SR).	White pine (LP), white spruce (MP).	Redcedar (SP), Russian-olive (SR), red pine (LP), white pine (LP), upright yew (SP), white spruce (MP).	Upright yew (SP), white pine (LP), white spruce (MP).
Red pine (LP), white pine (LP), Russian-olive (SR).	White pine (LP)----------	Redcedar (SP), jack pine (MP), white pine (LP), Russian-olive (SR).	White pine (LP).
White pine (LP), paper birch (MO), Russian-olive (SR), flowering crab (SR).	White pine (LP), blue beech (SR).	Redcedar (SP), white pine (LP), white-cedar (MC), white spruce (MP), Russian-olive (SR).	White pine (LP), white-cedar (MC), white spruce (MP).
None----------	None----------	Redcedar----------	None.
White spruce (MP), paper birch (MO), mountain-ash (SO), weeping willow (MPe), white-cedar (MP), river birch (MO).	White spruce (MP), mountain-ash (SO).	White-cedar (MC), white spruce (MP), Lombardy poplar (LC), laurel willow (MO).	White-cedar (MC), white spruce (MP).
Mountain-ash (SO), weeping willow (MPe), paper birch (MO).	Mountain-ash (SO)----------	White-cedar (MC), laurel willow (MO).	White-cedar (MC).
Paper birch (MO), white-cedar (MC), white spruce (MP), mountain-ash (SO), weeping willow (MPe).	White-cedar (MC), white spruce (MP), mountain-ash (SO).	White-cedar (MC), laurel willow (MO), Lombardy poplar (LC).	White-cedar (MC), Lombardy poplar (LC).
White-cedar (MC), white spruce (MP), weeping willow (MPe).	White-cedar (MC), white spruce (MP).	White-cedar (MC), laurel willow (MO).	White-cedar (MC).

The limitation on the use of equipment on these soils is moderate. The erosion hazard is moderate to severe, depending on slope. On south- and west- facing slopes, the hazard to seedling survival is moderate because of low available water capacity.

Red pine, white pine, and jack pine are species suitable for woodland or windbreak planting. Such shrubs as cotoneaster and Siberian peashrub also are suitable for use in windbreaks.

WOODLAND GROUP 3d1

This group consists of shallow, well-drained soils of the Casco, Edmund, and Lorenzo series. These soils have slopes of less than 12 percent. They are loamy soils underlain by stratified sand and gravel or dolomite. They have low or very low available water capacity and moderate natural fertility.

The native vegetation on these soils in mainly oak-hickory forest.

The measured site index in plots on these and similar soils was as follows: for red oak in eight plots, 64 ± 4.0; for aspen in two plots, 52 and 68; for sugar maple in five plots, 60 ± 3.3; for white pine in three plots, 48, 49, and 49; and for hickory in one plot, 64.

The hazard to seedling survival and the hazard of windthrow are moderate because of a shallow root zone. Selection of trees species for woodland and windbreak plantings is limited. Red pine and eastern redcedar are suitable for use.

WOODLAND GROUP 3r1

This group consists of shallow, well-drained soils of the Casco, Edmund, and Lorenzo series. These soils have slopes of 12 percent or more. They are loamy soils underlain by stratified sand and gravel or dolomite. They have low or very low available water capacity and moderate natural fertility.

Native vegetation on these soils is mainly oak-hickory forest.

The hazard to seedling survival and the hazard of windthrow are moderate because of a shallow root zone. The limitation to use of equipment is moderate. The erosion hazard is moderate to severe.

Selection of tree species for woodland and windbreak plantings is limited. Red pine and eastern redcedar are suitable.

WOODLAND GROUP 3w1

This group consists of moderately deep and deep, somewhat poorly drained soils of the Hayfield, Locke, and Wauconda series. These soils have slopes of 3 percent or less. They are silty or loamy soils underlain by sand, gravelly sandy loam, or stratified silt and fine sand. They have medium or high available water capacity and moderate natural fertility.

The native vegetation on these soils is wetland hardwoods, principally elm and soft maple. The trees commonly are scattered and are intermingled with marsh grasses and brush. Much of the area has been drained and is now farmed.

The potential for tree growth is variable; it depends on soil wetness. Because of the scarcity of measurable stands, no site-index plots have been measured.

Plant competition on these soils is moderate to severe. The hazard to seedling survival and the hazard of windthrow are moderate. Limitation on use of equipment for planting and harvesting is moderate to severe, because equipment can only be used on these soils during dry periods or when the soil is frozen.

Species suitable for woodland or windbreak planting are white spruce, northern white-cedar, and willow.

WOODLAND GROUP 3w2

This group consists of shallow to deep, somewhat poorly drained and poorly drained soils of the Maumee and Watseka series and the Billett series, mottled subsoil variant. These soils have slopes of 3 percent or less. They are sandy or loamy soils underlain by sand. They have low or very low available water capacity and low or moderate natural fertility.

The native vegetation on these soils is elm, soft maple, and willow. Most of the area has been cleared and is farmed.

The measured site index in plots on soils of this group in southern and central Wisconsin was as follows: For jack pine in four plots, 58 ± 12; for white pine in one plot, 53; for red pine in one plot, 49; for aspen in three plots, 66, 75, and 77; for red oak in one plot, 54; and for tamarack in one plot, 68.

The hazard to seedling survival is moderate because of wetness and weed competition. The hazard of windthrow is moderate because of the limited root zone on some sites.

Jack pine and white spruce are species suitable for woodland or windbreak planting.

WOODLAND GROUP 4o1

This group consists of moderately deep and deep, moderately well drained and well drained soils of the Durand, Griswold, Jasper, Ogle, Plano, Ringwood, Rockton, Troxel, Warsaw, and Winnebago series, the Oshtemo series, dark variant, and the Plano series, loamy variant. These are silty or loamy soils underlain by gravelly sandy loam, stratified sand and gravel, stratified silt and fine sand, or by dolomite. They have low, medium, or high available water capacity and moderate or high natural fertility.

The native vegetation on these soils is prairie grasses.

No site index plots have been measured on these soils because tree stands suitable for measuring do not exist. The potential for tree growth is moderately low or low for pine and very low for hardwoods. Competition from weeds is a severe hazard to young trees.

Species suitable for windbreak planting are red pine, white pine, Norway spruce, Black Hills spruce, white spruce, northern white-cedar, and many shrubs. Woodland plantings are seldom made.

WOODLAND GROUP 4w1

This group consists of moderately deep and deep, somewhat poorly drained and poorly drained soils of the Aztalan, Brookston, Colwood, Darroch, Elburn, Kane, Mahalasville, Marshan, Millington, Navan, and Sebewa series. These soils have slopes of 3 percent or less. They are silty or loamy soils underlain by gravelly sandy loam, stratified sand and gravel, stratified silt and fine sand, or stratified silt and clay. They have medium or high available water capacity and moderate or high natural fertility.

The native vegetation on these soils is prairie grasses and scattered wetland hardwoods, such as elm, soft maple, and willow. Most of the acreage is used for farming.

No site index information is available because there are few tree stands suitable for measuring. The potential for tree growth is low or very low for both hardwoods and conifers.

Plant competition on these soils is severe. The hazard to seedling survival and the hazard of windthrow are moderate. Limitation on use of equipment is moderate to severe. Heavy equipment can only be used during dry periods or when the soil is frozen.

Species suitable for woodland or windbreak planting are white spruce, northern white-cedar, or willow, depending on the degree of wetness.

WOODLAND GROUP 4w2

This group consists of deep, poorly drained soils of the Otter series. These soils have slopes of less than 2 percent. They are silty soils underlain by stratified sandy loam and loam. They have high available water capacity and moderate natural fertility. Also in this group is Alluvial land, wet. Its properties are too variable to be rated. Otter soils and Alluvial land, wet, are both subject to stream overflow.

The native vegetation on these soils is elm, ash, soft maple, and willow intermingled with prairie grasses in some areas. Because of the hazard of wetness and flooding, many areas remain wooded.

The potential for tree growth on these soils is variable; it depends on degree of wetness and soil depth. The measured site index in three plots in southern Wisconsin was 65 for white ash, 91 for soft maple, and 83 for cottonwood.

The hazard to seedling establishment and survival is severe because of wetness and competition from weeds and brush. Limitation to use of equipment is moderate. Equipment can only be used during dry periods or when the soil is frozen. The windthrow hazard is moderate. Streambank erosion and scouring by floodwater are special erosion hazards in some low-lying areas.

Species suitable for woodland planting are willow, soft maple, white spruce, and northern white-cedar.

WOODLAND GROUP 4f1

This group consists of very shallow and shallow, well-drained to excessively drained soils of the Lorenzo, Rodman, and Sogn series. These soils have slopes of less than 12 percent. They are loamy soils underlain by stratified sand and gravel or by dolomite. They have low or very low available water capacity and low or moderate natural fertility. The Rodman and Lorenzo soils are closely intermingled in a complex. Also in this group are areas of Rock land where slopes are less than 12 percent. This land type is underlain by dolomite or sandstone. Its other properties are too variable to be rated.

The native vegetation on these soils generally is oak-hickory forest. In most places the soils are not cultivated, but some areas are used for pasture.

The potential for tree growth is variable. It depends on soil depth but generally is low. Because of the poor quality of tree stands on these soils, no site index measurements have been made.

The limitation to use of equipment is moderate to severe, depending on the rockiness of the soil. The hazard to seedling survival and the hazard of windthrow are severe. The erosion hazard is moderate.

Eastern redcedar is a species suitable for planting on these soils.

WOODLAND GROUP 4r1

This group consists of very shallow and shallow, well-drained to excessively drained soils of the Lorenzo, Rodman, and Sogn series. These soils have slopes of 12 percent or more. They are loamy soils underlain by stratified sand and gravel or by dolomite. They have low or very low available water capacity and low or moderate natural fertility. The Rodman and Lorenzo soils are closely intermingled in complexes. Also in the group are areas of Rock land where slopes are 12 percent or more. This land type is underlain by dolomite or sandstone. Its other properties are too variable to be rated.

The native vegetation on these soils is variable, depending on soil depth, degree of slope, and aspect (the direction the slope faces). Generally, the vegetation is oak-hickory forest.

The potential for tree growth is variable. It depends on soil depth, slope, and aspect. Generally, black oak grows on north- and east-facing slopes and bur oak on south- and west-facing slopes. On these typical sites, the measured site index for bur oak in one plot was 32, and for black oak in one plot was 54.

The hazard to seedling establishment and survival is severe because of low available water capacity. Slope and stoniness are severe limitations on the use of equipment. Windthrow is a severe hazard. The erosion hazard is moderate to severe, depending on slope.

Eastern redcedar is the only species suitable for planting on these soils.

WOODLAND GROUP 5w3

This group consists of shallow to deep, very poorly drained soils of the Adrian, Houghton, Palms, and Rollin series. These soils have slopes of less than 2 percent. They are muck soils underlain by sand, marl, or stratified loamy layers. They have high or very high available water capacity and low natural fertility.

The native vegetation on these soils is variable, ranging from sedge, marshgrass, and cattails to elm, soft maple, and willow trees. Many areas have been drained and are used for the production of farm crops.

Tree growth and species distribution on these organic soils vary with wetness, kind of material in which the organic layer formed, acidity, and lateral movement of water. Most plots used to determine the measured site index on organic soils in Wisconsin were in stands of tamarack or northern white-cedar, and these trees are rarely native to Rock County. The following site-index data have been recorded: For northern white-cedar in five plots, 34 ± 4.7; for tamarack in seven plots, 47 ± 7.7; for elm in one plot, 47; and for red maple in one plot, 65.

The hazard to seedling establishment and survival is severe because of excessive wetness and standing water, as well as competition from weeds and brush. Limitations are severe for use of equipment, except when these soils are frozen. Windthrow is such a severe hazard that harvesting is limited to clear cutting. Diseases, such as butt rot and root rot, are related to these very wet sites and are a severe hazard. Idle areas are subject to soil blowing. The soil will burn if completely dry.

Tree planting on these soils is generally limited to windbreak planting on cropland. Green willow and laurel willow have been used most commonly. Disease is a problem with kinds of willow and other species being tried. Hybrid

TABLE 3.—Shrub and vine selection guide

[Only moderately well drained to excessively drained soils are in shrub groups 1 and 2]

Plant	Type	Description of plant		Suitable uses, by shrub groups of soils	
		Ultimate height (feet)	Other features	Group 1	Group 2
Arborvitae (Thuja spp.)	Coniferous shrub.	3-7	Slightly shade tolerant	Landscape; hedge, screen, and windbreak; wildlife food and cover.	Landscape; hedge, screen, and windbreak; wildlife food and cover.
Barberry, Japanese (Berberis thunbergi)	Shrub	6	Shade tolerant; colorful foliage; thorny; fall color; berries.	Landscape; hedge, screen, and windbreak; wildlife food and cover.	Landscape; hedge, screen, and windbreak; wildlife food and cover.
Bayberry (waxmyrtle) (Myrica pensylvanica)	Shrub	6	Shade tolerant; aromatic, semievergreen leaves: fall color; waxy berries.		Landscape; wildlife food and cover; ground cover.
Bittersweet (Celastrus scandens)	Vine		Native; shade tolerant; climbs; male and female plants; can injure trees; fall color; waxy berries.	Some landscape; wildlife food and cover; roadside planting; ground cover.	Some landscape; wildlife food and cover; roadside planting; ground cover.
Blackberry, dewberry, blackcap, raspberry. (Rubus spp.)	Bramble	1-5	Native; forms thickets thorny; flowers; fall color; berries; many species; edible.	Wildlife food and cover; roadside planting; ground cover.	Wildlife food and cover; roadside planting; ground cover.
Chokeberry, black Aronia melanocarpa)	Shrub	1-3	Native; shade tolerant; fall color; berries; forms thickets.	Landscape; wildlife food and cover; roadside planting; ground cover.	
Cotoneaster (Cotoneaster spp.)	Shrub	4-8	Fall color; berries; generally glossy foliage; sun lover.	Landscape; hedge, screen, and windbreak; wildlife food and cover.	Landscape; hedge, screen, and windbreak wildlife food and cover.
Crabapple (Malus spp.)	Shrub	Up to 25	Fall color; fruit; flowers; much used large shrub.	Landscape; hedge, screen, and windbreak; wildlife food and cover; roadside planting.	Landscape; hedge, screen, and windbreak; wildlife food and cover; roadside planting.
Currant, Alpine (Ribes alpinum)	Foliage shrub	6-7	Shade tolerant; especially good hedge plant; leafs out early; flowers.	Landscape; hedge, screen, and windbreak.	Landscape; hedge, screen, and windbreak.
Dogwood, gray (Cornus racemosa)	Shrub	6-10	Native; shade tolerant; best dogwood for dry sites; fall color; berries; flowers.	Wildlife food and cover; roadside planting.	Wildlife food and cover; roadside planting.
Dogwood, Pagoda (Cornus alternifolia)	Shrub	10-15	Native; shade tolerant; fall color; berries; flowers.	Wildlife food and cover; roadside planting.	
Dogwood, red-osier (Cornus stolonifera)	Shrub	3-9	Native; shade tolerant; fall color; berries; flowers; attractive red twigs; forms thickets.	Some landscape; wildlife food and cover; roadside planting.	
Dogwood, roundleaf (Cornus rugosa)	Shrub	3-9	Native; shade tolerant; fall color; berries; flowers.	Wildlife food and cover; roadside planting; ground cover.	

Dogwood, silky (Cornus amomum)	Shrub	6-10	Native; shade tolerant; fall color; berries; flowers.	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.	
Elder, American (Sambucus canadensis)	Shrub	3-10	Native; berries; flowers; forms thickets.	Wildlife food and cover; roadside planting.	
Filbert (hazelnut) (Corylus americana)	Shrub	5-8	Native; shade tolerant; edible nuts; fall color; forms thickets.	Wildlife food and cover; roadside planting.	Wildlife food and cover; roadside planting.
Forsythia (Forsythia spp.)	Shrub	4-8	Shade tolerant; early yellow blooms.	Landscape	Landscape.
Grape, wild (Vitis spp.)	Vine		Native; shade tolerant; fall color; fruit; climbs.	Wildlife food and cover; roadside planting; ground cover.	Wildlife food and cover; roadside planting; ground cover.
Hawthorn or thornapple (Crataegus spp.)	Shrub	5-15	Native; shade tolerant; many types; fall color; fruit; thorny.	Landscape; wildlife food and cover; roadside planting.	Landscape; wildlife food and cover; roadside planting.
Honeysuckle (Lonicera spp.)	Shrub	6-12	Shade tolerant; many shrub types; spreads by seed; fall color; berries; flowers.	Landscape; hedge, screen,, and windbreak; wildlife food and cover.	Landscape; hedge, screen, and windbreak; wildlife food and cover.
Juniper, creeping (Juniperus spp.)	Coniferous shrub.	1-2	Native; fall color; berries; prickly to touch.	Landscape; wildlife food and cover; roadside planting; ground cover.	Landscape; wildlife food and cover; roadside planting; ground cover.
Juniper, Pfitzer (Juniperous chinensis pfitzeriana)	Shrub	8-10	Native; shade tolerant; ornamental conifer; fall color.	Landscape; wildlife food and cover.	Landscape; wildlife food and cover.
Lilac (Syringa spp.)	Shrub	8-10	Many varieties; not all varieties suitable for dry sites; shade tolerant; flowers; forms some thickets.	Landscape; hedge, screen, and windbreak;roadside planting.	Landscape; hedge, screen, and windbreak; roadside planting.
Maple, Amur (Acer ginnala)	Tall shrub	15+	Low growing; can be pruned into hedge; fall color.	Landscape; hedge, screen, and windbreak.	Landscape; hedge, screen, and windbreak.
Mockorange (Philadelphus spp.)	Shrub	6-9	Sweet-scented flowers; several varieties.	Landscape; hedge, screen, and windbreak.	Landscape; hedge, screen, and windbreak.
Myrtle or periwinkle (Vinca minor)	Short vine	1	Shade tolerant; excellent ground cover in sun or shade; flowers; forms mat.	Landscape; roadside planting; ground cover.	Landscape; roadside planting; ground cover.
Ninebark, common (Physocarpus opulifolius)	Shrub	6-9	Shade tolerant; fall color; flowers.	Landscape; hedge, screen, and windbreak; wildlife food and cover; roadside planting.	Landscape; hedge, screen, and windbreak; wildlife food and cover; roadside planting.

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TABLE 3.—*Shrub and vine selection guide*—Continued

Plant	Description of plant			Suitable uses, by shrub groups of soils	
	Type	Ultimate height (feet)	Other features	Group 1	Group 2
Olive, Autumn (Elaeagnus umbellata)	Shrub	10-15	Shade tolerant; attracts birds; fall colors; berries.	Landscape; hedge, screen, and windbreak; wildlife food and cover.	Landscape; hedge, screen, and windbreak; wildlife food and cover.
Peashrub, Siberian (Caragana arborescens)	Shrub	10-15	Fall color; berries	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.
Pine, Mugho (Pinus mugho mughus)	Coniferous shrub.	6-9	Fall color	Landscape; wildlife food and cover.	Landscape; wildlife food and cover.
Plum, American (Prunus americana and other spp.)	Shrub	10-15	Native; shade tolerant; hardy; fall color; fruit; flowers; forms thickets; spreads; some thorny.	Wildlife food and cover; roadside planting.	Wildlife food and cover; roadside planting.
Privet, Amur (Ligustrum amurense)	Shrub	10	Shade tolerant; good hedge plant; fall color; berries; flowers.	Some landscape; hedge, screen, and windbreak; wildlife food and cover.	Some landscape; hedge, screen, and windbreak; wildlife food and cover.
Privet, Regels border (Ligustrum obtusifolium regelianum)	Shrub	6-9	Shade tolerant; fall color; berries.	Some landscape; hedge, screen, and windbreak; wildlife food and cover.	Some landscape; hedge, screen, and windbreak; wildlife food and cover.
Redcedar, eastern (Juniperus virginiana)	Coniferous shrub or small tree.	10-20	Native; fall color; berries; thorny to touch.	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.
Rose, rugosa, and horticultural varieties (Rosa spp.)	Shrub	2-6	Many species; use adapated species; berries; flowers.	Landscape; wildlife food and cover; roadside planting.	
Russian-olive (Elaeagnus angustifolia)	Shrub	15+	Outstanding gray foliage; fall color; berries; thorny.	Landscape; hedge, screen, and windbreak; wildlife food and cover.	Landscape; hedge, screen, and windbreak; wildlife food and cover.
Snowberry (Symphoricarpos spp.)	Shrub	3-4	Native; shade tolerant; fall color; berries; forms thickets.	Landscape; hedge; screen, and windbreak; wildlife food and cover; roadside planting; ground cover.	Landscape; hedge, screen, and windbreak; wildlife food and cover; roadside planting; ground cover.
Spirea, Anthony Waterer (Spirea bumalda)	Shrub	2-3	Good border plant; fall color; flowers.	Landscape	Landscape.
Spirea, Vanhoutte (Spirea vanhouttei)	Shrub	5-6	Shade tolerant; flowers	Landscape; hedge, screen, and windbreak.	Landscape; hedge, screen, and windbreak.
Sumac, fragrant (Rhus aromatica)	Shrub	3	Native; shade tolerant; brilliant foliage; fall color; fruits; forms thickets.	Landscape; wildlife food and cover; roadside planting; ground cover.	Landscape; wildlife food and cover; roadside planting; ground cover.

Sumac, smooth (Rhus glabra)	Shrub	6-10	Native; fall color; fruits	Wildlife food and cover; roadside planting.	Wildlife food and cover; roadside planting.
Sumac, staghorn (Rhus typhina)	Shrub	10-15	Native; shade tolerant; fall color; fruits; flowers.	Some landscape; wildlife food and cover; roadside planting.	Some landscape; wildlife food and cover; roadside planting.
Viburnum, American cranberrybush (Viburnum trilobum)	Shrub	7-9	Native; shade tolerant; versatile but slow growing; fall color; berries; flowers.	Landscape; hedge, screen, and windbreak; wildlife food and cover; roadside planting.	
Viburnum, arrowwood (Viburnum dentatum)	Shrub	10-12	Native; shade tolerant; slow growing; rich red color in fall; berries; flowers.	Landscape; hedge, screen, and windbreak; wildlife food and cover.	
Viburnum, blackhaw (Viburnum prunifolium)	Shrub	8-10	Native; shade tolerant; fall color; berries; flowers.	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.
Viburnum, mapleleaf (Viburnum acerifolium)	Shrub	3-5	Native; shade tolerant; fall color; berries; flowers.	Wildlife food and cover; roadside planting.	
Viburnum, nannyberry (Viburnum lentago)	Shrub	9-12	Native; shade tolerant; slow growing; fall color; berries; flowers.	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.	Hedge, screen, and windbreak; wildlife food and cover; roadside planting.
Viburnum, rafinesque (Viburnum rafinesquianum)	Shrub	2-4	Native; shade tolerant; fall color; flowers.	Wildlife food and cover; roadside planting.	Wildlife food and cover; roadside planting.
Viburnum, wayfaring-tree (Viburnum lantana)	Shrub	4-9	Native; shade tolerant; fall color; berries; winter food for birds; flowers; one of best Virburnums for dry soil.	Landscape; wildlife food and cover; roadside planting.	Landscape; wildlife food and cover; roadside planting.
Virginia creeper (Parthenocissus quinquefolia)	Vine		Native; shade tolerant; creeps; fall color; berries; climbs.	Some landscape; wildlife food and cover; roadside planting; ground cover.	
Wahoo, eastern (Euonymus atropurpureus)	Shrub	4-9	Native; shade tolerant; brilliant red color in fall; berries.	Landscape; wildlife food and cover; roadside planting.	
Weigela (Weigela spp.)	Shrub	4-8	Flowers showy	Landscape; hedge, screen, and windbreak.	

TABLE 3.—*Shrub and vine selection guide*—Continued

Plant	Description of plant			Suitable uses, by shrub groups of soils	
	Type	Ultimate height (feet)	Other features	Group 1	Group 2
Willow, pussywillow (Salix spp.)	Shrub	2-8	Native; pussywillow especially attractive early in spring.	Landscape; hedge, screen, and windbreak; wildlife food and cover.	
Winterberry, common (Ilex verticulata)	Shrub	6-9	Native; shade tolerant; fall color; colorful berries.	Wildlife food and cover; roadside planting.	
Yew (Taxus spp.)	Coniferous shrub.	3-10	Shade tolerant; best shade conifer; fall color; fruits.	Landscape; wildlife food and cover.	

poplar, crabapple, lilac, cotoneaster, and buffaloberry have shown promise during testing.

WOODLAND GROUP 5w5

This group consists of Marsh. This land type is covered with water most of the year. The underlying sediments are variable and range from silty to loamy material to mucky deposits. Because of their low position on the landscape, these soils have not been drained.

This land type is not suitable for trees, because of excessive wetness. Willow cuttings can be used to establish woody plantings around the edges or on hummocks.

Tree selection guide

In addition to their use in woodland, trees can be used as hedges, screens, and windbreaks and to provide shade and beautification to streets, roads, and lawns. Growth habits, shade tolerance, and esthetic features determine the suitability of trees for various functions and locations. Most plantings can be useful for more than one purpose if suitable trees are selected.

Table 2, p. 26, suggests kinds of trees suitable for several kinds of landscape plantings and windbreaks. The soils are placed in the same woodland groups that are described in the subsection immediately preceding this one." The soils in each group are shown in the "Guide to Mapping Units" at the end of this survey. Groups that consists of the shallower and steeper soils are not included in table 2. In choosing the right tree for a particular use, such factors as foliage color, flowering and fruiting characteristics, resistance to smoke injury, and susceptibility to insects and diseases should be considered. Only the commonly used kinds of trees are listed. Many horticultural varieties grow well in Wisconsin, but they are omitted from the table. Information on horticultural varieties can be obtained from nurserymen. American elm, a large and beautiful shade tree that is suitable for many soils, is not listed, because it is susceptible to the Dutch elm disease.

Shrub and vine selection guide

Table 3, p. 30, suggests suitable plants for landscape plantings, hedges, screens, windbreaks, wildlife food and cover, roadside plantings, and ground cover. All shrubs and vines listed are suited to the climate of southern Wisconsin, and only the commonly used plants have been included in this table. Only the moderately well drained to somewhat excessively drained soils that are normally used as building sites, or are close to these building sites, have been considered in the grouping of soils for table 3. The shrub group for each soil is shown in the "Guide to Mapping Units" at the end of this survey. Many of the shrubs and vines listed for the better drained soils are also suitable for the somewhat poorly drained and poorly drained soils that have been adequately drained. Organic soils, even if drained, have severe limitations for many plants.

Hardiness, shade tolerance, color and fragrance of flowers, and fruiting and foliage characteristics are important factors in the selection of shrubs and vines. The esthetic value of autumn color and winter beauty have also been considered. Adding beauty to the landscape is important to maintaining sound urban development and desirable farm homesteads. In addition to serving as good screening or ornamental plants, shrubs can be used to attract wildlife. Whenever possible shrubs should be selected for multipurpose uses. The better ornamental shrubs are multipurpose and are of particular visual interest during at least two seasons of the year.

Use of the Soils for Wildlife[4]

The soils of Rock County vary widely in physical and chemical characteristics that affect the kind and amount of vegetation and wildlife the soils will support. Research has shown a direct relationship between soil fertility and the number and vigor of wildlife. This correlation is applicable to upland and wetland soils, plants and animals, and domestic animals and wildlife.

Food and cover planting on land use primarily or secondarily for wildlife production are expected to encourage wildlife. Wildlife benefits from such soil and water conservation practices as stripcropping, fertilization, and tree planting on land used as pasture, as woodland, and for other uses.

The soil survey of Rock County indicates that soils occupying about 85,000 acres of the county are designated as wet soils that have a permanent or seasonal high water table or are subject to flooding. The remainder of the county is made up of moderately well drained to excessively drained soils that have ground water at a depth of 3 feet to more than 5 feet.

Most of the major soils are suitable for fairly intensive farming and have a high potential for wildlife, but because of other uses, there is little wildlife habitat.

The soils of Rock County have been placed in seven groups for wildlife interpretation purposes, according to a statewide system of grouping and identification. Of the nine groups in the statewide system, soils in groups 1, 3, 4, 5, 6, 7 and 8 occur in Rock County. Groups 5 and 6, consisting of somewhat poorly and poorly drained soils and organic soils, contain the most important soils for wildlife in the county. These two groups comprise the wetlands.

According to a 1958 survey, there were 20,311 acres of the wet soils remaining in their natural condition in the county. The "prairie soils" of group 4 also are important. These soils are well drained to moderately well drained, are loamy throughout, and have a thick, dark-colored surface layer. One of the few remaining flocks of the Prairie Canada Goose spends the winters on Rock Prairie in the eastern part of the county. The soils in group 4 apparently satisfy a specific need of this rare species of waterfowl.

In table 4 the wildlife groups of soils in Rock County are rated for their suitability to produce various elements of wildlife habitat. Each is rated according to its suitability in providing wildlife habitat elements. These are grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood trees and shrubs, coniferous trees, wetland plants for food and cover, and shallow and deep water developments.

Grain and seed crops include corn, oats, sorghums, wheat, barley, rye, soybeans, and other grain crops that are used by wildlife for food and cover.

Grasses and legumes include bluegrass, bromegrass, timothy, fescue, alfalfa, birdsfoot trefoil, red clover, sweetclover, vetch, and other grasses and legumes that are used by wildlife for food and cover.

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[4]By *LAVERNE C. STRICKER*, biologist, Soil Conservation Service.

TABLE 4.—*Soil interpretations for*

Wildlife suitability groups and map symbols	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Group 1: Well drained and moderately well drained soils that are loamy throughout and are not subject to flooding. BlA, BlB, DrA, DrB, DrC2, DrD2, EvB, EvC2, EvD, EvE, FlA, FlB, HeA, KdB, KdC2, KdD, KeA, KeB2, KeC2, KeD2, KeE, OoA, OoB, OoC2, OoD2, PeA, PeB2, PeC2, RtB2, RtC2, RtD, RuE, RuF, SaA, SaB, SaC2, SaD, SbA, SbB, SbC2, SkA, SkB, SkC2, WeA, WeB, WeC2, WfA, WfB2, WfC2, WhB2, WhC2, WlA, WlB2, WlC2, WlD2, ZuA, ZuB, ZuC2.	Good on slopes of 0 to 6 percent; fair on slopes of 6 to 12 percent; poor on slopes steeper than 12 percent; hazard of water erosion.	Good on slopes of 0 to 12 percent; fair on slopes of 12 to 20 percent; poor on slopes steeper than 20 percent.	Good on slopes of 0 to 20 percent; fair on slopes steeper than 20 percent.
Group 3: Well-drained to excessively drained, sandy and loamy soils that have a shallow rooting depth. CaB2, CaC2, CaD2, CaE, DcA, DcB, DcC2, EdB2, EdC2, EdD2, EdE, GoA, GoB, GoC2, GoD, GpB2, GpC2, LoA, LoB, LoC2, LoD, RrC2, RrE, RrF.	Fair on slopes of 0 to 6 percent; poor on slopes steeper than 6 percent; hazard of water erosion.	Good on slopes of 0 to 12 percent; fair on slopes of 12 to 20 percent; poor on slopes steeper than 20 percent.	Good on slopes of 0 to 20 percent; fair on slopes steeper than 20 percent.
Group 4: Well drained and moderately well drained soils that have a thick, dark-colored surface layer and are loamy throughout. DuA, DuB2, DuC2, GrA, GrB2, GrC2, GrD2, JaA, JaB, OgA, OgB, OsA, OsB, OsC2, PlA, PlB, PlC2, PmA, PmB, PnA, PnB, RnB2, RnC2, RpB, RpC2, RpD2, TrA, WaA, WaB, WaC2, WnA, WnB2, WnC2.	Good on slopes of 0 to 6 percent; fair on slopes of 6 to 12 percent; poor on slopes steeper than 12 percent; hazard of water erosion.	Good on slopes of 0 to 12 percent; poor on slopes steeper than 20 percent.	Good on slopes of 0 to 20 percent; fair on slopes steeper than 20 percent.
Group 5a: Somewhat poorly drained soils. AzA, BmA, Da, ElA, EmA, EoA, Ha, KaA, LkA, Wb, WcA.	Good where soil has been drained; fair where soil is undrained and wet.	Good where soil has been drained; fair where soil is undrained and wet; few species of grasses and legumes suited.	Fair: wet soil; some species of these plants not suited.
Group 5b: Poorly drained soils and land types. Aw, Br, Co, Ma, Mb, Mc, Md, Me, Mf, Na, Ot, Se.	Good where soil has been drained; unsuitable where soil is undrained and wet.	Fair where soil has been drained; poor where soil is undrained and wet.	Unsuitable: very wet soil; few species of these plants suited.
Group 6: Organic soils—— Ad, Ho, Pa, Rs.	Fair where soil has been drained; unsuitable where soil is undrained and wet.	Fair where soil has been drained; unsuitable where soil is undrained and wet; few species suited.	Unsuitable: wet soil; few species of these plants suited.
Group 7: Well drained and moderately well drained soils that are subject to flooding. JuA, WoA.	Good on slopes of 0 to 6 percent; fair on slopes steeper than 6 percent; hazard of water erosion and flooding.	Good——	Good——
Group 8: Shallow and very shallow soils and stony and rocky land types. Ro, SoB, SoC2, SoD, SoF.	Poor: hazard of water erosion; shallow to rock; very low available water capacity.	Fair on slopes of 0 to 12 percent; poor on slopes steeper than 12 percent; some species of grasses and legumes not suited; very low available water capacity.	Fair on slopes of 0 to 20 percent; poor on slopes steeper than 20 percent; some species of these plants not suited; very low available water capacity.

wildlife habitat elements

Woody plants		Wetland plants for food and cover	Shallow and deep water developments
Hardwood trees and shrubs	Coniferous trees		
Good on slopes of 0 to 20 percent; fair on slopes steeper than 20 percent.	Good on slopes of 0 to 20 percent; fair on slopes steeper than 20 percent.	Poor on slopes of 0 to 2 percent; unsuitable on slopes steeper than 2 percent; few species of these plants suited.	Poor on slopes of 0 to 2 percent; unsuitable on slopes steeper than 2 percent; moderate permeability.
Good on slopes of 0 to 20 percent; fair on slopes steeper than 20 percent.	Good on slopes of 0 to 20 percent; fair on slopes steeper than 20 percent.	Poor on slopes of 0 to 2 percent; unsuitable on slopes steeper than 2 percent; few species of these plants suited.	Unsuitable: shallow to very porous substratum or bedrock.
Fair on slopes of 0 to 20 percent; poor on slopes steeper than 20 percent; grass competition.	Fair: grass competition___	Poor on slopes of 0 to 2 percent; unsuitable on slopes steeper than 2 percent; few species of these plants suited.	Poor on slopes of 0 to 2 percent; unsuitable on slopes steeper than 2 percent; moderate permeability.
Fair: wet soil; some species of hardwoods not suited.	Fair: wet soil; some species of conifers not suited.	Fair: wet soil; some species of these plants not suited.	Fair on slopes of 0 to 2 percent; poor on slopes steeper than 2 percent; wet soil; moderately rapid or rapid permeability in some soils in the group.
Poor: very wet soil; few species of hardwoods suited.	Poor: very wet soil; few species of conifers suited.	Good_____	Good.
Poor: wet soil; few species of hardwoods suited.	Fair; wet soil; some species of conifers not suited.	Good_____	Good on slopes of 0 to 2 percent; fair on slopes steeper than 2 percent; wet soil.
Fair: hazard of flooding.	Fair: hazard of flooding; some species of conifers not suited.	Poor: few species of these plants suited.	Poor on slopes of 0 to 2 percent; unsuitable on slopes steeper than 2 percent; moderate permeability.
Poor: few species of hardwoods suited; very low available water capacity.	Poor: few species of conifers suited; very low available water capacity.	Unsuitable: very low available water capacity; insufficient soil moisture.	Unsuitable: shallow to fissured dolomite or gravel.

TABLE 5.—*Importance of wildlife habitat elements for selected kinds of wildlife*

[Numerals in columns have the following meaning: 4*, the element is a key or critical necessity to the survival of the stated kind of wildlife; 4, very important element; 3, important element; 2, element has some value; 1, element has little or no value; and dashed-lines, the element is not applicable to use by the stated kind of wildlife]

Selected wildlife species	Grain and seed crops		Grasses and legumes		Wild herbaceous upland plants	Woody plants			Wetland plants for food and cover	Water developments	
						Hardwood		Coniferous trees			
	Harvested	Unharvested	Harvested	Unharvested		Shrubs	Trees			Shallow water	Deep Water
Migratory waterfowl:											
Ducks	3	3	1	3	3		1		4*	4*	4
Geese	4	4*	4	1					2	3	3
Upland game birds:											
Hungarian partridge	4	4	3	4	4	1			1		
Pheasant	4	4		4*	4*	4		1	4*	3	
Quail	4	4	2	4	4	4*	2	1	4	3	
Woodcock			1	3	3	4	4	2	3		
Small game:											
Rabbit, cottontail	3	4	3	4*	4*	4*	3	1	2	3	
Raccoon	3	4		1	1	2	4		1	4*	4
Squirrels, fox and gray	3	4		1	1	2	4*	1			
Large game:											
Deer	3	4	3	3	4	4	4	4	3	3	2
Furbearers:											
Beaver						4	4*		4	4	4*
Fox, red[1]	2	3	2	3	3	3	2	1	3	3	1
Mink[1]						2	1	1	3	4*	4*
Muskrat	1	1				1			4	4*	4*

[1]Carnivorous species not strictly dependent on elements listed.

Wild herbaceous upland plants consist of native or introduced grasses, legumes, and other forbs that provide food and cover for upland wildlife and are mainly established by natural means. Plants such as bluegrass, prairie grasses, roundhead lespedeza, beggartick, aster, and goldenrod are important in this group.

Woody plants include shrubs, hardwood trees, and coniferous trees. Shrubs are low-growing woody plants (including conifers less than 8 feet tall) that furnish fruit, seeds, browse, and cover for wildlife. Examples are viburnum, dogwood, and hazelnut. Among the hardwood trees are oak, maple, cherry, and nut trees that furnish mast, fruit, seeds, dens, cover, and browse for wildlife. Examples of coniferous trees (more than 8 feet tall) are pine, fir, spruce, tamarack; and redcedar. These furnish seeds, fruit, browse, and cover for wildlife.

Wetland plants for food and cover are forbs, grasses, sedges, aquatic plants, and woody plants that grow well in wet areas. They furnish fruit, seeds, browse, and cover for wildlife that live in wet areas and on or near open water. Examples are smartweed, canarygrass, sedges, and sagittaria. These plants grow well in types 1, 2, and 6 wetlands as defined by the U.S. Department of the Interior (USDI). Type 1 wetlands are seasonally flooded basins and nearly level areas that are covered with water or saturated with water during seasonal wet periods but usually are relatively dry during much of the growing season. Type 2 wetlands include fresh meadows that usually are not covered by water during the growing season but are saturated within a few inches of the soil surface. Type 6 wetlands consists of shrub swamp areas in which the soil is usually saturated during the growing season and is often covered with as much as 6 inches of water.

Shallow water developments are less than 5 feet deep and include natural and dug-out water areas or water areas formed by a combination of dug-out areas and low embankments. Common plants are cattails, bulrushes, sedges, and reeds. These are types 3 and 4 wetlands as defined by the USDI. Type 3 wetlands consist of shallow marshes in which the soil is saturated or covered with as much as 6 inches of water during the growing season. Type 4 wetlands are deep marshes that are covered by 6 inches to about 3 feet of water during the growing season.

Deep water developments are more than 5 feet deep and consist of natural water areas, dug-out areas, or water areas formed by a combination of dug-out areas and embankments. Common plants are coontail, water lily, milfoil, and waterweed. The deep water areas consist of ponds, lakes, and type 5 wetlands as defined by the USDI. Type 5 wetlands are open fresh-water areas that include shallow ponds and reservoirs or wet areas where water is less than 10 feet deep.

Table 5 contains lists of the important kinds of wildlife in Rock County and rates the importance of the various habitat elements for the stated kinds of wildlife.

By using tables 4 and 5, the suitability of a particular soil for a given species of wildlife can be determined. For example, critical parts of the habitat for ringnecked pheasants are grasses and legumes, wild herbaceous upland plants, and herbaceous wetland plants. Only a combination of soil groups would be well suited for all these habitat elements. An environment containing soils in group 1 (loamy, well-drained soils) and group 6 (organic soils) would be desirable.

Use of the Soils in Engineering[5]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal system. Among the properties most important to engineers are permeability, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and reaction. The depth to the water table, the depth to bedrock or to sand and gravel, and the topography are also important.

Information in this survey can be used in conjunction with the soil map to:

1. Make studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates for use in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations that will aid in selecting highway, airport, pipeline, and cable locations and in planning detailed investigations at selected locations.
4. Locate probable sources of gravel and other construction materials.
5. Correlate performance of engineering structures with soil mapping units to develop information that will be useful in designing and maintaining certain engineering practices and structures.
6. Determine the suitability of soil for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, reports, and aerial photographs to make maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

With the use of the soil map for identification, the data and interpretations in this section can be useful for many purposes. They do not eliminate the need for sampling and testing at the site of specific engineering works, especially of large structures. The estimates are generally to a depth of about 5 feet, and therefore interpretations normally do not apply to greater depth. Specific values for bearing capacity should not be assigned to estimated values expressed in words, whether these values are in tables or text. Soils designated by a given name differ somewhat from place to place so that there might be some variance from the properties listed in the tables. It should also be remembered that a soil map at a scale of 3 to 4 inches to the mile cannot show small areas of contrasting soil because of scale limitations. Many of these areas are shown by the use of special symbols.

Some of the terms used by soil scientists may be unfamiliar to engineers, and some words, for example, soil, clay,

[5] Soil interpretations for engineering uses have been reviewed by *ROBERT C. BINTZLER*, assistant State conservation engineer, Soil Conservation Service.

silt, and sand, have special meanings in soil science. These and other special terms are defined in the Glossary.

Soil interpretations for engineering uses are in tabular form. Table 6 contains available engineering test data for representative soils of the county. Table 7 gives the engineering classification of the soils and estimates of some of their properties. Tables 8 and 9 contain engineering interpretations of soil properties for farm uses and for town and country planning.

Engineering classification systems

Two common systems of soil classification are used by engineers. The most widely known and used in highway construction is the system approved by the American Association of State Highway Officials (AASHO) (*1*). The other is the Unified system, which is used principally by the U.S. Corps of Engineers and U.S. Bureau of Reclamation in the construction of roads, airfields, foundations, earth dams, embankments, and canals (*14*).

In the AASHO system, soil materials are classified in seven principal groups based on the gradation, liquid limit, and plasticity index of the soils. The groups are designated as A-1 through A-7. The best soils for subgrades, gravelly soil of high bearing capacity, are classified as A-1; the next best A-2; and so on to the poorest, A-7, which are clay soils having low strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses after the soil group symbol in table 7.

In the Unified system, soils are classified in 15 groups on the basis of particle size, particle gradation, plasticity, and liquid limit. They are grouped according to their performance as material for engineering construction. The soil materials are identified as coarse grained, four classes; fine grained, four classes; mixed coarse and fine grained, four classes; and organic, three classes. The coarse-grained soils are subdivided into gravel (G) and sand (S); the fine-grained soils are subdivided into silt (M) and clay (C). The four secondary divisions of coarse-grained soils in each group—GW, GP, GM, and GC (gravel); SW, SP, SM, and SC (sand)—depend on the amount and type of fines and the degree of particle-size grading. The letter "W" indicates well graded and the letter "P" indicates poorly graded. The silt and clay groups have secondary divisions based on whether the soils have a relatively low (L) or high (H) liquid limit. The only other group used in this survey represents the highly organic muck soil, which is designated by the symbol "Pt."

The last column of table 6 gives the classification of the tested soils according to the Unified system.

Engineering test data

To help evaluate the soils for engineering purposes, soil samples from major horizons of representative profiles were tested. Table 6 contains engineering test data for several of the more extensive soils in Rock County.

The figures listed under the column "Depth from surface" refer to the depth from the surface downward.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of fine-grained soil increases from a dry state, the material changes from a semisolid and then to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 6 also gives optimum moisture and maximum dry density values for most of the tested soils. If soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material will increase until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed maximum dry density. Moisture-density data are important to earthwork, for, as a general rule, highest stability is obtained if the soil is compacted to maximum dry density at standard compactive effort when at optimum moisture content.

The engineering classifications given in table 6 are based on data obtained by mechanical analysis and by tests to determine liquid limits and plastic limits. The mechanical analysis was made by combined sieve and hydrometer methods.

Estimated engineering properties of the soils

Estimates of the engineering classification of the soils and of the physical and chemical properties on which these classifications are based are given in table 7. The information is based on the test data in table 6 and on test data from other counties. Where no tests were available, estimates were made by comparison with similar soils that had been tested and by observations and determinations in the field.

The estimates in table 7 are for soils as they occur in their natural state and not for disturbed areas that have been altered by cut and fill operations. Other information about the properties of the soils can be obtained by referring to the section "Descriptions of the Soils."

The column headed "Estimated depth to water table" gives estimates in feet of the depth to free water during periods of high precipitation or in spring. Some soils have a temporary, or perched, water table in wet periods only; other soils have a high water table throughout most of the year.

Under "Classification," the USDA classifications, as well as the Unified and AASHO classifications, are given.

A very broad mechanical analysis is given for each major soil horizon. The estimated percentages of soil material passing through No. 4, No. 10, and No. 200 sieves represent the approximate limits of gravel, sand, and fines (silt and clay). The percentages are rounded off to the nearest 5 percent. Some of this data was secured from actual tests on soils listed in table 6. The range of values for the characteristics of these soils generally covers a spread of at least 10 percent.

The estimated range in permeability in inches per hour is given for various soil depths. Permeability values listed are estimates of the range in rate of downward water movement when the major soil horizons are saturated, but allowed to drain freely. The estimates are based on soil texture, soil structure, available data on permeability and infiltration tests, and drainage observations of the water movement through the soils. In most soils, particularly in soil horizons that are high in clay content or organic-matter content, permeability rates under unsaturated conditions are considerably higher than the values given here. In a given soil, percolation through the surface layer varies according to

use and management as well as with initial moisture conditions. Bedrock formations, such as fissured or broken limestone, have a wide range of permeability rates. Relative classes of soil permeability are based on the rate of water movement in inches per hour. Terms for these classes and the rates of downward water movement in inches per hour are: *very slow*, less than 0.06; *slow*, 0.06 to 0.2; *moderately slow*, 0.2 to 0.63; *moderate*, 0.63 to 2.0; *moderately rapid*, 2.0 to 6.3; *rapid*, 6.3 to 20.0; and *very rapid*, more than 20.0.

The available water capacity in inches per inch of soil has been estimated for various soil depths. Available water capacity refers to the maximum amount of water that can be stored in the soil that is available for use by plants. The estimated values are based on the difference in percent of moisture retained at the wilting point of most plants and at field capacity or about one-third and 15 atmospheres of tension for medium and fine textured soils and between one-tenth and 15 atmospheres of tension for sandy soils.

The column headed "Reaction" shows the estimated acidity or alkalinity of the soils, expressesd as a pH value. A neutral soil has a pH of 7.0. A pH value lower than 7.0 indicates acidity, and one higher than 7.0 indicates alkalinity. The reaction is an indication of the need for lime and also an indication of the hazard of corrosion of metal conduits or of deterioration of concrete tile.

The estimated shrink-swell potential is given for each soil depth. Shrink-swell potential is an indication of the change in volume to be expected of a soil material that results from a change in moisture content. The amount and type of clay and the organic-matter content affect the shrink-swell potential. Sandy soils have a low shrink-swell potential. Soils in which illite clays are dominant do not have so high a shrink-swell potential as do soils in which montmorillonite clays are dominant.

Frost hazard is closely related to soil wetness and texture. The freezing of water within a soil causes expansion of the soil and heaving of the pavement resting on it. During periods of thaw the excess water causes mud boils or frost boils that weaken subgrade and foundations. Wet, silty soils generally are more susceptible to frost heave than other soils. Gravelly and sandy soils are the least susceptible to frost heave.

The relative corrosion potential of soils on underground metal and concrete conduits is estimated for each soil. Most conduits are laid in the substratum, and therefore ratings apply only to that part of the soil. Where the surface layer and subsoil are similar to the substratum in texture, drainage, acidity, salt content, or electrical conductivity, the same rating can be applied. In Wisconsin, experience with metal conduits indicates that most rapid corrosion occurs in somewhat poorly and poorly drained, calcareous or very acid soils. Corrosion of concrete conduits is directly related to the degree of acidity or inversely related to the pH value. Acid, somewhat poorly or poorly drained soils that have a low pH value are the most corrosive for concrete pipe, whereas alkaline soils with a high pH value are the least corrosive.

Most soils in the survey area are deep enough over bedrock that bedrock generally does not affect their use. The following soils are underlain by dolomite: Sogn soils, at a depth of 4 to 16 inches; Edmund soils at a depth of 12 to 20 inches; Whalan and Rockton soils, at a depth of 20 to 40 inches; and Gotham soils, bedrock variant, at a depth of 24 to 40 inches. Sandstone is at a depth from 20 to 40 inches in the Eleva soils.

Engineering interpretations for farm uses

The interpretations of engineering properties of the soils for specified farm uses are given in table 8 (p. 54). Soil features related to these uses are given, but the soils are not rated according to degree of limitations.

Soils for which surface or subsurface drainage is beneficial generally have a seasonal or permanent high water table, but some soils that are saturated for long periods because of a relatively slowly permeable layer are included. Soil permeability determines the rate at which water moves through the soil after drainage and affects the spacing of tile lines and ditches. Such features as shallowness to bedrock, presence of sand, tightly packed silts, or clayey layers affect water movement and, in turn, drainage design. Soil stability influences the kind of drainage system to be installed. Soils that have loose sands in the lower horizons may need special precautions to prevent sand from entering tile lines. Frequency of flooding affects the feasibility of drainage and the kind of system that is used. The corrosion potential, as listed in table 7, indicates the approximate life of metal or concrete tile in the soil. The relationship of soil position to available outlets affects the feasibility of draining a soil. Suitable outlets are generally more difficult to find for very poorly drained mineral and organic soils than for better drained soils because the very poorly drained soils normally occupy the lowest position on the landscape.

The most important soil features to be considered in planning irrigation are available water capacity and water-intake rate. Available water capacity affects design and use of the irrigation system by determining the time interval between irrigations. A soil that has a large amount of available water that can be held in the root zone requires less frequent irrigation. Water-intake rate determines the rate at which water can be applied efficiently. Slope affects efficiency of irrigation systems and the degree of erosion that can be expected at a given rate of application of irrigation water. Stoniness, the height of a water table, the presence of a clay layer or other impervious material, and depth of the root zone also affect irrigation feasibility and design.

Features that affect limitations for terraces and diversions are those that concern the relative difficulty of laying out and constructing systems. Such features are uniformity of slope; depth of the soil over bedrock, sand and gravel, or an impervious clay layer; stoniness; and availability of outlets. The texture and permeability of soils, their stability, and potential siltation of channels affect the operation of terraces after installation. Terraces and diversions can be used to protect low-lying areas and poorly drained soils, but they are generally not constructed on these soils, because runoff is slow. Terraces are difficult to construct and maintain in areas where the slope is greater than 12 percent. Diversions are effective on these steep slopes.

The soil features to be considered in planning grassed waterways are those that affect establishment, growth, and maintenance of plants, and features that could make construction of waterways difficult. Important features are the stability of the soil material and its texture and thickness, the natural drainage, stoniness, slope, available water capacity, and the suitability of the soil for plants usable in waterways.

Soil features that affect farm ponds can be separated into those that affect reservoir areas and those that affect the embankments.

Factors for farm pond reservoir areas are characteristics and qualities of undisturbed soils. Permeability is impor-

TABLE 6.—*Engineering*

[Tests performed by Wisconsin Department of Transportation, Division of Highways, and Bureau of Public Roads (BPR)]

Soil name and location	Soil material	Depth from surface	Moisture-density data[1]		Mechanical analysis[2]			
			Maximum dry density	Optimum moisture	Percentage passing sieve—			
					1-1/2 in.	3/4 in.	3/8 in.	No. 4 (4.7 mm.)
		Inches	Lb. per. cu. ft.	Percent				
Colwood silt loam:								
NE1/4NE1/4SE1/4 sec. 19, T. 2 N., R. 12 E. (Modal)	Loamy material over calcareous, stratified silt and fine sand.	23-29 35-60				100	98	95
Dresden silt loam:								
NE1/4NE1/4SW1/4 sec. 32. T. 4 N., R. 11 E. (Modal)	Loamy material over calcareous, stratified sand and gravel.	25-34 34-60	126 132	11 9	100 [4] 99	98 86	92 71	87 59
Durand silt loam;								
SW1/4SW1/4NE1/4 sec. 19, T. 3 N., R. 12 E. (Modal)	Loamy material over calcareous gravelly sandy loam till.	20-29 36-60 60-70	120 128	12 9	100	99 94	97 89	96 86
Elburn silt loam:								
SE1/4SE1/4NW1/4 sec. 29, T. 1 N., R. 14 E. (Solum thicker than modal)	Silty material over calcareous gravelly sandy loam till.	24-40 70-76	103 124	20 10				
Otter silt loam:								
SW1/4NW1/4SW1/4 sec. 29, T. 1 N., R. 12 E. (Modal)	Silty material over loamy alluvium.	8-26 34-72						
Pecatonica silt loam:								
SE1/4NE1/4SE1/4 sec. 3, T. 1 N., R. 13 E. (Modal)	Loamy material over calcareous gravelly sandy loam till.	18-28 43-66 66-80	134	9	[6] 95	100 94	98 90	96 86
St. Charles silt loam:								
SE1/4NE1/4NW1/4 sec. 22, T. 4 N., R. 10 E. (Solum slightly thicker than modal)	Silty material over calcareous gravelly sandy loam till.	22-37 65-72	133	8	100	99	96	93
St. Charles silt loam, gravelly substratum:								
NE1/4SW1/4SE1/4 sec. 15. T. 1 N., R. 13 E. (Modal)	Silty material over calcareous, stratified sand and gravel.	24-41 41-47			100	98	93	91
SE1/4SE1/4SE1/4 sec. 14. T. 4 N., R. 12 E. (Silty material a little thinner than modal)	Silty material over calcareous, stratified sand and gravel.	20-28 36-45	106 123	18 10	100	95	86	80

[1]Based on AASHO Designation T 99-57, Method C (1).

[2]Mechanical analysis according to AASHO Designation: T 88. Results by this procedure frequently differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all material coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

test data

in accordance with standard procedures of American Association of State Highway Officials (AASHO)]

Mechanical analysis[2]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued			Percentage smaller than—							
No. 10 (2.0 mm.)	No. 40 (0.12 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO	Unified[3]
							Percent			
93	82	53	52	40	23	19	31	17	A-6(7)	CL
100	98	85	83	54	18	11	24	6	A-4(8)	ML
82	63	22	21	20	16	14	30	16	A-2-6(0)	SC
46	20	4	2	1	1	0	0	[5] NP	A-1-a(0)	SP
100	98	87	86	66	36	30	37	15	A-6(10)	CL
94	85	45	42	36	25	20	24	10	A-4(2)	SC
82	72	29	24	15	8	6	-------	[5] NP	A-2-4(0)	SM
100	99	97	97	70	38	30	48	25	A-7-6(16)	CL
100	88	15	15	11	8	7	-------	[5] NP	A-2-4(0)	SM
100	99	84	83	65	35	22	54	24	A-7-5(17)	CL
100	87	23	22	13	6	5	-------	[5] NP	A-2-4(0)	SM
100	99	92	32	84	46	34	38	18	A-6(11)	CL
95	85	42	40	36	28	24	33	19	A-6(4)	SC
83	73	40	37	26	14	9	15	2	A-4(1)	SM
100	99	85	85	58	35	30	39	19	A-6(12)	ML-CL
89	75	34	31	17	7	5	-------	[5] NP	A-2-4(0)	SM
100	96	86	85	69	41	35	48	28	A-7-6(17)	CL
87	67	40	39	38	30	28	46	28	A-7-6(5)	SC
100	99	94	92	74	45	37	50	27	A-7-6(17)	CL
72	45	18	17	17	15	14	35	17	A-2-6(0)	SC

[3]SCS and BPR have agreed that all soils having plasticity indexes within 2 points of the A-line are to be given line classifications. ML-CL is an example of a borderline classification obtained by this use.

[4]99 percent passed the 2-inch sieve.

[5]NP means nonplastic.

[6]96 percent passed the 2-inch sieve.

TABLE 7.—*Estimated engineering*

[The land types Alluvial land, wet (Aw), Marsh (Mc), and Rock land (Ro) are omitted from this table because their ping unit is made up of two or more kinds of soil. The soils in such mapping units may have different properties series as

Soil series and map symbols	Estimated depth to water table	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	Inches			
Adrian: 1/ Ad	0-1	0-32	Muck	Pt	-----
		32-60	Sand	SP	A-3
Aztalan: 1/ AzA	1-3	0-10	Silt loam	ML	A-4
		10-30	Clay loam	CL	A-7
		30-40	Silty clay loam	CL	A-6
		40-60	Stratified silt and clay	CL	A-7
Billett: B1A, B1B	5+	0-25	Sandy loam	SM	A-2
		25-38	Loamy sand	SM	A-2
		38-60	Sand	SP	A-3
Billett, mottled subsoil variant: 1/ BmA.	1-3	0-26	Sandy loam	SM	A-2
		26-33	Loamy sand	SM	A-2
		33-60	Sand	SP	A-3
Brookston: 1/ Br	0-1	0-17	Silt loam	ML	A-7
		17-30	Loam	CL	A-7
		30-60	Sandy loam	SM	A-2
Casco: CaB2, CaC2, CaD2, CaE	5+	0-9	Loam	ML	A-4
		9-14	Gravelly sandy clay loam	SC	A-4
		14-18	Gravelly sandy loam	SM	A-2
		18-60	Sand and gravel	SP	A-1
Colwood: 1/ Co	0-1	0-10	Silt loam	ML	A-4
		10-29	Clay loam	CL	A-6
		29-35	Sandy loam	SM	A-2
		35-60	Silt and fine sand	ML	A-4
Darroch: 1/ Da	1-3	0-20	Loam	ML	A-4
		20-28	Clay loam	CL	A-7
		28-60	Silt and fine sand	ML	A-4
Dickman: DcA, DcB, DcC2	5+	0-20	Sandy loam	SC-SM	A-2
		20-32	Sandy loam	SC-SM	A-2
		32-60	Sand	SP	A-3
Dresden: DrA, DrB, DrC2, DrD2		0-8	Silt loam	ML	A-4
		8-25	Loam	ML	A-4
		25-34	Gravelly sandy clay loam	SC	A-2
		34-60	Sand and gravel	SP	A-1
Durand: DuA, DuB2, DuC2	3-5+	0-25	Silt loam	ML	A-4
		25-31	Clay loam	CL	A-6
		31-68	Sandy clay loam	SC	A-4
		68-74	Sandy loam	SM	A-2
Edmund: EdB2, EdC2, EdD2, EdE	5+	0-13	Loam	ML	A-4
		13-17	Clay	CH	A-7
		17-60	Dolomite.		
Elburn: E1A	1-3	0-15	Silt loam	ML	A-4
		15-60	Silty clay loam	CL	A-7
		60-74	Sandy loam	SM	A-2
Elburn: 1/ EmA, EoA	1-3	0-12	Silt loam	ML	A-6
		12-36	Silty clay loam	CL	A-7
		36-40	Loam	ML	A-4
		40-60	Sand and gravel	SP	A-1
Eleva: EvB, EvC2, EvD, EvE	5+	0-25	Sandy loam	SM	A-2
		25-33	Sand	SP	A-3
		33-60	Sandstone.		

See footnotes at end of table.

properties of the soils

characteristics are too variable for estimating. An asterisk in the first column indicates that at least one map- and limitations, and it is therefore necessary to follow carefully the instructions for referring to other indicated]

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost hazard	Corrosion potential	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						Metal	Concrete
			Inches per hour	Inches per inch of soil	pH value				
---	---	---	2.0-6.3	0.25-0.35	6.6-7.3	Low	---	Moderate	Moderate.
90-100	70-90	1-5	6.3-20.0	0.03-0.06	7.4-8.4	Very low	Low	---	
95-100	95-100	80-90	0.63-2.0	0.20-0.24	7.4-7.8	Low	Moderate	Low	Low.
90-100	85-95	65-75	0.63-2.0	0.16-0.20	6.6-8.4	Moderate	---	---	
95-100	95-100	90-100	0.20-0.63	0.16-0.20	7.4-8.4	Moderate	---	---	
95-100	95-100	95-100	0.20-0.63	0.16-0.20	7.4-8.4	High	---	---	
95-100	95-100	25-35	2.0-6.3	0.12-0.16	5.6-6.5	Low	Low	Low	Low.
95-100	95-100	20-25	6.3-20.0	0.05-0.07	6.1-6.5	Low	---	---	
95-100	90-100	1-5	6.3-20.0	0.04-0.06	6.6-7.3	Low	---	---	
95-100	95-100	25-35	2.0-6.3	0.12-0.16	5.6-7.3	Low	Low	Low	Low.
95-100	95-100	20-25	6.3-20.0	0.05-0.07	6.1-6.5	Low	---	---	
95-100	90-100	1-5	6.3-20.0	0.04-0.06	6.6-7.3	Low	---	---	
95-100	95-100	90-100	0.63-2.0	0.20-0.24	7.4-8.4	Low	High	High	Low.
90-100	85-95	55-65	0.63-2.0	0.16-0.20	7.9-8.4	Moderate	---	---	
90-100	85-95	25-35	2.0-6.3	0.10-0.14	7.4-8.4	Low	---	---	
90-100	90-100	65-75	0.63-2.0	0.18-0.22	6.6-7.8	Low	Low	Low	Low.
80-90	70-80	35-45	0.63-2.0	0.14-0.18	6.1-6.5	Low	---	---	
80-90	70-80	25-35	2.0-6.3	0.08-0.12	6.6-7.3	Low	---	---	
45-55	40-50	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low	---	---	
95-100	95-100	85-95	0.63-2.0	0.20-0.24	6.1-6.5	Low	High	High	Low.
90-100	85-95	65-75	0.63-2.0	0.16-0.20	6.1-7.8	Moderate	---	---	
95-100	90-100	25-35	2.0-6.3	0.08-0.12	7.9-8.4	Low	---	---	
95-100	95-100	75-85	0.63-2.0	0.16-0.20	7.4-8.4	Low	---	---	
90-100	90-100	65-75	0.63-2.0	0.18-0.22	5.6-7.3	Low	Moderate	High	Low.
90-100	85-95	65-75	0.63-2.0	0.16-0.20	6.1-6.5	Moderate	---	---	
95-100	95-100	75-85	0.63-2.0	0.14-0.18	6.6-8.4	Low	---	---	
95-100	95-100	25-35	2.0-6.3	0.12-0.16	6.1-7.3	Low	Low	Low	Low.
95-100	95-100	25-35	6.3-20.0	0.08-0.12	5.6-6.0	Low	---	---	
95-100	90-100	1-5	6.3-20.0	0.04-0.06	5.6-7.3	Low	---	---	
95-100	95-100	85-95	0.63-2.0	0.18-0.22	6.6-7.3	Low	Low	Low	Low.
95-100	90-100	55-65	0.63-2.0	0.16-0.20	6.1-6.5	Moderate	---	---	
85-95	75-85	20-35	0.63-2.0	0.16-0.20	6.1-6.5	Moderate	---	---	
55-65	40-50	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Very low	---	---	
95-100	95-100	90-100	0.63-2.0	0.20-0.24	5.1-7.8	Low	Moderate	Moderate	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	5.6-6.0	Moderate	---	---	
95-100	90-100	35-45	0.63-2.0	0.14-0.18	5.6-6.0	Moderate	---	---	
85-95	80-90	25-35	0.63-2.0	0.08-0.12	7.4-8.4	Low	---	---	
95-100	90-100	55-65	0.63-2.0	0.16-0.20	6.1-6.5	Moderate	Low	---	Low.
95-100	95-100	80-90	0.20-0.63	0.12-0.16	6.6-7.3	High	Low	---	
95-100	95-100	90-100	0.63-2.0	0.20-0.24	5.6-6.5	Low	High	High	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	5.6-8.4	High	---	---	
90-100	85-95	15-30	2.0-6.3	0.10-0.14	7.4-7.8	Low	---	---	
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.1-7.3	Low	High	High	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	5.1-7.3	High	---	---	
95-100	90-100	55-65	0.63-2.0	0.16-0.20	7.4-7.8	Low	---	---	
50-60	40-50	1-5	6.3-20.0	0.02-0.04	7.4-7.8	Very low	---	---	
90-100	90-100	25-35	2.0-6.3	0.10-0.14	6.1-6.5	Low	Low	Low	Low.
90-100	90-100	1-5	6.3-20.0	0.04-0.06	5.6-6.5	Low	---	---	

TABLE 7.—*Estimated engineering*

Soil series and map symbols	Estimated depth to water table	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	Inches			
Flagg: F1A, F1B	5+	0-8	Silt loam	ML	A-4
		8-45	Silty clay loam	CL	A-6
		45-82	Sandy clay loam	SC	A-4
		82-92	Sandy loam	SM	A-2
Gotham: GoA, GoB, GoC2, GoD	5+	0-12	Loamy sand	SM	A-2
		12-22	Loamy sand	SM	A-2
		22-60	Sand	SP	A-3
Gotham, bedrock variant: GpB2, GpC2	5+	0-33	Loamy sand	SM	A-2
		33-36	Sandy clay loam	SC	A-4
		36-60	Dolomite.		
Griswold: GrA, GrB2, GrC2, GrD2	5+	0-13	Loam	ML	A-4
		13-21	Clay loam	CL	A-7
		21-26	Sandy clay loam	SC	A-4
		26-60	Sandy loam	SM	A-2
Hayfield: 1/ Ha	1-3	0-25	Loam	ML	A-4
		25-30	Sandy loam	SM	A-4
		30-60	Sand	SP	A-3
Hebron: HeA	3-5+	0-7	Loam	ML	A-4
		7-23	Clay loam	CL	A-6
		23-32	Silty clay loam	CL	A-6
		32-60	Silty clay loam	CL	A-7
Houghton: 1/ Ho	0-1	0-65	Muck	Pt	-----
Jasper: JaA, JaB	5+	0-14	Loam	ML	A-4
		14-29	Sandy clay loam	SC	A-4
		29-47	Silt loam	ML	A-4
		47-60	Silt and fine sand	ML	A-4
Juneau: 1/ JuA	3-5+	0-41	Silt loam	ML	A-4
		41-60	Silty clay loam	CL	A-7
Kane: 1/ KaA	1-3	0-17	Loam	ML	A-4
		17-34	Clay loam	CL	A-7
		34-60	Sand and gravel	SP	A-1
Kidder: KdB, KdC2, KdD, KeA, KeB2, KeC2, KeD2, KeE.	5+	0-7	Silt loam	ML	A-4
		7-17	Clay loam	CL	A-6
		17-28	Sandy clay loam	SC	A-6
		28-60	Sandy loam	SM	A-2
Locke: 1/ LkA	1-3	0-8	Loam	ML	A-4
		8-28	Sandy clay loam	SC	A-4
		28-60	Sandy loam	SM	A-2
Lorenzo: LoA, LoB, LoC2, LoD	5+	0-10	Loam	ML	A-4
		10-15	Gravelly clay loam	CL	A-7
		15-60	Sand and gravel	GP-GM	A-1
Mahalasville: Ma, Mb	0-1	0-7	Silt loam	ML	A-6
		7-22	Silty clay loam	CL	A-6
		22-70	Silt loam	ML	A-6
		70-80	Sand and gravel	SP	A-1
Marshan: 1/ Md	0-1	0-8	Loam	ML	A-4
		8-25	Clay loam	CL	A-6
		25-37	Sandy clay loam	SC	A-4
		37-60	Sand	SP	A-3
Maumee: 1/ Me	0-1	0-15	Loamy sand	SM	A-2
		15-36	Sand	SP	A-3
		36-60	Sand and gravel	SP	A-3

See footnotes at end of table.

properties of the soils—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost hazard	Corrosion potential	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						Metal	Concrete
			Inches per hour	Inches per inch of soil	pH value				
95-100	95-100	90-100	0.63-2.0	0.20-0.24	7.9-8.4	Moderate	Low	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	5.1-7.3	Moderate			
95-100	90-100	35-45	0.63-2.0	0.14-0.18	6.1-7.3	Moderate			
90-100	85-95	25-35	0.63-2.0	0.10-0.14	7.4-8.4	Low			
95-100	95-100	20-25	6.3-20.0	0.08-0.12	6.1-6.5	Low	Low	Low	Low.
95-100	95-100	20-25	2.0-6.3	0.06-0.08	7.4-7.8	Low			
95-100	95-100	1-5	6.3-20.0	0.04-0.06	7.4-7.8	Low			
95-100	95-100	20-25	2.0-6.3	0.08-0.12	6.1-7.3	Low	Low	Low	Low.
95-100	95-100	35-45	0.63-2.0	0.14-0.18	6.6-7.3	Moderate			
95-100	90-100	55-65	0.63-2.0	0.18-0.22	6.6-7.3	Moderate	Low	Low	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	6.1-7.3	Moderate			
95-100	90-100	40-50	0.63-2.0	0.14-0.18	6.1-6.5	Moderate			
90-100	85-95	25-35	0.63-2.0	0.10-0.14	7.4-8.4	Low			
95-100	90-100	60-70	0.63-2.0	0.18-0.22	5.6-7.8	Low	Low	Low	Moderate.
95-100	90-100	35-45	2.0-6.3	0.10-0.14	6.6-7.3	Low			
95-100	90-100	1-5	6.3-20.0	0.03-0.05	6.6-7.3	Low			
95-100	90-100	55-65	0.63-2.0	0.16-0.20	7.9-8.4	Low	Low	Moderate	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	6.6-7.8	Moderate			
95-100	95-100	90-100	0.20-0.63	0.16-0.20	7.4-7.8	Moderate			
95-100	95-100	90-100	0.20-0.63	0.16-0.20	7.4-8.4	High			
---	---	---	2.0-6.3	0.25-0.35	7.4-7.8	Low		High	Low.
95-100	95-100	55-65	0.63-2.0	0.16-0.20	6.6-7.3	Low	Low	Moderate	Low.
95-100	90-100	35-45	0.63-2.0	0.14-0.18	7.4-7.8	Moderate			
95-100	95-100	90-100	0.63-2.0	0.18-0.22	5.6-6.5	Low			
95-100	90-100	75-85	0.63-2.0	0.14-0.18	7.4-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	7.4-7.8	Low	Moderate	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	6.1-7.3	Moderate			
95-100	90-100	55-65	0.63-2.0	0.18-0.22	7.4-7.8	Low	Low	Moderate	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	7.4-7.8	Moderate			
50-60	30-40	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
95-100	90-100	80-90	0.63-2.0	0.20-0.24	6.6-7.3	Low	Low	Low	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	6.6-7.3	Moderate			
95-100	90-100	40-50	0.63-2.0	0.14-0.18	6.6-7.3	Moderate			
90-100	85-90	25-35	2.0-6.3	0.10-0.14	7.4-8.4	Low			
95-100	90-100	65-75	0.63-2.0	0.18-0.22	7.4-7.8	Low	Low	High	Low.
95-100	90-100	35-45	0.63-2.0	0.14-0.18	6.1-7.3	Moderate			
90-100	85-95	25-35	6.3-20.0	0.10-0.14	7.4-7.8	Moderate			
95-100	85-95	60-70	0.63-2.0	0.18-0.22	6.1-6.5	Low	Low	Low	Low.
90-100	75-85	50-60	0.63-2.0	0.16-0.20	6.1-6.5	Moderate			
55-65	40-50	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.6-7.3	Moderate	High	High	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	6.6-7.8	Moderate			
95-100	95-100	90-100	0.63-2.0	0.18-0.22	7.4-8.4	Low			
55-65	40-50	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
95-100	90-100	60-70	0.63-2.0	0.18-0.22	7.9-8.4	Low	Moderate	High	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	6.6-7.8	Moderate			
95-100	90-100	35-45	0.63-2.0	0.14-0.18	7.9-8.4	Moderate			
95-100	90-100	1-5	6.3-20.0	0.03-0.05	7.9-8.4	Low			
95-100	90-100	20-25	2.0-6.3	0.06-0.10	6.1-7.8	Low	Low	Moderate	Low.
95-100	90-100	1-5	6.3-20.0	0.03-0.05	6.1-8.4	Low			
90-100	50-60	1-5	6.3-20.0	0.02-0.04	6.6-8.4	Low			

TABLE 7.—*Estimated engineering*

Soil series and map symbols	Estimated depth to water table	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	Inches			
Millington: [1/] Mf	0-1	0-42	Silt loam	ML	A-4
		42-58	Loam	ML	A-4
		58-70	Gravelly sandy loam	SM	A-4
Navan: [1/] Na	0-1	0-10	Silt loam	ML	A-4
		10-29	Clay loam	CL	A-6
		29-60	Silty clay loam	CL	A-7
Ogle: OgA, OgB	5+	0-23	Silt loam	ML	A-4
		23-48	Silty clay loam	CL	A-6
		48-62	Clay loam	CL	A-6
		62-96	Sandy clay loam	SC	A-6
Oshtemo: OoA, OoB, OoC2, OoD2	5+	0-8	Sandy loam	SM	A-2
		8-48	Sandy loam	SM	A-2
		48-60	Sand and gravel	SP	A-3
Oshtemo, dark variant: OsA, OsB, OsC2.	5+	0-23	Sandy loam	SM	A-2
		23-45	Loamy sand	SM	A-2
		45-60	Sand and gravel	SP	A-3
Otter: [1/] Ot	0-1	0-34	Silt loam	CL	A-6
		34-60	Sandy loam	SM	A-2
Palms: [1/] Pa	0-1	0-24	Muck	Pt	-----
		24-45	Loam	ML	A-4
		45-50	Sandy clay loam	SC	A-4
		50-60	Loamy sand	SM	A-2
Pecatonica: PeA, PeB2, PeC2	3-5+	0-10	Silt loam	ML	A-4
		10-28	Silty clay loam	CL	A-6
		28-43	Clay loam	CL	A-6
		43-66	Sandy clay loam	SC	A-6
Plano: P1A, P1B, P1C2	3-5+	0-44	Silt loam	ML	A-4
		44-60	Sandy clay loam	SC	A-6
		60-75	Sandy loam	SM	A-2
Plano, gravelly substratum: PmA, PmB.	3-5+	0-16	Silt loam	ML	A-4
		16-46	Silty clay loam	CL	A-6
		46-57	Gravelly sandy clay loam	SC	A-4
		57-70	Sand and gravel	SP	A-1
Plano, loamy variant: PnA, PnB	3-5+	0-31	Loam	ML	A-4
		31-59	Silt loam	ML	A-4
		59-66	Sandy clay loam	SC	A-4
		66-72	Sand and gravel	SP	A-1
Ringwood: RnB2, RnC2	5+	0-14	Silt loam	ML	A-4
		14-27	Silty clay loam	CL	A-6
		27-32	Clay loam	CL	A-6
		32-60	Gravelly sandy loam	SM	A-2
Rockton: RpB, RpC2, RpD2	5+	0-18	Loam	ML	A-4
		18-27	Clay loam	CL	A-7
		27-60	Dolomite.		
*Rodman: RrC2, RrE, RrF For Lorenzo part of RrC2, RrE, and RrF, see Lorenzo series.	5+	0-10	Gravelly sandy loam	SM	A-2
		10-60	Sand and gravel	SP	A-1
Rollin: Rs	0-1	0-25	Muck	Pt	-----
		25-60	Marl	MH	A-7

See footnotes at end of table.

properties of the soils—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost hazard	Corrosion potential	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						Metal	Concrete
			Inches per hour	Inches per inch of soil	pH value				
90-100	85-95	80-90	0.63-2.0	0.20-0.24	7.9-8.4	Low	High	High	Low.
90-100	85-95	60-70	0.63-2.0	0.16-0.20	7.9-8.4	Low			
90-100	70-80	35-45	2.0-6.3	0.10-0.14	7.9-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	7.4-7.8	Low	High	High	Low.
95-100	90-100	65-75	0.20-0.63	0.16-0.20	7.4-7.8	Moderate			
95-100	95-100	90-100	0.20-0.63	0.16-0.20	7.4-8.4	Moderate			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.1-7.3	Low	Low	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	5.1-5.5	Moderate			
95-100	90-100	65-75	0.63-2.0	0.16-0.20	6.1-6.5	Moderate			
95-100	90-100	40-50	0.63-2.0	0.14-0.18	6.1-6.5	Moderate			
95-100	95-100	25-35	2.0-6.3	0.10-0.14	6.1-6.5	Low	Low	Low	Low.
95-100	90-100	25-35	2.0-6.3	0.08-0.12	6.6-7.3	Low			
85-95	75-85	1-5	6.3-20.0	0.03-0.05	7.4-8.4	Low			
95-100	95-100	25-35	2.0-6.3	0.10-0.14	6.1-7.3	Low	Low	Low	Low.
95-100	90-100	20-25	2.0-6.3	0.06-0.10	5.6-7.3	Low	Low	Low	Low.
85-95	75-85	1-5	6.3-20.0	0.03-0.05	7.4-8.4	Low	Low	Low	Low.
95-100	95-100	80-90	0.63-2.0	0.20-0.24	7.4-8.4	Low	High	High	Low.
90-100	85-95	25-35	2.0-6.3	0.10-0.14	7.9-8.4	Low			
			2.0-6.3	0.25-0.35	6.6-7.3	Low		High	Low.
95-100	90-100	60-70	0.63-2.0	0.16-0.20	7.9-8.4	Low			
95-100	90-100	35-45	0.63-2.0	0.14-0.18	7.9-8.4	Moderate			
95-100	90-100	20-25	2.0-6.3	0.06-0.10	7.9-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.6-7.3	Low	Low	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	6.6-7.3	Moderate			
95-100	90-100	65-75	0.63-2.0	0.16-0.20	5.6-6.5	Moderate			
95-100	90-100	35-45	0.63-2.0	0.14-0.18	6.1-6.5	Moderate			
95-100	95-100	90-100	0.63-2.0	0.18-0.22	6.6-7.8	Low	Low	Low	Low.
95-100	90-100	35-45	0.63-2.0	0.14-0.18	6.6-8.4	Moderate			
95-100	85-95	25-35	2.0-6.3	0.10-0.14	7.4-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.1-7.3	Low	Low	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	6.1-6.5	Moderate			
90-100	70-80	35-45	0.63-2.0	0.14-0.18	7.4-7.8	Moderate			
50-60	30-40	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
95-100	95-100	60-70	0.63-2.0	0.18-0.22	6.1-7.8	Low	Low	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.18-0.22	6.1-6.5	Low			
90-100	90-100	35-45	0.63-2.0	0.14-0.18	7.9-8.4	Moderate			
50-60	30-40	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.6-8.4	Low	Low	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.16-2.0	6.1-6.5	Moderate			
95-100	90-100	65-75	0.63-2.0	0.16-0.20	6.6-7.3	Moderate			
90-100	70-80	25-35	2.0-6.3	0.10-0.14	7.4-8.4	Low			
95-100	90-100	60-70	0.63-2.0	0.18-0.22	6.1-7.3	Low	Low	Low	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	6.1-6.5	Moderate			
90-100	70-80	25-35	2.0-6.3	0.10-0.14	7.4-8.4	Low	Low	Low	Low.
50-60	40-50	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
			2.0-6.3	0.25-0.35	6.6-7.8	Low		High	Low.
90-100	90-100	90-100	0.06-0.20	0.16-0.20	7.4-8.4	Moderate			

TABLE 7.—*Estimated engineering*

Soil series and map symbols	Estimated depth to water table	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	Inches			
*Rotamer: RtB2, RtC2, RtD, RuE, RuF	5+	0-8	Loam	ML	A-4
For Rotamer, thin variant, part of RuE and RuF, see Rotamer series, thin variant.		8-19	Clay loam	CL	A-6
		19-60	Gravelly sandy loam	SM	A-2
Rotamer, thin variant	5+	0-7	Gravelly sandy loam	SM	A-2
Mapped only in complexes with Rotamer soils.		7-60	Gravelly sandy loam	SM	A-2
St. Charles: SaA, SaB, SaC2, SaD	3-5+	0-12	Silt loam	ML	A-4
		12-60	Silty clay loam	CL	A-6
		60-65	Sandy clay loam	SC	A-6
		65-72	Sandy loam	SM	A-2
St. Charles, gravelly substratum: SbA, SbB, SbC2.	3-5+	0-20	Silt loam	ML	A-4
		20-43	Silty clay loam	CL	A-6
		43-52	Gravelly loamy sand	SM-SC	A-2
		52-60	Sand and gravel	SP	A-1
Sebewa: [1/] Se	0-1	0-13	Silt loam	ML	A-6
		13-30	Clay loam	CL	A-6
		30-60	Sand and gravel	SP	A-1
Sisson: SkA, SkB, SkC2	5+	0-23	Loam	ML	A-4
		23-39	Fine sandy loam	ML	A-4
		39-60	Silt and fine sand	ML	A-4
Sogn: SoB, SoC2, SoD, SoF	5+	0-12	Loam	ML	A-4
		12-60	Dolomite.		
Troxel: [1/] TrA	3-5+	0-38	Silt loam	ML	A-4
		38-46	Silty clay loam	CL	A-6
		46-60	Clay loam	CL	A-6
Warsaw: WaA, WaB, WaC2	5+	0-14	Silt loam	ML	A-4
		14-25	Clay loam	CL	A-6
		25-36	Gravelly sandy clay loam	SC	A-4
		36-60	Sand and gravel	SP	A-1
Watseka: [1/] Wb	1-3	0-14	Loamy fine sand	SM	A-2
		14-31	Loamy fine sand	SM	A-2
		31-60	Sand	SP	A-3
Wauconda: [1/] WcA	1-3	0-12	Silt loam	ML	A-4
		12-37	Silty clay loam	CL	A-7
		37-60	Silt and fine sand	ML	A-4
Westville: WeA, WeB, WeC2, WfA, WfB2, WfC2.	3-5+	0-13	Loam	ML	A-4
		13-48	Clay loam	CL	A-7
		48-83	Sandy clay loam	SC	A-4
		83-92	Sandy loam	SM	A-2
Whalan: WhB2, WhC2, W1A, W1B2, W1C2, W1D2.	5+	0-13	Loam	ML	A-4
		13-34	Clay loam	CL	A-7
		34-36	Clay	CH	A-7
		36-60	Dolomite.		
Winnebago: WnA, WnB2, WnC2	3-5+	0-11	Silt loam	ML	A-4
		11-63	Clay loam	CL	A-7
		63-70	Sandy clay loam	SC	A-4
		70-87	Sandy loam	SM	A-2

See footnotes at end of table.

properties of the soils—Continued

Percentage passing sieve--			Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost hazard	Corrosion potential	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						Metal	Concrete
			Inches per hour	Inches per inch of soil	pH value				
95-100	90-100	55-65	0.63-2.0	0.18-0.22	6.6-7.3	Low	Low	Low	Low.
90-100	85-95	65-75	0.63-2.0	0.16-0.20	6.6-8.4	Moderate			
80-90	70-80	25-35	2.0-6.3	0.10-0.14	7.4-8.4	Low			
90-100	70-80	25-35	2.0-6.3	0.12-0.16	7.4-8.4	Low	Low	Low	Low.
80-90	70-80	25-35	2.0-6.3	0.10-0.14	7.4-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	7.4-7.8	Low	Low	Low	Low.
95-100	95-100	80-90	0.63-2.0	0.16-0.20	5.6-6.0	Moderate			
95-100	90-100	35-45	0.63-2.0	0.14-0.18	6.1-6.5	Moderate			
90-100	85-95	25-35	2.0-6.3	0.10-0.14	7.4-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.1-7.3	Low	Low	Low	Low.
95-100	95-100	85-95	0.63-2.0	0.16-0.20	5.1-5.5	Moderate			
80-95	70-90	15-25	2.0-6.3	0.06-0.10	6.6-7.8	Low			
55-65	45-55	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.6-7.8	Low	High	High	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	7.4-7.8	Moderate			
50-60	30-40	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
95-100	90-100	60-70	0.63-2.0	0.18-0.22	7.4-7.8	Low	Low	Low	Low.
95-100	95-100	50-55	0.63-2.0	0.12-0.16	6.6-7.3	Low			
95-100	95-100	75-85	0.63-2.0	0.14-0.18	7.4-8.4	Low			
90-100	85-95	60-70	0.63-2.0	0.18-0.22	6.6-8.4	Low	Low	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.1-7.8	Low	Moderate	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	5.6-6.0	Moderate			
90-100	90-100	65-75	0.63-2.0	0.16-0.20	5.1-6.0	Moderate			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	5.6-7.3	Low	Low	Low	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	5.6-6.0	Moderate			
90-100	75-85	35-45	0.63-2.0	0.14-0.18	5.6-6.0	Moderate			
50-60	30-40	1-5	6.3-20.0	0.02-0.04	7.4-8.4	Low			
95-100	95-100	25-30	2.0-6.3	0.10-0.14	7.9-8.4	Low	Low	Moderate	Low.
95-100	95-100	25-30	6.3-20.0	0.08-0.12	6.6-7.8	Low			
95-100	85-95	1-5	6.3-20.0	0.03-0.05	6.6-7.3	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	7.4-7.8	Low	High	Moderate	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	7.4-7.8	Moderate			
95-100	95-100	55-65	0.63-2.0	0.16-0.20	7.4-8.4	Low			
95-100	90-100	60-70	0.63-2.0	0.18-0.22	7.4-7.8	Low	Low	Low	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	4.5-6.5	Moderate			
95-100	90-100	35-45	0.63-2.0	0.14-0.18	4.5-7.3	Moderate			
90-100	85-95	25-35	2.0-6.3	0.10-0.14	7.4-7.8	Low			
95-100	90-100	60-70	0.63-2.0	0.18-0.22	5.6-6.5	Low	Low	Low	Low.
95-100	90-100	65-75	0.63-2.0	0.16-0.20	6.1-7.3	Moderate			
95-100	95-100	80-90	0.20-0.63	0.10-0.14	6.6-7.3	High			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	6.1-6.5	Low	Low	Low	Low.
95-100	85-95	65-75	0.63-2.0	0.16-0.20	5.6-6.0	Moderate			
95-100	85-95	35-45	0.63-2.0	0.14-0.18	6.1-6.5	Moderate			
90-100	85-95	25-35	2.0-6.3	0.10-0.14	7.4-7.8	Low			

TABLE 7.—*Estimated engineering*

Soil series and map symbols	Estimated depth to water table	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	Inches			
Worthen:[1/] WoA	3-5+	0-10	Silt loam	ML	A-4
		10-60	Silt loam	ML	A-4
Zurich: ZuA, ZuB, ZuC2	3-5+	0-12	Silt loam	ML	A-4
		12-37	Silty clay loam	CL	A-7
		37-60	Silt and fine sand	ML	A-4

[1/] Soils are subject to flooding, ponding, or occasional overflow of short duration.

tant because the reservoir must be able to retain water with a minimum of seepage. Other features that affect this use are depth to the water table and depth to bedrock or other unfavorable layers. Soil slope affects the relationship of reservoir size to the size of the embankment. Farm ponds in nearly level to gently sloping areas have a larger potential reservoir area than those on sloping and steep areas with the same size embankments.

The features that are related to disturbed soils are considered for farm pond embankments. The ratings are based on the behavoir of the soil after it has been placed in the embankment. The soil should compact easily, be stable in place, and have a low compressibility. It should have a high shear strength, a low shrink-swell potential, and low susceptibility to piping. Erodibility should be low and there should be few stones. Organic soils are generally unsuitable for embankments.

Town and country planning

Table 9 (p. 66) contains soil interpretations that are pertinent to urban expansion. One such interpretation applies to soils where public sewerage systems have not been installed and where builders must depend on onsite soil absorption systems. Other interpretations indicate soil features affecting road construction, foundation for low buildings, and sanitary land fill. Suitability of soils as a source of topsoil, sand and gravel, and road fill also is given. Soils are rated in terms of suitability as a source of topsoil, sand and gravel, and road fill because the rating is dependent mainly on availability of materials and little if anything can be done to compensate for a deficiency. Septic tank filter fields and sewage lagoons are rated in terms of limitations that can be overcome by manipulation or management.

Suitability ratings of good, fair, poor, and unsuitable and limitation ratings of slight, moderate, and severe are used in this survey. A suitability rating of good or a limitation rating of slight indicates the soil has no limitations or that the limitations for a given use are easy to overcome. Fair suitability or moderate limitation ratings are used for a given use that can be overcome by average management and manipulation. Poor suitability or severe limitation ratings are used for soils that have limitations for a given use that are difficult to overcome. Unsuitable ratings are reserved for those soils that have limitations that generally preclude their use for a given purpose.

In this table, the heading "Topsoil" refers to soil material to be used in a location other than its natural position. The material generally is moved from its original location to a new residential development, a fresh road cut, or a new embankment. When spread over the new location, it is used to grow grass, shrubs, or flowers. Both surface soil and subsoil are rated because, in some areas, the subsoil may be the best material available. Soil properties that affect plant growth, such as productivity and available water capacity, are part of the criteria used to determine the suitability of soil for topsoil. Dark-colored soils that contain large amounts of active organic matter and that have high natural fertility are generally productive. Stability in sloping areas and erodibility are among the factors that indicate how well the soil material will remain in place at its new location. Wetness and topography affect the ease of removing the soil material. Thickness of soil layers and depth to bedrock determine the quantity that can be economically removed. Gravel, stones, and cobblestones generally make the material unfavorable for use as topsoil.

The rating of soils for suitability as a source of sand and gravel are based mainly on the nature of the subsoil and substratum. The principal criteria for rating the soil is the presence or absence of soil material that is suitable for use as a base course in construction work or in concrete. Quality, quantity, and difficulty of excavation are factors that affect the ratings. The presence of stones and boulders and the presence and amount of fines (silt and clay) affect the quality of the material. Grain sizes and shape of the sand and gravel particles affect suitability for kinds of use, such as concrete or road base. Thickness of the deposits, depth to sand and gravel, and depth to ground water affect the availability and difficulty of obtaining the material. Soils underlain, at a depth of less than 5 feet, by bedrock suitable for crushing are indicated in the interpretations.

The suitability of soils as a source of road fill is based on the performance of the soil material in an embankment that

properties of the soils—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost hazard	Corrosion potential	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						Metal	Concrete
			Inches per hour	Inches per inch of soil	pH value				
95-100	95-100	90-100	0.63-2.0	0.20-0.24	5.6-6.0	Low	High	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.20-0.24	5.6-7.3	Low			
95-100	95-100	90-100	0.63-2.0	0.20-0.24	7.4-7.9	Low	Low	Low	Low.
95-100	95-100	90-100	0.63-2.0	0.16-0.20	6.1-8.4	Moderate			
95-100	95-100	75-85	0.63-2.0	0.12-0.16	7.9-8.4	Low			

supports the road subbase and base course or surface course. Ratings are for material, generally in the subsoil and substratum, that has been excavated from borrow pits and moved to the fill or embankment. Sandy soils that contain some silt and clay for binder are best for this use. Shear strength, bearing value, stability, and erodibility are important factors affecting suitability because they determine how well the soil can remain in place when used for road fill. Compressibility, shrink-swell potential, and susceptibility to frost action affect the durability of most all-weather surface coatings. Unfavorable extremes in these factors result in breakage of concrete or asphalt pavement. Workability, accessibility, depth to water table, and the presence of stones or boulders affect the ease of moving soil material and building an embankment. Depth to water table also affects stability and generally determines the volume of the road fill necessary to achieve stability.

The kind of soil beneath a highway affects the cost of construction, the durability, and the cost of maintenance. Where there are unfavorable soil features in the proposed site of a highway, measures can be taken to compensate for them. In many cases the proposed highway can be relocated to a more favorable site. The subsoil and substratum are rated for highway location. The surface layer generally is removed in construction because it contains a large amount of organic matter. Internal soil features that affect highway location are the presence of organic material, thickness of organic layers, depth to bedrock, presence of and depth to a high water table (permanent or seasonal), frost-heave potential, and plasticity of the soil material. External features that affect highway location are stability of slopes, erodibility, flood hazard, topography (the need for cuts and fills), and the ease of excavation. Areas that have springs or seep spots are very unfavorable as highway sites.

Low buildings are residential developments, buildings for light industry or commercial enterprises, and other small buildings, such as utility buildings for recreational developments and parks, small schools, and churches. These buildings are no more than three stories high and have no more than 2,500 square feet of floor space per floor. The undisturbed subsoil and substratum are rated for foundations for low buildings. Factors that determine the ability of a soil to support foundation loads normal for low buildings are the criteria upon which ratings are based. Ratings are given for buildings with and without basements.

Basements built in somewhat poorly drained or poorly drained soils are generally wet unless precautions are taken to remove excess water or to waterproof the basement. Soil features, such as shear strength, shrink-swell potential, degree of compaction under load, bearing value, and compressibility, can be determined by test. Susceptibility to liquefaction, piping, and sliding are mainly determined by observation and experience. Soil features, for example, depth to bedrock, affect ease of excavation and stability under load. Depth to the water table, whether permanent or seasonal, indirectly affects bearing value and stability and has a direct effect on the amount of moisture in and around basements. It is difficult to maintain dry conditions where water levels are above the basement floor level. The depth to which frost may cause heaving also affects the depth to which foundations need to be placed.

Sanitary land fills are receiving much attention because, where improperly constructed or located, they can become a source of rat infestation, disease, and ground water pollution. As population centers grow, disposing of solid waste becomes a more acute problem. Sites in soil that ameliorate the leachate from land-fill pits and yet permit the passage of leachate through the soil are desirable. Soil texture is important to location of sanitary land fills because of the need gradually to remove, by leaching, toxic or other substances detrimental to health. Other factors that help determine limitations of soils for this purpose are soil wetness, depth to the water table, and depth to bedrock. Soil slope, hardness of the bedrock, presence of stones, and the flood hazard also are important.

In areas beyond the reach of a municipal sewerage system, the septic tank and the accompanying filter field are important to comfortable living and health of individuals and the surrounding community. The filter field, if properly installed, distributes the effluent fro the septic tank uniformly over a large area of soil. Passage of effluent through the soil helps purify the effluent by leaching out toxic solids

TABLE 8.—*Engineering interpretations*

[The land types Alluvial land, wet (Aw), Marsh (Mc), and Rock land (Ro) are omitted from this table because their at least one mapping unit is made up of two or more kinds of soil. The soils in such mapping units may have ferring to other

Soil series and map symbols	Soil features affecting—		
	Agricultural drainage	Irrigation	Terraces and diversions
Adrian: Ad	Substratum has rapid permeability and is generally unstable; subsurface drainage feasible; very poorly drained.	High available water capacity; moderately deep and deep soil; rapid water-intake rate; subject to blowing; very poorly drained; nearly level.	Generally not applicable.
Aztalan: AzA	Moderately slow permeability; somewhat poorly drained; subsurface or surface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; somewhat poorly drained; nearly level and gently sloping.	Wetness can hinder construction.
Billett: B1A, B1B	Natural drainage is adequate.	Low available water capacity; deep soil; rapid water-intake rate; nearly level and gently sloping.	Difficult to vegetate and stabilize.
Billett, mottled subsoil variant: BmA.	Moderately rapid permeability; somewhat poorly drained; subsurface drainage feasible.	Low available water capacity; deep soil; rapid water-intake rate; somewhat poorly drained; nearly level and gently sloping.	Difficult to stabilize; wetness can hinder construction.
Brookston: Br	Moderate permeability; poorly drained; surface or subsurface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; poorly drained; nearly level.	Wetness can hinder construction.
Casco: CaB2, CaC2, CaD2, CaE.	Natural drainage is adequate.	Low available water capacity; shallow soil over stratified sand and gravel; moderate water-intake rate; gently sloping to very steep.	Shallow to sand and gravel.
Colwood: Co	Moderate permeability; poorly drained; substratum generally unstable; subsurface or surface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; poorly drained; nearly level.	Generally not applicable.
Darroch: Da	Moderate permeability; somewhat poorly drained; subsurface or surface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; somewhat poorly drained; nearly level.	Low stability; highly erodible; wetness can hinder construction.
Dickman: DcA, DcB, DcC2	Natural drainage is adequate.	Low available water capacity; deep soil; rapid water-intake rate; nearly level to sloping.	Loamy soil difficult to vegetate and stabilize.
Dresden: DrA, DrB, DrC2, DrD2.	Natural drainage is adequate.	Medium available water capacity; moderately deep soil; moderate water-intake rate; nearly level to steep.	Sand and gravel at a depth of 20 to 40 inches.
Durand: DuA, DuB2, DuC2	Natural drainage is adequate.	High available water capacity; deep soil; moderate water-intake rate; nearly level to sloping.	No adverse features
Edmund: EdB2, EdC2, EdD2, EdE	Natural drainage is adequate.	Very low available water capacity; shallow soil; moderate water-intake rate; gently sloping to very steep.	Shallow to dolomite bedrock; clayey subsoil.

for farm uses

characteristics are variable. Onsite investigation is required. An asterisk in the first column indicates that different properties and limitations, and it is therefore necessary to follow carefully the instructions for re- series as indicated]

Soil features affecting—Continued		
Grassed waterways	Farm ponds	
	Reservoir areas	Embankments
Subject to soil blowing; erodible; nearly level; wetness can hinder construction.	Moderately rapid permeability in muck; rapid permeability in sand substratum; high water table; dug-out ponds feasible.	Organic material not suitable for embankment. Substratum: poor stability; low compressibility; piping hazard; very pervious.
Erodible; wetness can hinder construction.	Moderately slow permeability; seasonal saturation with water; dug-out ponds may be feasible.	Subsoil and substratum: fair to good stability; medium to high compressibility; fair to good compaction characteristics; semipervious.
Erodible; difficult to vegetate and stabilize; subject to blowing.	Moderately rapid permeability.	Subsoil: fair stability; fair to good compaction characteristics; piping hazard; pervious. Substratum: poor stability; fair compaction characteristics; piping hazard; very pervious.
Erodible; difficult to stabilize; subject to blowing if drained; wetness can hinder construction.	Moderately rapid permeability; seasonal saturation with water; dug-out ponds feasible.	Subsoil: fair stability; fair to good compaction characteristics; piping hazard; pervious. Substratum: poor stability; fair compaction characteristics; piping hazard; very pervious.
Poorly drained; erodible; wetness can hinder construction.	Moderate permeability; high water table; dug-out ponds feasible.	Subsoil and substratum: fair to good stability; fair to good compaction characteristics; semipervious
Erodible; less than 2 feet to sand and gravel.	Moderate permeability in subsoil; rapid permeability in substratum.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; very pervious.
Poorly drained, erodible; wetness can hinder construction.	Moderate permeability; high water table; dug-out ponds feasible.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: poor stability; poor compaction characteristics; piping hazard; pervious.
Somewhat poorly drained; erodible; wetness can hinder construction.	Moderate permeability; seasonal saturation with water; dug-out ponds feasible.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: poor stability; poor compaction characteristics; piping hazard; pervious.
Erodible; difficult to vegetate and stabilize; subject to soil blowing.	Rapid permeability	Subsoil: fair stability; fair to good compaction characteristics; pervious. Substratum: poor stability; fair compaction characteristics; very pervious.
Erodible	Moderate permeability in subsoil; rapid permeability in substratum.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; very pervious.
Erodible	Moderate permeability	Subsoil: fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; piping hazard; pervious.
Shallow to dolomite bedrock; clayey subsoil.	Subsoil: moderate permeability. Substratum: fractured dolomite bedrock at a depth of 12 to 20 inches.	Subsoil: fair to poor stability; fair to poor compaction characteristics; very thin. Substratum: fractured dolomite bedrock at a depth of 12 to 20 inches.

TABLE 8.—*Engineering interpretations*

Soil series and map symbols	Soil features affecting—		
	Agricultural drainage	Irrigation	Terraces and diversions
Elburn:			
E1A	Moderate permeability; somewhat poorly drained; subsurface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; somewhat poorly drained; nearly level and gently sloping.	Wetness can hinder construction.
EmA	Moderate permeability, except in the subsiratum where it is rapid; somewhat poorly drained; subsurface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; somewhat poorly drained; nearly level and gently sloping.	Wetness can hinder construction.
EoA	Moderate permeability; somewhat poorly drained; subject to flooding; dikes, surface and subsurface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; subject to flooding; somewhat poorly drained; nearly level and gently sloping.	Low stability; subject to flooding; wetness can hinder construction.
Eleva: EvB, EvC2, EvD, EvE.	Natural drainage is adequate	Low available water capacity; moderately deep soil; moderate water-intake rate; gently sloping to very steep.	Sandstone bedrock at a depth of 20 to 40 inches.
Flagg: F1A, F1B	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level and gently sloping.	No adverse features
Gotham: GoA, GoB, GoC2, GoD.	Natural drainage is adequate	Low available water capacity; moderately deep soil; rapid water-intake rate; subject to soil blowing; nearly level to moderately steep.	Sandy soil difficult to vegetate and stabilize.
Gotham, bedrock vriant: GpB2, GpC2.	Natural drainage is adequate	Low available water capacity; moderately deep soil; rapid water-intake rate; subject to soil blowing; gently sloping and sloping.	Sandy soil, difficult to vegetate and stabilize; dolomite bedrock at a depth of 24 to 40 inches.
Griswold: GrA, GrB2, GrC2, GrD2.	Natural drainage is adequate	Medium available water capacity; deep soil; moderate water-intake rate; nearly level to moderately steep.	Sandy loam substratum at a depth of 20 to 40 inches; moderate stability.
Hayfield: Ha	Moderate permeability in subsoil; rapid permeability in substratum; somewhat poorly drained; subsurface or surface drainage feasible.	Medium available water capacity; moderately deep soil; moderate water-intake rate; somewhat poorly drained; nearly level.	Sand substratum at a depth of 20 to 40 inches; wetness can hinder construction.
Hebron: HeA	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level and gently sloping.	No adverse features
Houghton: Ho	Moderately rapid permeability; very poorly drained; subsurface drainage feasible.	Very high available water capacity; deep soil; rapid water-intake rate; subject to soil blowing; very poorly drained; nearly level.	Generally not applicable.

for farm uses—Continued

Soil features affecting—Continued		
Grassed waterways	Farm ponds	
	Reservoir areas	Embankments
Wetness can hinder construction.	Moderate permeability; seasonal saturation with water; dug-out ponds feasible.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; piping hazard; pervious.
Wetness can hinder construction.	Moderate permeability in subsoil; rapid permeability in substratum; seasonal saturation with water; dug-out ponds feasible.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; very pervious.
Wetness can hinder construction.	Moderate permeability; seasonal saturation with water; subject to flooding; dug-out ponds feasible.	Subsoil and substratum: poor stability; medium compressibility; poor compaction characteristics; pervious.
Erodible; difficult to vegetate and stabilize; subject to soil blowing.	Moderately rapid permeability.	Subsoil: poor stability; poor compaction characteristics; piping hazard; semipervious. Substratum: sandstone bedrock.
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; pervious.
Erodible; difficult to vegetate and stabilize; subject to soil blowing.	Moderately rapid permeability in substratum.	Subsoil: fair stability; fair to good compaction characteristics; pervious. Substratum: poor stability; fair compaction characteristics; piping hazard; very pervious.
Erodible; difficult to vegetate and stabilize; subject to soil blowing.	Subsoil: moderately rapid permeability. Substratum: fractured dolomite bedrock at a depth of 24 to 40 inches.	Subsoil: fair stability; fair to good compaction characteristics; pervious. Substratum: fractured dolomite bedrock.
Erodible	Moderate permeability	Subsoil: fair stability; fair to good compaction characteristics; semipervious. Substratum: fair to good compaction characteristics; pervious.
Wetness can hinder construction.	Moderate permeability in subsoil; rapid permeability in substratum; seasonal saturation with water; dug-out ponds feasible.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: poor stability; fair compaction characteristics; piping hazard; very pervious.
No adverse features	Moderately slow permeability	Subsoil: fair stability; fair to good compaction characteristics; semipervious. Substratum: fair to good stability; fair to good compaction characteristics; semipervious; moderate shrink-swell potential.
Very poorly drained; subject to soil blowing; nearly level; wetness can hinder construction.	Moderately rapid permeability; high water table; dug-out ponds feasible.	Organic material not suitable for embankment.

TABLE 8.—*Engineering interpretations*

Soil series and map symbols	Soil features affecting—		
	Agricultural drainage	Irrigation	Terraces and diversions
Jasper: JaA, JaB	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level and gently sloping.	Low stability; highly erodible.
Juneau: JuA	Well drained and moderately well drained; subject to occasional flooding.	High available water capacity; deep soil; moderate water-intake rate; nearly level and gently sloping.	No adverse features
Kane: KaA	Moderate permeability in subsoil; rapid permeability in substratum; somewhat poorly drained; subsurface drainage feasible.	Medium available water capacity; moderately deep soil; moderate water-intake rate; somewhat poorly drained; nearly level and gently sloping.	Wetness can hinder construction.
Kidder: KdB, KdC2, KdD, KeA, KeB2, KeC2, KeD2, KeE.	Natural drainage is adequate	Medium available water capacity; deep soil; moderate water-intake rate; nearly level to steep.	Sandy loam substratum at a depth of 20 to 40 inches.
Locke: LkA	Moderate permeability; somewhat poorly drained; subsurface or surface drainage feasible.	Medium available water capacity; deep soil; moderate water-intake rate; somewhat poorly drained; nearly level to gently sloping.	Sandy loam substratum at a depth of 20 to 40 inches; wetness can hinder construction.
Lorenzo: LoA, LoB, LoC2, LoD.	Natural drainage is adequate	Low available water capacity; shallow soil; rapid water-intake rate; nearly level to very steep.	Shallow to sand and gravel.
Mahalasville: Ma, Mb	Moderate permeability; poorly drained; subsurface or surface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; poorly drained; nearly level.	Generally not applicable.
Marshan: Md	Moderate permeability in subsoil; rapid permeability in substratum; poorly drained; substratum generally unstable; subsurface or surface drainage feasible.	Medium available water capacity; moderately deep soil; moderate water-intake rate; poorly drained; nearly level.	Generally not applicable.
Maumee: Me	Rapid permeability; poorly drained; substratum generally unstable; subsurface or surface drainage feasible.	Very low available water capacity; deep soil; rapid water-intake rate; subject to soil blowing; poorly drained; nearly level.	Generally not applicable.
Millington: Mf	Moderate permeability; poorly drained; subject to flooding; subsurface or surface drainage and dikes are feasible.	High available water capacity; deep soil; moderate water-intake rate; poorly drained; nearly level.	Generally not applicable.
Navan: Na	Moderately slow permeability; poorly drained; surface or subsurface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; poorly drained; nearly level.	Generally not applicable.
Ogle: OgA, OgB	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level and gently sloping.	No adverse features
Oshtemo: OoA, OoB, OoC2, OoD2.	Natural drainage is adequate	Low available water capacity; deep soil; rapid water-intake rate; subject to soil blowing; nearly level to steep.	Sandy loam soil difficult to vegetate and stabilize.

for farm uses—Continued

Soil features affecting—Continued		
Grassed waterways	Farm ponds	
	Reservoir areas	Embankments
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: poor stability; poor compaction characteristics; piping hazard; pervious.
No adverse features	Moderate permeability	Subsoil and substratum: fair to good stability; fair to good compaction characteristics; semipervious.
Wetness can hinder construction.	Moderate permeability in subsoil; rapid permeability in substratum; seasonal saturation with water; dug-out ponds feasible.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; good compaction characteristics; very pervious.
Erodible; sandy loam surface difficult to vegetate and stabilize.	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; pervious.
Wetness can hinder construction.	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; piping hazard; pervious.
Erodible; difficult to establish good cover.	Moderate permeability in subsoil; rapid permeability in substratum.	Subsoil: fair stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; very pervious.
Wetness can hinder construction.	Moderate permeability; high water table; dug-out ponds feasible.	Subsoil and substratum: fair to good stability; fair to good compaction characteristics; semipervious; moderate shrink-swell potential in subsoil.
Wetness can hinder construction.	Moderate permeability in the subsoil; rapid permeability in the substratum; high water table; dug-out ponds feasible.	Subsoil: fair to good stability; fair compaction characteristics; piping hazard; very pervious.
Erodible; difficult to stabilize; subject to soil blowing when drained; wetness can hinder construction.	Shallow to underlying sand; rapid permeability; high water table; dug-out ponds feasible.	Subsoil and substratum: poor stability; fair compaction characteristics; piping hazard; very pervious.
Wetness can hinder construction; nearly level.	Moderate permeability; high water table; dug-out ponds feasible.	Subsoil and substratum: fair stability; fair compaction characteristics; semipervious.
Wetness can hinder construction.	Moderately slow permeability; high water table; dug-out ponds feasible.	Subsoil and substratum: fair to good stability; fair to good compaction characteristics; semipervious.
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious.
Sandy loam soil difficult to vegetate and stabilize; erodible; subject to soil blowing.	Moderately rapid permeability	Subsoil: fair stability; fair to good compaction characteristics; pervious. Substratum: poor stability; fair compaction characteristics; erodible; piping hazard.

TABLE 8.—*Engineering interpretations*

Soil series and map symbols	Soil features affecting—		
	Agricultural drainage	Irrigation	Terraces and diversions
Oshtemo, dark variant: OsA, OsB, OsC2.	Natural drainage is adequate.	Low available water capacity; deep soil; rapid water-intake rate; subject to soil blowing; nearly level to sloping.	Sandy loam soil difficult to vegetate and stabilize.
Otter: Ot	Moderate permeability; poorly drained; subject to flooding; subsurface or surface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; subject to flooding; poorly drained; nearly level.	Generally not applicable.
Palms: Pa	Moderately rapid permeability in the organic material; moderate permeability in the substratum; very poorly drained; subsurface or surface drainage feasible.	Very high available water capacity; deep soil; rapid water-intake rate; subject to soil blowing; very poorly drained; nearly level.	Generally not applicable.
Pecatonica: PeA, PeB2, PeC2.	Natural drainage is adequate.	High available water capacity; deep soil; moderate water-intake rate; nearly level to sloping.	No adverse features.
Plano: P1A, P1B, P1C2	Natural drainage is adequate.	High available water capacity; deep soil; moderate water-intake rate; nearly level to sloping.	No adverse features.
Plano, gravelly substratum: PmA, PmB.	Natural drainage is adequate.	High available water capacity; deep soil; moderate water-intake rate; nearly level and gently sloping.	No adverse features.
Plano, loamy variant: PnA, PnB.	Natural drainage is adequate.	High available water capacity; deep soil; moderate water-intake rate; nearly level to gently sloping.	No adverse features.
Ringwood: RnB2, RnC2	Natural drainage is adequate.	High available water capacity; deep soil; moderate water-intake rate; gently sloping and sloping.	Sandy loam substratum at a depth of 24 to 40 inches.
Rockton: RpB, RpC2, RpD2	Natural drainage is adequate.	Medium available water capacity; moderately deep soil; moderate water-intake rate; gently sloping to moderately steep.	Dolomite bedrock at a depth of 20 to 40 inches.
*Rodman: RrC2, RrE, RrF. For Lorenzo part of RrC2, RrE, and RrF, see Lorenzo series.	Natural drainage is adequate.	Very low available water capacity; shallow and very shallow soil; rapid water-intake rate; sloping to very steep.	Sand and gravel substratum at a depth of 8 to 14 inches.
Rollin: Rs	Moderately rapid permeability in the organic material; slow permeability in the substratum; very poorly drained; subsurface or surface drainage feasible.	Very high available water capacity; moderately deep soil; rapid water-intake rate; subject to soil blowing; very poorly drained; nearly level.	Generally not applicable.
*Rotamer: RtB2, RtC2, RtD, RuE, RuF. For Rotamer, thin variant, part of RuE and RuF, see Rotamer series, thin variant.	Natural drainage is adequate.	Medium available water capacity; moderately deep soil; moderate water-intake rate; gently sloping to very steep.	Sandy loam substratum at a depth of 10 to 24 inches.

for farm uses—Continued

Soil features affecting—Continued		
Grassed waterways	Farm ponds	
	Reservoir areas	Embankments
Sandy loam soil difficult to vegetate and stabilize; erodible; subject to soil blowing.	Moderately rapid permeability	Subsoil: fair stability; fair to good compaction characteristics; pervious. Substratum: poor stability; fair compaction characteristics; erodible; piping hazard.
Wetness can hinder construction; nearly level.	Moderate permeability; subject to flooding; high water table; dug-out ponds feasible.	Subsurface and substratum: fair to good stability; fair to good compaction characteristics; semipervious; medium to high compressibility.
Subject to soil blowing; erodible; nearly level; wetness can hinder construction.	Moderately rapid permeability in the organic material; moderate permeability in the substratum; high water table; dug-out ponds feasible.	Organic material not suitable for embankment. Substratum: poor to fair stability; poor to fair compaction characteristics; pervious to semipervious.
Erodible	Moderate permeability	Subsoil and substratum: fair stability; fair to good compaction characteristics; pervious.
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair to good compaction characteristics; pervious.
Erodible	Moderate permeability in subsoil; rapid permeability in substratum.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; very pervious.
Erodible	Moderate permeability in subsoil; rapid permeability in substratum.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair to good compaction characteristics; very pervious.
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; pervious.
Erodible	Subsoil: moderate permeability. Substratum: fractured dolomite rock at a depth of 20 to 40 inches.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fractured dolomite bedrock.
Erodible; sand and gravel difficult to vegetate and stabilize.	Rapid permeability	Substratum: fair stability; fair to good compaction characteristics; very pervious; commonly stony.
Subject to soil blowing; erodible; nearly level; wetness can hinder construction.	Moderately rapid permeability in organic material; slow permeability in substratum; high water table; dug-out ponds feasible.	Organic material not suitable for embankment. Substratum: poor stability; poor to very poor compaction characteristics.
Erodible	Moderate permeability	Subsoil: fair stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; pervious.

TABLE 8.—*Engineering interpretations*

Soil series and map symbols	Soil features affecting—		
	Agricultural drainage	Irrigation	Terraces and diversions
Rotamer, thin variant. Mapped only in complexes with Rotamer soils.	Natural drainage is adequate	Low available water capacity; shallow soil; rapid water-intake rate; steep and very steep.	Sandy loam substratum at a depth of 5 to 24 inches.
St. Charles: SaA, SaB, SaC2, SaD.	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level to moderately steep.	No adverse features
St. Charles, gravelly substratum: SbA, SbB, SbC2.	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level to sloping.	No adverse features
Sebewa: Se	Moderate permeability in subsoil; rapid permeability in substratum; poorly drained; subsurface or surface drainage feasible.	Medium available water capacity; moderately deep soil; moderate water-intake rate; poorly drained; nearly level.	Generally not applicable.
Sisson: SkA, SkB, SkC2	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level to sloping.	Low stability; highly erodible.
Sogn: SoB, SoC2, SoD, SoF	Natural drainage is adequate	Very low available water capacity; shallow and very shallow soil; moderate water-intake rate; gently sloping to very steep.	Dolomite bedrock at a depth of 4 to 6 inches.
Troxel: TrA	Well drained and moderately well drained; subject to occasional flooding.	High available water capacity; deep soil; moderate water-intake rate; nearly level and gently sloping.	No adverse features
Warsaw: WaA, WaB, WaC2	Natural drainage is adequate	Medium available water capacity; moderately deep soil; moderate water-intake rate; nearly level to sloping.	Sand and gravel at a depth of 20 to 40 inches.
Watseka: Wb	Rapid permeability; somewhat poorly drained; subsurface drainage feasible.	Low available water capacity; moderately deep soil; rapid water-intake rate; somewhat poorly drained; nearly level.	Sandy soil difficult to vegetate and stabilize; wetness can hinder construction.
Wauconda: WcA	Moderate permeability; somewhat poorly drained; subsurface or surface drainage feasible.	High available water capacity; deep soil; moderate water-intake rate; somewhat poorly drained; nearly level and gently sloping.	Wetness can hinder construction; low stability.
Westville: WeA, WeB, WeC2, WfA, WfB2, WfC2.	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level to sloping.	No adverse features
Whalan: WhB2, WhC2, W1A, W1B2, W1C2, W1D2.	Natural drainage is adequate	Medium available water capacity; moderately deep soil; moderate water-intake rate; nearly level to moderately steep.	Dolomite bedrock at a depth of 20 to 40 inches.

for farm uses—Continued

Soil features affecting—Continued		
Grassed waterways	Farm ponds	
	Reservoir areas	Embankments
Erodible	Moderately rapid permeability	Subsoil and substratum: fair stability; fair to good compaction characteristics; pervious; stony in places.
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; pervious.
Erodible	Moderate permeability in subsoil; rapid permeability in substratum.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; very pervious.
Wetness can hinder construction.	Moderate permeability in subsoil; rapid permeability in substratum; high water table; dug-out ponds feasible.	Subsoil: fair stability; good to fair compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; very pervious.
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: poor stability; poor compaction characteristics; piping hazard; pervious.
Erodible; dolomite bedrock at a depth of 4 to 16 inches.	Subsoil: moderate permeability. Substratum: fractured dolomite bedrock at a depth of 4 to 16 inches.	Subsoil: very thin or absent. Substratum: fractured dolomite bedrock.
No adverse features	Moderate permeability	Subsoil and substratum: fair to good stability; fair to good compaction characteristics; semipervious.
Erodible	Moderate permeability in subsoil; rapid permeability in substratum.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; very pervious.
Erodible; difficult to vegetate and stabilize; subject to soil blowing if drained; wetness can hinder construction.	Rapid permeability; seasonal saturation with water; dug-out ponds feasible.	Subsoil: fair stability; fair to good compaction characteristics; pervious. Substratum: poor stability; fair compaction characteristics; piping hazard; very pervious.
Wetness can hinder construction.	Moderate permeability; seasonal saturation with water; dug-out ponds feasible.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; piping hazard; pervious.
Erodible; difficult to establish vegetation where suface layer is sandy loam.	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; pervious.
Erodible; difficult to establish vegetation where surface layer is sandy loam.	Moderate permeability. Substratum: fractured dolomite bedrock.	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fractured dolomite bedrock.

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TABLE 8.—Engineering interpretations

Soil series and map symbols	Soil features affecting—		
	Agricultural drainage	Irrigation	Terraces and diversions
Winnebago: WnA, WnB2, WnC2	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level to sloping.	No adverse features
Worthen: WoA	Well drained and moderately well drained; subject to occasional flooding:	Very high available water capacity; deep soil; moderate water-intake rate; nearly level and gently sloping.	No adverse features
Zurich: ZuA, ZuB, ZuC2	Natural drainage is adequate	High available water capacity; deep soil; moderate water-intake rate; nearly level to sloping.	Low stability; highly erodible.

and permitting bacterial destruction of noxious substances. To accomplish these objectives, the soil must be relatively deep over bedrock or sand and gravel, must have moderate or moderately rapid permeability, must be relatively deep over ground water, and must not be susceptible to flooding (*3*).

Soil permeability is an important feature in determining the limitations of soils for septic tank filter fields. Effluent will be held above moderately slow to very slowly permeable layers and eventually emerge on the soil surface. Very rapidly permeable soils will permit effluent to move into the ground water with very little leaching or very little opportunity for the breakdown of noxious substances through bacterial activity.

Depth to the water table is important because of the dangers of contamination where the soil layer is thin over ground water. Where there is danager of flooding, the soils have very severe limitations for filter fields. The systems will not function when flooded or when soils are saturated with water and there is danger of spreading the effluent to downstream areas. Excessive soil slope causes excessive lateral movement of effluent and resultant surface seepage.

Depth to impervious bedrock or other impervious strata restrict adequate leaching of the effluent. Shallow impervious layers in the soil cause unleached effluent to flow laterally and emerge on the surface as seepage. The danger of ground-water contamination is always a factor in selection of a site for septic tank filter fields. Where soils are underlain by fractured or creviced bedrock at shallow depths, there is a danger of effluent flowing for long distances and eventually getting into the ground water (fig. 19, p. 82).

A sewage lagoon is a shallow lake that is used to hold sewage for the time required for bacterial decomposition. The requirements for the dam are the same as for other embankments designed to impound water (see "Farm pond embankment" in table 8). Adequate soil material must be available that is suitable for the structure, and when properly constructed the lagoon must be capable of holding water with minimum seepage. The material should be free of coarse cobblestones and stone-size fragments over 6 inches in diameter that interfere with compaction processes. Soil requirements for basin floors of lagoons are (1) imperviousness to seepage, (2) an even surface of low gradient and low relief, and (3) little or no organic matter.

Moderate to high amounts of organic matter are unfavorable in the basin floor, even though it is underlain by suitable soil material. Organic matter promotes acquatic plant growth that is detrimental to proper functioning of the lagoon. Fragments more than 6 inches in diameter interfere with manipulation and compaction of the soil material in the process of smoothing the basin floor and are therefore undesirable in sewage lagoon sites.

Recreational uses of the soils

The soils of Rock County have been placed in 11 recreation groups. The symbols of the soils assigned to each group are given in table 10 (p. 80). The name of each of the soils can be readily learned by referring to the "Guide to Mapping Units." The table describes the degree of limitation and soil features affecting the use of soils for various kinds of recreational developments. Each soil is rated as if it comprised the entire area of development. Although esthetics and other features are important to planning, they are not considered in these ratings. Only the soil features are considered. The size, shape, and pattern of occurrence are not considered. In general, severely eroded soils have a more severe rating than the soils listed in the tables. The degree of limitation given for the poorly drained soil is for soils in their natural state without adequate drainage. Many of these soils can be improved by artificial drainage. Soils subject to flooding vary in their degree of limitation for recreational use, depending on the duration of the flooding, as well as on the season. Flooding during the off season, for example, is much less of a limitation than flooding during the season of active use.

The ratings used in the table are slight, moderate, severe, and very severe. A rating of slight indicates that the limitation is not serious and is easily overcome. A rating of moderate indicates that the limitation generally can be corrected by practical means. A rating of severe indicates that the limitation is difficult to overcome and that suitability of the soils for the specific use is questionable. A rating of very severe indicates that the soils generally are not suitable for the specified purpose.

for farm uses—Continued

Soil features affecting—Continued		
Grassed waterways	Farm ponds	
	Reservoir areas	Embankments
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: fair stability; fair to good compaction characteristics; pervious.
No adverse features	Moderate permeability	Subsoil and substratum: poor stability and compaction characteristics; piping hazard; semipervious.
Erodible	Moderate permeability	Subsoil: fair to good stability; fair to good compaction characteristics; semipervious. Substratum: poor stability; poor compaction characteristics; piping hazard; pervious.

The information given in the table can serve as a general guide for evaluating the soils for recreational uses, but the ratings are not intended to eliminate the need for detailed onsite investigation.

The recreational uses listed in the table are discussed in the following paragraphs.

Playgrounds, athletic fields, and intensive play areas.—In this category are soils that are used for playgrounds and organized sports, such as baseball, football, tennis, and other games that subject the soil to heavy foot traffic. The ideal soil for this purpose is nearly level, well drained, firm, and provides good traction when moist. An adequate vegetative cover can be produced and maintained. Wetness or internal drainage is important because the surface of some soils remains wet for long periods after rain. Other soils drain quickly and can be used within a short time after the rain stops. Where flooding is of short duration and occurs during seasons of nonuse, it is relatively unimportant. Permeability affects the rate at which the surface dries after rain by determining the amount of water that can enter the soil and move into the lower part of the profile. It is difficult to manipulate sloping or steep soils to provide sufficient area for playgrounds and athletic fields. Texture of the surface layer affects trafficability when this layer is very dry or very moist. It also affects the hazard of soil blowing. Other features, such as depth to bedrock, stoniness, and rockiness, need to be considered.

Picnic areas, parks, and extensive play areas.—The same features that affect the use of soils for picnic areas also affect their use for parks and extensive play areas. In general, these uses are not so intensive as for athletic fields and do not involve regularly scheduled events. These areas, therefore, can be subject to occasional flooding, can be more sloping, and can be saturated with water for longer periods of time than is permissible for athletic fields. Stones and rocks are not so serious a limitation, unless they are numerous or large. Wetness or internal drainage is important because generally the poorly drained and very poorly drained soils, and some areas of somewhat poorly drained soils, are subject to ponding and are too wet for use for several weeks during the picnicking season. Flooding is important if it occurs during the season of active use. Areas that have slopes of up to 12 percent can be used for picnic sites, but areas that have moderately steep to very steep slopes of more than 12 percent are difficult to use for this purpose. Soil texture, as related to trafficability, blowing dust, and slipperiness when wet, is important for picnic areas. In general, clay, sand, and organic soils are least desirable, and sandy loam and loam soils are most desirable.

Bridle paths, nature and hiking trails.—In general, the areas are used as they occur in nature and have little or no movement of soil. The paths and trails should be relatively dry, should be relatively free of dust, and have good trafficability during the season of use. Slope is important because of its effect on soil erodibility and the gradient of the paths. Stones and rocks in small numbers are not a serious problem. A high water table and ponding, such as in poorly drained soils, limit their use for paths and trails to the drier season. Flooding during the season of use is detrimental. The sandy loam and loam soils generally have good trafficability and are relatively free of dust. Silty soils are slippery when wet and dusty when dry. Clayey soils remain wet for long periods after rain. Organic soils are not suitable for paths and trails.

Golf course fairways.—Soils used for golf course fairways are rated as in their undisturbed condition. In general, the soils should be relatively dry during the season of use, have good trafficability, and be capable of supporting a thick turf without special management (fig. 20, p. 83). Wetness is important because poorly drained and very poorly drained soils are generally subject to ponding and are wet for long periods after rain. Frequent flooding during the season of use is very unfavorable, but occasional flooding during the season of use can be tolerated. The principal features that control limitations are depth to water table, flood hazard, trafficability, available water capacity, permeability, erosion hazard, and stoniness or rockiness.

Tent and camp trailer sites.—The limitation of soils as sites for tents, small camp trailers, and the activities that generally center around them are rated in this column. The area of use should be relatively dry and have a relatively low slope gradient, good trafficability, and very few stones and rocks. Ponding has a very unfavorable effect on use of soils for campsites. Poorly drained and very poorly drained

TABLE 9.—*Engineering interpretations*

[The land types Alluvial land, wet (Aw), Marsh (Mc), and Rock land (Ro) are omitted from this table because their least one mapping unit is made up of two or more kinds of soil. The soils in such mapping units may have different to other series

Soil series and map symbols	Suitability as a source of--		
	Topsoil	Sand and gravel	Road fill 1/
Adrian: Ad	Organic layers: poor; erodible; oxidize rapidly.	Fair: sand poorly graded in substratum; high water table hinders excavation.	Organic layers: unsuitable; unstable; high compressibility; very low bearing value. Substratum: fair; low stability; high water table.
Aztalan: AzA	Surface layer: good. Subsoil: fair; crusts readily.	Unsuitable: very low sand and gravel content.	Subsoil: fair; moderate stability and bearing value. Substratum: poor; high shrink-swell potential; low bearing value; unstable; seasonal saturation with water.
Billett: BlA, BlB	Surface layer: fair. Subsoil: poor; sandy in lower part; erodible.	Good	Good
Billett, mottled subsoil variant: BmA.	Surface layer: fair; sandy loam. Subsoil: fair; sandy loam in upper part; erodible.	Good	Fair: low stability unless confined; erodible; seasonal saturation with water.
Brookston: Br	Surface layer: good. Subsoil: fair; crusts easily.	Poor: pockets of poorly graded sand and gravel occur in places in the substratum.	Subsoil: poor; moderate shrink-swell potential; moderate bearing value; unstable.
Casco: CaB2, CaC2, CaD2, CaE	Surface layer: good. Subsoil: fair; thin over gravel; crusts easily.	Good	Good
Colwood: Co	Surface layer: good. Subsoil: poor; unstable on slopes; subject to ponding.	Poor: poorly graded fine sand with silt.	Subsoil: poor; highly susceptible to frost action; moderate stability; sloping areas are erodible; high water table.
Darroch: Da	Surface layer: good. Subsoil: fair; unstable on slopes.	Poor: poorly graded fine sand with silt and clay layers.	Subsoil: fair; highly susceptible to frost action; moderate stability; sloping areas are erodible. Substratum: poor; unstable; highly susceptible to frost action; seasonal high water table.
Dickman: DcA, DcB, DcC2	Surface layer: fair; sandy loam. Subsoil: poor; sandy; erodible.	Fair: poorly graded sand substratum	Good

See footnotes at end of table.

for town and country planning

characteristics are variable. Onsite investigation is required. An asterisk in the first column indicates that at properties and limitations, and it is therefore necessary to follow carefully the instructions for referring as indicated]

Soil features affecting—			Soil limitations for sewage disposal	
Highway locations 1/	Foundations for low buildings 1/	Sanitary land fill 2/	Septic tank filter fields	Sewage lagoons
Organic soil less than 40 inches thick; less than 1 foot to permanent or seasonal high water table.	Organic layers have very low bearing value; liquefaction and piping hinder installation; basements subject to wetness.	High water table; moderately rapid permeability in the organic layers and rapid permeability in the substratum.	Severe: high water table.	Severe: high water table; rapidly permeable in substratum; overlying layers consist of organic material.
Seasonal saturation with water at depth of 1 to 3 feet; springs and seeps may be present; cuts and fills low in stability.	Subsoil has moderate shrink-swell potential, bearing value, and shear strength. Substratum has high shrink-swell potential and low bearing value; basements subject to wetness.	Seasonal saturation with water; moderately slow permeability.	Severe: seasonal saturation with water; moderately slow permeability.	Slight on slopes of 0 to 2 percent; moderate on slopes of 2 to 3 percent; seasonal saturation with water.
Loose sand hinders hauling; subject to blowing.	Can liquefy and flow when wet.	Little amelioration of leachate; moderately rapid permeability.	Moderate on slopes of 0 to 6 percent; danger of contaminating ground water.	Severe: moderately rapid permeability.
Seasonal saturation with water.	Seasonal saturation with water restricts installations; basements subject to wetness.	Little amelioration of leachate; moderately rapid permeability.	Severe: seasonal saturation with water; danger of contaminating ground water.	Severe: seasonal saturation with water; moderately rapid permeability.
Less than 1 foot to permanent high water table; hauling and excavation difficult.	Moderate bearing value; basements subject to wetness.	High water table; moderate permeability.	Severe: high water table.	Moderate: high water table; moderate permeability; low stability.
Less than 20 inches to sand and gravel; gently sloping to steep.	Subject to liquefaction and piping.	Little amelioration of leachate; moderate permeability in the subsoil and rapid permeability in the substratum.	Moderate on slopes of 0 to 12 percent; severe on steeper soils; danger of contaminating ground water.	Severe: rapid permeability in substratum.
Less than 1 foot to permanent or seasonal high water table; hauling and excavation difficult; high frost-heave potential.	Moderate bearing value; subject to liquefaction and piping; basements subject to wetness.	High water table; moderate permeability.	Severe: high water table	Severe: high water table; moderate permeability; low stability when wet.
Seasonal saturation with water at depth of 1 to 3 feet; high frost-heave potential; cuts and fills have low stability.	Moderate bearing value; subject to liquefaction and piping; basements subject to seasonal wetness.	Seasonal saturation with water; moderate permeability.	Severe: seasonal saturation with water.	Moderate on slopes of 0 to 2 percent; moderate permeability.
Loose sand hinders hauling operations.	Can liquefy and flow when wet.	Little amelioration of leachate; rapid permeability.	Moderate on slopes of 0 to 12 percent; danger of contaminating ground water.	Severe: rapid permeability.

TABLE 9.—Engineering

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road fill 1/
Dresden: DrA, DrB, DrC2, DrD2__	Surface layer: good. Subsoil: fair; gravelly, in places; crusts easily.	Good_____	Subsoil: fair; moderate shrink-swell potential; moderate bearing value. Substratum: good.
Durand: DuA, DuB2, DuC2_____	Surface layer: good. Subsoil: fair; clayey.	Poor: pockets of poorly graded sand and gravel occur in places in the substratum.	Subsoil: fair; moderate bearing value; unstable. Substratum: good; moderate stability and bearing value.
Edmund: EdB2, EdC2, EdD2, EdE___	Surface layer; good. Subsoil: poor; thin over bedrock; crusts easily.	Unsuitable: clayey soil over dolomite bedrock; source of dolomite for crushing.	Subsoil: poor; high shrink-swell potential; high compressibility and elasticity. Substratum: dolomite bedrock.
Elburn: E1A_____	Surface layer: good. Subsoil: fair; sloping areas are erodible.	Poor: pockets of poorly graded sand and gravel in substratum; thick overburden.	Fair: moderate bearing value; unstable; seasonal saturation with water.
EmA_____	Surface layer: good. Subsoil: fair; sloping areas are erodible.	Fair: poorly to well graded sand and gravel in substratum; thick overburden; seasonal saturation with water.	Fair: moderate bearing value; unstable when wet; seasonal saturation with water.
EoA_____	Surface layer: good. Subsoil: fair; sloping areas are erodible.	Unsuitable: silty_____	Subsoil: fair; moderate bearing value; low stability; moderate shrink-swell potential; seasonal saturation with water.
Eleva: EvB, EvC2, EvD, EvE_____	Surface layer: fair; thin; sandy loam. Subsoil: fair; sandy loam; thin over sandstone bedrock; sloping soils are erodible.	Good_____	Subsoil: good. Substratum: weakly cemented sandstone bedrock.
Flagg: F1A, F1B_____	Surface layer: good. Subsoil: fair; sloping soils are erodible; crusts easily.	Poor: poorly graded pockets of sand and gravel in substratum.	Subsoil: fair; moderate bearing value; unstable. Substratum: good.
Gotham: GoA, GoB, GoC2, GoD_____	Surface layer and subsoil: poor; sandy; erodible.	Good_____	Subsoil and substratum: good.
Gotham, bedrock variant: GpB2, GpC2.	Surface layer and subsoil: poor; sandy; erodible. Substratum: unsuitable; dolomite bedrock.	Poor: dolomite bedrock substratum; source of dolomite for crushing.	Subsoil: good. Substratum: poor; dolomite bedrock.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—			Soil limitations for sewage disposal	
Highway locations 1/	Foundations for low buildings 1/	Sanitary land fill 2/	Septic tank filter fields	Sewage lagoons
20 to 40 inches to sand and gravel; nearly level to moderately steep.	Subject to liquefaction and piping.	Little amelioration of leachate; moderate permeability in the subsoil and rapid permeability in the substratum.	Moderate on slopes of 0 to 12 percent; severe where soils are steeper; danger of contaminating ground water.	Severe: substratum has rapid permeability.
Moderate frost-heave potential.	Can liquefy and flow when wet.	Possible lateral seepage to the surface on slopes; moderate permeability.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent; possible lateral seepage to the surface on slopes.	Moderate on slopes of 0 to 6 percent; severe where soils are steeper; moderate permeability.
Dolomite bedrock at depth of 12 to 20 inches.	Subsoil has high shrink-swell potential; dolomite bedrock at depth of 12 to 20 inches hinders excavation.	Danger of unameliorated leachate contaminating ground water; moderate permeability.	Severe: dolomite bedrock at depth of 12 to 20 inches restricts use; danger of contaminating ground water.	Severe: dolomite bedrock at depth of 12 to 20 inches restricts use.
Seasonal saturation with water at depth of 1 to 3 feet; moderate frost-heave potential in subsoil.	Seasonal saturation with water may restrict installation; basements subject to seasonal wetness.	Seasonal saturation with water; difficult to work in wet seasons; moderate permeability.	Severe: seasonal saturation with water.	Moderate on slopes of 0 to 3 percent; moderate permeability.
Seasonal saturation with water at depth of 1 to 3 feet; moderate frost-heave potential in subsoil.	Seasonal saturation with water may restrict installations; basements subject to seasonal wetness.	Seasonal saturation with water; difficult to work in wet seasons; moderate permeability in the subsoil and rapid permeability in the substratum	Severe: seasonal saturation with water.	Severe: rapid permeability in substratum.
Subject to flooding; seasonal saturation with water at depth of 1 to 3 feet; high frost-heave potential.	Seasonal saturation with water may restrict installations; basements subject to seasonal wetness and flooding.	Seasonal saturation with water; subject to flooding; moderate permeability.	Severe: seasonal saturation with water; subject to flooding.	Moderate: subject to flooding; moderate permeability; low stability.
Depth to sandstone bedrock is 20 to 40 inches.	Weakly cemented sandstone bedrock is relatively easy to excavate.	Little amelioration of leachate; moderately rapid permeability.	Moderate on slopes of 0 to 12 percent; severe where soils are steeper; danger of contaminating ground water.	Severe: sandstone bedrock at depth of 20 to 40 inches.
Moderate frost-heave potential; moderate erosion hazard on cuts and fills.	Subject to liquefaction and piping.	Possible lateral seepage to the surface on slopes; moderate permeability.	Slight	Moderate on slopes of 0 to 6 percent; substratum has moderate permeability.
Loose sand hinders hauling; subject to soil blowing.	Subject to liquefaction and piping.	Little amelioration of leachate: moderately rapid permeability.	Moderate on slopes of 0 to 12 percent; severe where soils are steeper; danger of contaminating ground water.	Severe; moderately rapid permeability.
Loose sand hinders hauling operations; subject to blowing; dolomite bedrock is at depth of 24 to 40 inches.	Subject to liquefaction and piping; dolomite bedrock hinders excavation.	Little amelioration of leachate; moderately rapid permeability.	Severe: dolomite bedrock at depth of 24 to 40 inches restricts use; danger of contaminating ground water.	Severe: dolomite bedrock at depth of 24 to 40 inches restricts use.

See footnotes at end of table.

TABLE 9.—*Engineering*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road fill 1/
Griswold: GrA, GrB2, GrC2, GrD2__	Surface layer: good. Subsoil: fair; sandy clay loam and clay loam; crusts easily.	Poor: pockets of poorly graded sand and gravel occur in substratum.	Subsoil: fair; moderate shrink-swell potential, stability, and bearing value. Substratum: good.
Hayfield: Ha_____	Surface layer: good. Subsoil: fair; thin over sand; low fertility.	Good_____	Fair: moderate bearing value; unstable; seasonal saturation with water.
Hebron: HeA_____	Surface layer: good. Subsoil: fair; crusts easily.	Unsuitable: clayey_____	Subsoil: poor; moderate shrink-swell potential and bearing value. Substratum: poor; high shrink-swell potential; moderate bearing value; unstable.
Houghton: Ho_____	Surface layer and subsoil: poor; erodible; oxidize rapidly.	Unsuitable: organic material.	Organic layers: unsuitable; high compressibility; unstable; very low bearing value; high water table.
Jasper: JaA, JaB_____	Surface layer: good. Subsoil: fair; unstable on slopes.	Poor: poorly graded fine sand with silt and clay layers.	Fair: moderate bearing value; unstable; highly susceptible to frost action; erodible on slopes.
Juneau: JuA_____	Surface layer: good. Subsoil: fair; erodible on slopes.	Unsuitable: silty___	Fair: moderate bearing value; unstable.
Kane: KaA_____	Surface layer: good. Subsoil: fair; thin over sand and gravel.	Good_____	Subsoil: fair; moderate bearing value; unstable. Substratum: good.
Kidder: KdB, KdC2, KdD, KeA, KeB2, KeC2, KeD2, KeE.	Surface layer: fair for sandy loam, good for loam and silt loam. Subsoil: fair; clay loam and sandy clay loam.	Poor: pockets of poorly graded sand and gravel occur in places in the substratum.	Good_____
Locke: LkA_____	Surface layer: good. Subsoil: fair: sandy clay loam.	Poor: pockets of poorly graded sand and gravel occur in places in the substratum.	Fair: moderate shrink-swell potential and bearing value; unstable when wet; seasonal saturation with water.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—			Soil limitations for sewage disposal	
Highway locations 1/	Foundations for low buildings 1/	Sanitary land fill 2/	Septic tank filter fields	Sewage lagoons
Stones hinder hauling and grading operations.	Stones hinder excavation.	Possible lateral seepage to the surface on slopes; moderate permeability.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent; severe where soils are steeper; possible lateral seepage to the surface on slopes.	Severe: moderate permeability; stony in places
Seasonal saturation with water at depth of 1 to 3 feet.	Moderate bearing value; can liquefy and flow when wet; basements subject to wetness.	Little amelioration of leachate; seasonal saturation with water; moderate permeability in the subsoil and rapid permeability in the substratum.	Severe: seasonal saturation with water; danger of contaminating ground water.	Severe: rapidly permeable in substratum.
Plastic substratum; cuts and fills low in stability.	Subsoil has moderate shrink-swell potential, bearing value, and shear strength. Substratum has high shrink-swell potential and moderate bearing value.	Clayey substratum ponds water in pits; difficult to work in wet seasons; moderately slow permeability.	Moderate: moderately slow permeability.	Slight on slopes of 0 to 2 percent; moderate on slopes of 2 to 3 percent; moderately slow permeability.
Organic material more than 50 inches thick; less than 1 foot to permanent or seasonal high water table.	High compressibility; low shear strength; basements subject to wetness.	High water table; moderately rapid permeability.	Severe: high water table.	Severe: overlying layers consist of organic material; high water table.
Moderate to high frost-heave potential; cuts and fills are unstable; erodible.	Moderate bearing value; subject to liquefaction and piping.	Partial amelioration of leachate; moderate permeability.	Moderate: filter fields difficult to maintain.	Moderate: unstable when wet; difficult to compact.
High frost-heave potential; subject to occasional flooding.	Moderate bearing value, shear strength, and compressibility; subject to occasional flooding.	Subject to flooding: moderate permeability.	Severe: subject to flooding.	Moderate: moderate permeability; subject to flooding.
Seasonal saturation with water at depth of 1 to 3 feet; subsoil has moderate frost-heave potential.	Seasonal saturation with water hinders installation; basements subject to seasonal wetness.	Little amelioration of leachate; moderate permeability in the subsoil and rapid permeability in the substratum.	Severe: seasonal saturation with water; danger of contaminating ground water.	Severe: substratum has rapid permeability.
Stones in subsoil may hinder hauling and grading.	Moderate bearing value; stones can hinder excavation in places.	Possible lateral seepage to the surface where soils are steep; moderate permeability.	Slight on slopes of 2 to 6 percent; moderate on slopes of 6 to 12 percent; severe where soils are steep; possible lateral seepage to the surface on slopes.	Severe: moderate permeability; commonly stony.
Seasonal saturation with water at depth of 1 to 3 feet; subsoil has moderate frost-heave potential and is plastic.	Seasonal saturation with water restricts installation in places; basements subject to seasonal wetness.	Seasonal saturation with water; difficult to work in wet seasons; moderate permeability.	Severe: seasonal saturation with water.	Severe: moderate permeability.

TABLE 9.—*Engineering*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road fill 1/
Lorenzo: LoA, LoB, LoC2, LoD	Surface layer: good. Subsoil: fair; gravelly.	Good	Good
Mahalasville: Ma	Surface layer: good. Subsoil: fair; erodible on slopes.	Poor: very thick cover of silty material.	Poor: moderate bearing value; unstable and not accessible; high water table.
Mb	Surface layer: good. Subsoil: fair; erodible on slopes.	Poor: very thick cover of silty material.	Poor: moderate bearing value; unstable; high compressibility and elasticity; high water table.
Marshan: Md	Surface layer: good. Subsoil: fair; erodible on slopes.	Fair: poorly graded sand substratum; high water table hinders excavation.	Poor: unstable; high water table.
Maumee: Me	Surface layer and subsoil: poor; sandy; erodible.	Fair: poorly graded sand substratum; high water table hinders excavation.	Substratum: fair; lacks stability under wheel loads when dry; low stability unless confined; seasonal saturation with water; erodible.
Millington: Mf	Surface layer: good. Subsoil: good.	Unsuitable: silty very little sand or gravel.	Subsoil: poor; low bearing value and stability; high water table.
Navan: Na	Surface layer: good. Subsoil: poor; crusts easily.	Unsuitable: very little sand or gravel.	Poor: moderate shrink-swell potential and bearing value; high water table.
Ogle: OgA, OgB	Surface layer: good. Subsoil: fair; erodible on slopes; clayey.	Poor: pockets of poorly graded sand and gravel occur in places in the substratum.	Subsoil: fair; moderate shrink-swell potential; unstable. Substratum: good.
Oshtemo: OoA, OoB, OoC2, OoD2	Surface layer: fair; sandy loam. Subsoil: fair; sandy loam; erodible.	Good	Good
Oshtemo, dark variant: OsA, OsB, OsC2.	Surface layer: fair; sandy loam. Subsoil: fair; sandy loam; erodible.	Good: poorly graded sand with some gravel in the substratum.	Good

See footnotes at end of table.

interpretations—Continued

Soil features affecting—			Soil limitations for sewage disposal	
Highway locations 1/	Foundations for low buildings 1/	Sanitary land fill 2/	Septic tank filter fields	Sewage lagoons
Stones hinder hauling and grading operations in places.	Stones hinder excavation in places.	Little amelioration of leachate; moderate permeability in the subsoil and rapid permeability in the substratum.	Moderate on slopes of 0 to 12 percent; severe where slopes are steeper; danger of contaminating ground water.	Severe: substratum is rapidly permeable.
Less than 1 foot to permanent or seasonal high water table; high frost-heave potential.	High compressibility; moderate bearing value and shrink-swell potential; basements subject to wetness.	High water table; moderate permeability.	Severe: high water table.	Moderate: high water table; moderate permeability; unstable.
Less than 1 foot to permanent or seasonal high water table; subsoil has high frost-heave potential; subject to flooding.	High compressibility; moderate shrink-swell potential and bearing value; basements subject to wetness and flooding.	High water table; subject to flooding; moderate permeability.	Severe: high water table; subject to flooding.	Severe: high water table; subsoil has moderate permeability; unstable; subject to flooding.
Less than 1 foot to permanent or seasonal high water table; hauling and excavation difficult.	Moderate bearing value; subject to liquefaction and piping; basements subject to wetness.	High water table; moderate permeability in the subsoil and rapid permeability in the substratum.	Severe: high water table;	Severe: substratum has rapid permeability; high water table.
Less than 1 foot to permanent or seasonal high water table; hauling and excavation difficult.	Moderate bearing value; subject to liquefaction and piping; basements subject to wetness.	High water table; rapid permeability.	Severe: high water table.	Severe: high water table; rapid permeability.
Less than 1 foot to permanent or seasonal high water table; subject to flooding; high frost-heave potential.	Moderate compressibility and low bearing value; can liquefy and flow when wet; basements subject to wetness and flooding.	High water table; subject to flooding; moderate permeability.	Severe: high water table; subject to flooding.	Moderate: high water table; subject to flooding; moderate permeability.
Less than 1 foot to permanent or seasonal high water table; hauling and excavation difficult; substratum is plastic.	Moderate shrink-swell potential, bearing value, and shear strength; basements subject to wetness.	High water table; moderately slow permeability.	Severe: high water table.	Moderate: high water table; moderately slow permeability.
Subsoil has moderate frost-heave potential.	Can liquefy and flow when wet.	Possible lateral seepage to the surface on slopes; moderate permeability.	Slight----------	Slight on slopes of 0 to 2 percent; moderate on slopes of 2 to 6 percent; moderate permeability.
Loose sand hinders hauling operations; subject to blowing.	Can liquefy and flow when wet.	Little amelioration of leachate; moderately rapid permeability.	Moderate on slopes of 0 to 12 percent; severe where soils are steeper; danger of contaminating ground water	Severe: moderately rapid permeability.
Loose sand hinders hauling operations; subject to blowing.	Can liquefy and flow when wet.	Little amelioration of leachate; moderately rapid permeability.	Moderate on slopes of 0 to 12 percent; danger of contaminating ground water.	Severe: moderately rapid permeability.

TABLE 9.—*Engineering*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road fill 1/
Otter: Ot	Surface layer: good. Subsoil: good.	Unsuitable: silty	Poor: low bearing value; unstable; high compressibility; high water table.
Palms: Pa	Organic layers: poor; oxidize rapidly; erodible.	Unsuitable: organic material over loamy material.	Organic layers: unsuitable; high compressibility; unstable; very low bearing value; high water table.
Pecatonica: PeA, PeB2, PeC2	Surface layer: good. Subsoil: fair; erodible on slopes.	Poor: pockets of poorly graded sand and gravel in the substratum.	Subsoil: fair; moderate shrink-swell potential and bearing value. Substratum: good.
Plano: P1A, P1B, P1C2	Surface layer: good. Subsoil: fair; erodible on slopes; crusts easily.	Poor: pockets of poorly graded sand and gravel in the substratum.	Subsoil: fair; moderate shrink-swell potential and bearing value; unstable. Substratum: good.
Plano, gravelly substratum: PmA, PmB.	Surface layer: good. Subsoil: fair; erodible on slopes; crusts easily.	Good	Subsoil: fair; moderate shrink-swell potential and bearing value; unstable. Substratum: good.
Plano, loamy variant: PnA, PnB	Surface layer: good. Subsoil: fair; erodible on slopes.	Good	Subsoil: fair; moderate shrink-swell potential and stability. Substratum: good.
Ringwood: RnB2, RnC2	Surface layer: good. Subsoil: fair; erodible on slopes.	Poor: pockets of poorly graded sand and gravel in the substratum.	Subsoil: fair; moderate shrink-swell potential and stability. Substratum: good.
Rockton: RpB, RpC2, RpD2	Surface layer: good. Subsoil: fair; thin over bedrock.	Unsuitable: loamy soil over dolomite bedrock; source of dolomite for crushing.	Subsoil: fair; moderate shrink-swell potential and bearing value. Substratum: dolomite bedrock.
*Rodman: RrC2, RrE, RrF. For Lorenzo part of RrC2, RrE, and RrF, see Lorenzo series.	Surface layer and subsoil: poor; gravelly; stony.	Good	Good
Rollin: Rs	Surface layer and subsoil: poor; erodible; oxidizes rapidly.	Unsuitable: organic soil over marl.	Organic layers: unsuitable; high compressibility; unstable; very low bearing value. Substratum: unsuitable; unstable; low bearing value; high water table.

See footnote at end of table.

interpretations—Continued

Soil features affecting—			Soil limitations for sewage disposal	
Highway locations 1/	Foundations for low buildings 1/	Sanitary land fill 2/	Septic tank filter fields	Sewage lagoons
Less than 1 foot to permanent seasonal high water table; high frost-heave potential; subject to flooding.	Low bearing value when wet; high compressibility; basements subject to wetness and flooding.	High water table; subject to flooding; moderate permeability.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding; unstable; moderate permeability.
Less than 1 foot to permanent or seasonal high water table; organic material less than 50 inches thick over loamy material.	Organic layers have very low bearing value; high water table restricts installation; basements subject to wetness.	High water table; moderately rapid permeability in the organic layers and moderate permeability in the substratum.	Severe: high water table.	Severe: high water table; substratum has moderate permeability; overlying layers consist of organic material.
Moderate frost-heave potential.	Can liquefy and flow when wet.	Possible lateral seepage to the surface; moderate permeability.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent; possible lateral seepage to the surface.	Moderate on slopes of 0 to 6 percent; severe where soils are steeper; substratum has moderate permeability.
Subsoil has moderate frost-heave potential.	Can liquefy and flow when wet.	Possible lateral seepage to the surface; moderate permeability.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent; possible lateral seepage to the surface.	Moderate on slopes of 0 to 6 percent; severe where soils are steeper; substratum has moderate permeability.
Subsoil has moderate frost-heave potential.	Can liquefy and flow when wet.	Little amelioration of leachate; moderate permeability in the subsoil and rapid permeability in the substratum.	Moderate: danger of contaminating ground water.	Severe: rapid permeability in substratum.
Subsoil has moderate frost-heave potential.	Can liquefy and flow when wet.	Little amelioration of leachate; moderate permeability in the subsoil and rapid permeability in the substratum.	Moderate: danger of contaminating ground water.	Severe: rapid permeability in substratum.
Subsoil has moderate frost-heave potential.	Can liquefy and flow when wet.	Possible lateral seepage to the surface; moderate permeability.	Slight on slopes of 2 to 6 percent; moderate on slopes of 6 to 12 percent; possible lateral seepage to the surface.	Severe: moderate permeability.
Depth to dolomite bedrock is from 20 to 40 inches.	Moderate bearing value and shrink-swell potential; dolomite bedrock at depth of 20 to 40 inches hinders excavation.	Danger of unameliorated leachate contaminating ground water; moderate permeability.	Severe: dolomite bedrock at depth of 20 to 40 inches restricts use.	Severe: dolomite bedrock at depth of 20 to 40 inches restricts use; moderate permeability.
Stones hinder hauling and grading.	Stones hinder excavation.	Little amelioration of leachate; rapid permeability.	Moderate on slopes of 6 to 12 percent; severe where slopes are steeper; danger of contaminating ground water.	Severe: rapid permeability.
Organic soil over marl; less than 1 foot to permanent or seasonal high water table.	High compressibility; low shear strength and very low bearing value; basements subject to wetness.	High water table; moderately rapid permeability in the organic layers and slow permeability in the substratum.	Severe: high water table.	Severe: high water table; overlying layers consist of organic material; moderately rapid permeability in organic layers, slow permeability in substratum.

TABLE 9.—*Engineering*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road fill 1/
*Rotamer: RtB2, RtC2, RtD, RuE, RuF. For Rotamer, thin variant, part of RuE and RuF, see Rotamer series, thin variant.	Surface layer: good; thin. Subsoil: fair; thin; stony in places.	Poor; pockets of poorly graded sand and gravel in substratum.	Subsoil: fair; moderate shrink-swell potential and bearing value; unstable. Substratum: good.
Rotamer, thin variant. Mapped only in complexes with Rotamer soils.	Surface layer and subsoil: poor; gravelly; stony.	Poor; pockets of poorly graded sand and gravel in substratum.	Good
St. Charles: SaA, SaB, SaC2, SaD	Surface layer: good. Subsoil: fair; erodible on slopes; crusts easily.	Poor: pockets of poorly graded sand and gravel in substratum.	Subsoil: fair; moderate shrink-swell potential and bearing value; unstable. Substratum: good.
St. Charles, gravelly substratum: SbA, SbB, SbC2.	Surface layer: good. Subsoil: fair; erodible on slopes; crusts easily.	Good	Subsoil: fair; moderate shrink-swell potential and bearing value; unstable. Substratum: good.
Sebewa: Se	Surface layer: good. Subsoil: poor; crusts easily.	Fair: poorly graded to well-graded sand and gravel substratum; high water table.	Poor: moderate bearing value and stability; high water table.
Sisson: SkA, SkB, SkC2	Surface layer: good. Subsoil: fair; unstable on slopes.	Poor: poorly graded fine sand with silt and clay layers.	Poor: highly susceptible to frost action; moderate stability; erodible on slopes.
Sogn: SoB, SoC2, SoD, SoF	Surface layer: fair; thin over bedrock; stony in places.	Unsuitable: dolomite bedrock.	Substratum: dolomite bedrock.
Troxel: TrA	Surface layer: good. Subsoil: fair; erodible on slopes; crusts easily.	Unsuitable: silty	Subsoil: poor; moderate bearing value; unstable.
Warsaw: WaA, WaB, WaC2	Surface layer: good. Subsoil: fair; thin over gravel; crusts easily.	Good	Subsoil: fair; moderate shrink-swell potential and bearing value. Substratum: good.
Watseka: Wb	Surface layer and subsoil: poor; sandy; erodible.	Good	Subsoil and substratum: fair; highly stable; seasonal high water table.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—			Soil limitations for sewage disposal	
Highway locations 1/	Foundations for low buildings 1/	Sanitary land fill 2/	Septic tank filter fields	Sewage lagoons
Stones may hinder hauling and grading in places.	Stones hinder excavation.	Lateral seepage to the surface where soils are steeper; moderate permeability.	Slight on slopes of 2 to 6 percent; moderate on slopes of 6 to 12 percent; severe where soils are steeper; possible lateral seepage to the surface.	Severe: moderate permeability.
Stones and boulders hinder hauling and grading.	Stones and boulders hinder excavation.	Lateral seepage to the surface; moderately rapid permeability.	Severe: possible lateral seepage to the surface.	Severe: moderately rapid permeability; stony in many places.
Subsoil has moderate frost-heave potential.	Stones hinder excavation.	Possible lateral seepage to the surface; moderate permeability.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent; severe where soils are steeper; possible lateral seepage to the surface.	Moderate on slopes of 0 to 6 percent; severe where soils are steeper; moderate permeability.
Subsoil has moderate frost-heave potential.	Can liquefy and flow when wet.	Little amelioration of leachate; moderate permeability in the subsoil, rapid permeability in the substratum.	Moderate: danger of contaminating ground water.	Severe: rapid permeability in substratum.
Less than 1 foot to permanent or seasonal high water table; hauling and excavation difficult.	High water table hinders installation; basements subject to wetness.	High water table; moderate permeability in subsoil and rapid permeability in substratum.	Severe: high water table.	Severe: substratum has rapid permeability.
Moderate to high frost-heave potential; cuts and fills low in stability; highly erodible.	Moderate bearing value; subject to liquefaction and piping.	Possible lateral seepage to the surface; partial amelioration of leachate; moderate permeability.	Moderate: filter fields difficult to maintain.	Moderate: on slopes of 0 to 6 percent; severe where soils are steeper; low stability; difficult to compact.
Depth to dolomite bedrock is from 4 to 16 inches.	Dolomite bedrock at a depth of 4 to 16 inches hinders excavation.	Dolomite bedrock at a depth of 4 to 16 inches restricts use; moderate permeability.	Severe: dolomite bedrock at a depth of 4 to 16 inches restricts use; danger of contaminating ground water.	Severe: dolomite bedrock at a depth of 4 to 16 inches restricts use.
High frost-heave potential; subject to occasional flooding.	Moderate bearing value, shear strength, and compressibility; basements subject to flooding.	Subject to occasional flooding; moderate permeability.	Severe: in places subject to flooding.	Moderate: moderate permeability; unstable when wet.
Subsoil has moderate frost-heave potential.	Can liquefy and flow when wet.	Little amelioration of leachate; moderate permeability in subsoil and rapid permeability in substratum.	Moderate: danger of contaminating ground water.	Severe: rapid permeability in the substratum.
Seasonal saturation with water at depth of 1 to 3 feet.	Seasonal saturation with water may restrict installations; basements subject to seasonal wetness.	Little amelioration of leachate; rapid permeability.	Severe: seasonal saturation with water; danger of contaminating ground water.	Severe: seasonal saturation with water; rapid permeability.

TABLE 9.—*Engineering*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road fill 1/
Wauconda: WcA	Surface layer: good. Subsoil: fair; unstable on slopes.	Poor: poorly graded fine sand with silt layers in substratum.	Poor: moderate shrink-swell potential and bearing value; unstable; highly susceptible to frost action; seasonal saturation with water.
Westville: WfA, WfB2, WfC2, WeA, WeB, WeC2.	Surface layer: good for loam; fair for sandy loam. Subsoil: fair; crusts easily.	Poor: pockets of poorly graded sand and gravel in substratum.	Subsoil: fair; moderate shrink-swell potential and bearing value. Substratum: good.
Whalan: W1A, W1B2, W1C2, W1D2, WhB2, WhC2.	Surface layer: good for loam, fair for sandy loam. Subsoil: fair; thin over bedrock; crusts easily.	Unsuitable: loamy soil over dolomite bedrock; source of dolomite for crushing.	Subsoil: fair; moderate shrink-swell potential and bearing value. Substratum: dolomite bedrock.
Winnebago: WnA, WnB2, WnC2	Surface layer: good. Subsoil: fair; erodible on slopes; crusts easily.	Poor: pockets of poorly graded sand and gravel in substratum.	Subsoil: fair; moderate shrink-swell potential and bearing value. Substratum: good.
Worthen: WoA	Surface layer and subsoil: good.	Unsuitable: silty	Substratum: poor; unstable; high compressibility and elasticity; moderate bearing value.
Zurich: ZuA, ZuB, ZuC2	Surface layer: good. Subsoil: fair; clayey; unstable on slopes.	Poor: poorly graded sand with silt layers in substratum.	Subsoil: poor; moderate shrink-swell potential and bearing value unstable. Substratum: poor; unstable; highly susceptible to frost action.

1/ Engineers and others should not apply specific values to the estimates given for bearing capacity of soils.

soils are generally subject to frequent ponding. Somewhat poorly drained soils are still not ideal campsites if ponding occurs. Flooding during any part of the season of use is very detrimental. Soil permeability affects use of soils for campsites by limiting the movement of water from the surface into and through the soil. Nearly level soils are the most desirable for campsites. Soils steeper than 12 percent have severe limitations. Trafficability and the presence of dust are controlled mainly by texture of the surface layer. Sandy loam and loam soils are the most favorable. Excessive rockiness and stoniness are not desirable.

Descriptions of the Soils

This section describes the soil series and mapping units of Rock County. The acreage and proportionate extent of each mapping unit are given in table 11 (p. 84).

The procedure is first to describe the soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How This Survey Was Made," not all mapping units are

interpretations—Continued

Soil features affecting—			Soil limitations for sewage disposal	
Highway locations 1/	Foundations for low buildings 1/	Sanitary land fill 2/	Septic tank filter fields	Sewage lagoons
Seasonal saturation with water at depth of 1 to 3 feet; high frost-heave potential; cuts and fills have low stability.	Moderate bearing value; subject to liquefaction and piping; basements subject to seasonal wetness.	Seasonal saturation with water; partial amelioration of leachate; moderate permeability.	Severe: seasonal saturation with water.	Moderate: moderate permeability; unstable.
Moderate frost-heave potential.	Can liquefy and flow when wet.	Possible lateral seepage to the surface; moderate permeability.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent; possible lateral seepage to the surface.	Moderate on slopes of 0 to 6 percent; severe where soils are steeper; moderate permeability.
Depth to dolomite bedrock is from 20 to 40 inches.	Moderate bearing value and shrink-swell potential; dolomite bedrock at depth of 20 to 40 inches hinders excavation.	Danger of unameliorated leachate contaminating ground water; moderate permeability.	Severe: dolomite bedrock at depth of 20 to 40 inches restricts use.	Severe: dolomite bedrock at depth of 20 to 40 inches restricts use.
Moderate frost-heave potential.	Can liquefy and flow when wet.	Possible lateral seepage to the surface; moderate permeability.	Slight on slopes of 0 to 6 percent; moderate on slopes of 6 to 12 percent; possible lateral seepage to the surface.	Moderate on slopes of 0 to 6 percent; severe where soils are steeper; moderate permeability.
High frost-heave potential; subject to seasonal flooding.	Moderate bearing value, shear strength, and compressibility; basements subject to flooding.	Subject to occasional flooding; moderate permeability.	Severe: in places subject to flooding.	Moderate: moderate permeability; unstable.
Cuts and fills have low stability; moderate to high frost-heave potential; highly erodible.	Moderate bearing value, subject to liquefaction and piping.	Partial amelioration of leachate; unstable; moderate permeability.	Moderate: filter fields difficult to maintain.	Moderate: moderate permeability; unstable; difficult to compact.

2/ Statements apply to a depth of not more than 5 or 6 feet. For land fills of greater depth, onsite investigation is needed of the underlying strata, water table, hazard of pollution, and drainage into ground water.

members of a soil series. Alluvial land, wet, and Marsh, for example, are miscellaneous land types that do not belong to a soil series. They are listed, nevertheless, in alphabetic order along with the soil series.

In comparing a mapping unit with a soil series, many will prefer to read the short description of a representative profile in paragraph form. It precedes the technical description that identifies layers by A, B, C, and R horizons and depth ranges. The technical profile descriptions are mainly for soil scientists and others who want detailed information about soils. Unless otherwise indicated, the colors given in the descriptions are those of a moist soil. Some of the terms used to describe the soils are defined in the Glossary at the back of this soil survey.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the interpretive groups in which the mapping unit has been placed. The pages on which each group is described are in the "Guide to Mapping Units" at the back of this survey.

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TABLE 10.—*Degree and kind of*

Recreation groups and map symbols	Playgrounds, athletic fields, and intensive play areas	Picnic grounds, parks, and extensive play areas
Group 1: Moderately deep and deep, moderately well drained and well drained silt loam soils. DrA, DrB, DrC2, DrD2, DuA, DuB2, DuC2, F1A, F1B, KeA, KeB2, KeC2, KeD2, KeE, OgA, OgB, PeA, PeB2, PeC2, P1A, P1B, P1C2, PmA, PmB, RnB2, RnC2, SaA, SaB, SaC2, SaD, SbA, SbB, SbC2, WaA, WaB, WaC2, WnA, WnB2, WnC2, ZuA, ZuB, ZuC2.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent; severe where slopes are steeper; sloping soils are erodible; compacted easily when wet.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible; compacted easily when wet.
Group 2: Moderately deep and deep, moderately well drained and well drained loam and sandy loam soils. GrA, GrB2, GrC2, GrD2, HeA, JaA, JaB, KdB, KdC2, KdD, PnA, PnB, RtB2, RtC2, RtD, SkA, SkB, SkC2, WeA, WeB, WeC2, WfA, WfB2, WfC2.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent; severe where slopes are steeper; sloping soils are erodible; leveling may expose sand and gravel.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible.
Group 3: Well-drained sandy loam soils. B1A, B1B, OoA, OoB, OoC2, OoD2, OsA, OsB, OsC2.	Moderate where slopes are 0 to 6 percent; severe where slopes are steeper; sloping soils are erodible; leveling may expose sand and gravel.	Moderate where slopes are 0 to 12 percent; severe where slopes are steeper; erodible.
Group 4: Well-drained and excessively drained soils that are shallow or very shallow over sand and gravel or glacial till. CaB2, CaC2, CaD2, CaE, LoA, LoB, LoC2, LoD, RrC2, RrE, RrF, RuE, RuF.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent; severe where slopes are steeper; sloping soils are erodible; extensive leveling may expose sand and gravel.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible.
Group 5: Somewhat poorly drained soils. AzA, BmA, Da, E1A, EmA, EoA, Ha, KaA, LkA, Wb, WcA.	Moderate: seasonal saturation with water; compacted easily and is muddy and slippery when wet.	Moderate: seasonal saturation with water; compacted easily when wet; water may pond for short periods in low areas.
Group 6: Poorly drained soils. Aw, Br, Co, Ma, Mb, Md, Me, Mf, Na, Ot, Se.	Severe: high water table; compacted easily when wet; low trafficability when wet; sod easily damaged; occasional flooding; muddy and slippery when wet.	Severe: high water table; compacted easily when wet; low trafficability when wet; sod easily damaged; occasional flooding.
Group 7: Well drained and moderately well drained soils that formed in alluvium. JuA, TrA, WoA.	Moderate: occasional flooding; compacted easily and is muddy and slippery when wet.	Moderate: occasional flooding of short duration during use period.
Group 8: Organic soils and marsh. Ad, Ho, Mc, Pa, Rs.	Very severe: high water table; poor trafficability when wet; sod easily damaged; erodible.	Very severe: high water table; poor trafficability when wet; sod easily damaged; erodible.
Group 9: Loamy and sandy soils. DcA, DcB, DcC2, GoA, GoB, GoC2, GoD, GpB2, GpC2.	Moderate where slopes are 0 to 2 percent; severe where slopes are 2 to 20 percent; erodible; sod is difficult to maintain; extensive leveling will expose sand substratum.	Moderate where slopes are 0 to 6 percent; severe where slopes are 6 to 20 percent; erodible; difficult to maintain a good sod.
Group 10: Moderately deep, well-drained soils underlain by bedrock. EvB, EvC2, EvD, EvE, RpB, RpC2, RpD2, WhB2, WhC2, W1A, W1B2, W1C2, W1D2.	Moderate where slopes are 0 to 2 percent; severe where slopes are steeper; extensive leveling may expose bedrock; compacted easily and is muddy and slippery when wet.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible.
Group 11: Very shallow and shallow soils underlain by bedrock. EdB2, EdC2, EdD2, EdE, Ro, SoB, SoC2, SoD, SoF.	Severe; compacted easily and is muddy and slippery when wet; extensive leveling will expose dolomite bedrock.	Moderate where slopes are 0 to 12 percent; severe where slopes are steeper; sloping soils are erodible; stony or rocky in places.

limitations for recreational uses

Bridle paths, nature and hiking trails	Golf course fairways	Tent and camp trailer sites
Moderate: muddy and slippery when wet; surfacing needed in places; sloping soils are erodible.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible.	Moderate where slopes are 0 to 6 percent; severe where slopes are steeper; surface is wet and soft after rains; compacted easily.
Slight where slopes are 0 to 12 percent; moderate where slopes are 12 to 20 percent; sloping soils are erodible.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 12 percent; severe where slopes are steeper; sloping soils are erodible.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible.
Moderate where slopes are 0 to 12 percent; severe where slopes are steeper; erodible; poor stability on slopes; paths and trails are difficult to maintain.	Severe: erodible; good turf difficult to maintain.	Moderate where slopes are 0 to 6 percent; severe where slopes are steeper; erodible; vegetation difficult to maintain.
Slight where slopes are 0 to 12 percent; moderate where slopes are 12 to 20 percent; severe where slopes are steeper; sloping soils are erodible.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible.
Moderate: wet for moderate periods; muddy and slippery when wet.	Moderate: seasonal saturation with water; sites remain wet and soft for moderate periods; turf easily damaged when wet.	Moderate: sites remain wet and soft for moderate periods.
Severe: high water table; wet for long periods; muddy and slippery when wet; occasional flooding; poor trafficability.	Severe: high water table; poor trafficability when wet; turf easily damaged when wet; occasional flooding; sites remain wet and soft for long periods.	Severe: surface is wet and soft for long periods; poor trafficability when wet; occasional flooding.
Moderate: occasional flooding during use periods; muddy and slippery when wet.	Moderate: occasional flooding during use period.	Severe: occasional flooding during use period.
Very severe: high water table; poor trafficability; paths and trails are difficult to maintain.	Severe: high water table; turf easily damaged when wet; poor trafficability when wet; sites remain wet and soft for long periods.	Very servere: sites remain wet and soft for long periods; poor trafficability.
Moderate where slopes are 0 to 12 percent; severe where slopes are 12 to 20 percent; poor stability on slopes; paths and trails are difficult to maintain; erodible.	Severe: erodible; good turf is difficult to maintain.	Moderate where slopes are 0 to 6 percent; severe where slopes are 6 to 20 percent; erodible; vegetation difficult to maintain.
Moderate where slopes are 0 to 12 percent; severe where slopes are steeper; muddy and slippery when wet; sloping soils are erodible; stony or rocky in places.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe where slopes are steeper; sloping soils are erodible.	Moderate where slopes are 0 to 12 percent; severe where slopes are steeper; sloping soils are erodible; stony or rocky in places; sites remain wet and soft for short periods.
Moderate where slopes are 0 to 12 percent; severe where slopes are steeper; muddy and slippery when wet; sloping soils are erodible; stony or rocky in places.	Moderate where slopes are 0 to 6 percent; severe where slopes are steeper; thin over bedrock; sloping soils are erodible; stony or rocky in places.	Moderate where slopes are 0 to 12 percent; severe where slopes are steeper; sites remain wet and soft for short periods; stony or rocky in places.

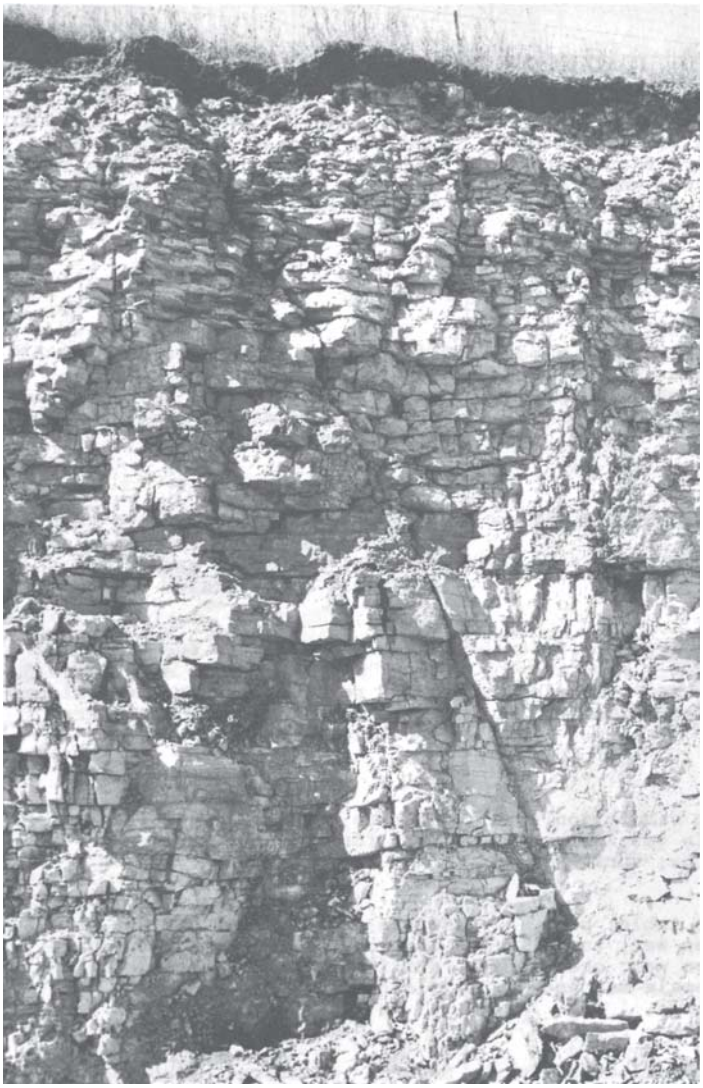

Figure 19.—Wall of a quarry showing Edmund and Sogn soils that have formed over dolomite. The ground water is likely to be contaminated if these soils are used as a site for septic tank filter fields, because the natural crevices and fissures permit rapid downward movement of effluent to the level of the ground water.

Adrian Series

The Adrian series consists of very poorly drained muck soils underlain by sand at depths of 16 to 45 inches. These soils are nearly level and are on flood plains, on low terraces, and in slight depressions. In areas that are not drained, ground water is at or near the surface throughout the year.

In a representative profile, the organic layer is black muck about 32 inches thick. This is underlain by light brownish-gray, loose sand that extends to a depth below 60 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid in the muck and rapid in the substratum. Depth of the root zone is limited by the water table. Natural fertility is low.

Where drained, these soils are used for corn and pasture. Undrained areas are too wet for cultivation and are used for unimproved pasture and wildlife habitat.

Representative profile of Adrian muck in a pasture 20 feet south of Hafeman Road, NW¼NE¼SW¼ sec. 31, T. 2 N., R. 10 E.:

Oa1—0 to 4 inches, black (10YR 2/1 to N 2/0 where rubbed) sapric material; trace of herbaceous fibers where not rubbed; common, medium, distinct, dark reddish-brown (5YR 3/4) mottles; weak, medium, granular structure; nonsticky; neutral; clear, wavy boundary.

Oa2—4 to 16 inches, black (N 2/0) sapric material; trace of herbaceous fibers where not rubbed; common, medium, distinct, dark reddish-brown (5YR 3/4) mottles; moderate, fine and very fine, subangular blocky structure; nonsticky; netural; clear, wavy boundary.

Oa3—16 to 24 inches, black (N 2/0) sapric material; about 10 percent of horizon is herbaceous fiber; weak, thick, platy structure; nonsticky; netural; clear, wavy boundary.

Oa4—24 to 32 inches, black (N 2/0) sapric material; about 8 percent of horizon is herbaceous fiber; weak, medium, subangular blocky structure; nonsticky; a few thin bands of light brownish-gray (2.5Y 6/2) sand; nonsticky; neutral; clear; smooth boundary.

IIC—32 to 60 inches, light brownish-gray (2.5Y 6/2) sand; single grain; loose; few thin bands of very dark gray (N 3/0) organic matter; mildly alkaline.

The organic layer ranges from 16 to 45 inches in thickness. Immediately above its contact with sandy mineral, the organic layer normally has a comparatively high mineral content that can amount to as much as 50 percent of the volume.

Adrian soils are associated with Houghton, Palms, and Rollin soils. They have a coarser textured substratum than do Palms and Rollin soils. The organic layer is thinner in Adrian soils than it is in the Houghton soils.

Adrian muck (0 to 2 percent slopes) (Ad).—This nearly level soil occurs in long, narrow tracts along the smaller flood plains and in irregular areas on larger flood plains and in old lake basins. It is commonly between areas of Houghton soils and surrounding mineral outwash soils.

Included with this soil in mapping were small areas of Marshan, Maumee, Palms, and Sebewa soils. Also included were areas that have only 12 to 16 inches of muck over sand, areas that have loamy and clayey strata in the muck layer, and areas that are covered with silty overwash. Areas that have 16 to 40 inches of silty overwash are indicated on the soil map by a symbol for silty overwash.

Adrian muck is ponded in wet seasons and after heavy rain. Surface drainage is used to dispose of excess water rapidly. Tile drainage can be used if measures are taken to prevent the underlying sand from filling the tile. Cultivated areas are subject to soil blowing and burning. If the water table is lowered excessively, the organic matter decomposes very rapidly in cultivated areas and subsidence becomes a problem.

If drained, this soil is suited to pasture, corn, and certain kinds of vegetable crops, such as beets and carrots. (Capability unit IVw-7; woodland group 5w3; wildlife group 6; not placed in a shrub and vine group; recreation group 8)

Alluvial Land, Wet

Alluvial land, wet (0 to 2 percent slopes) (Aw) consists of nearly level, poorly drained sediments deposited by streams. Ground water is at or near the surface throughout the year unless the land is drained. This land occurs in long, narrow tracts on flood plains. Many of these tracts are dissected by streams, old stream channels, sloughs, and oxbows.

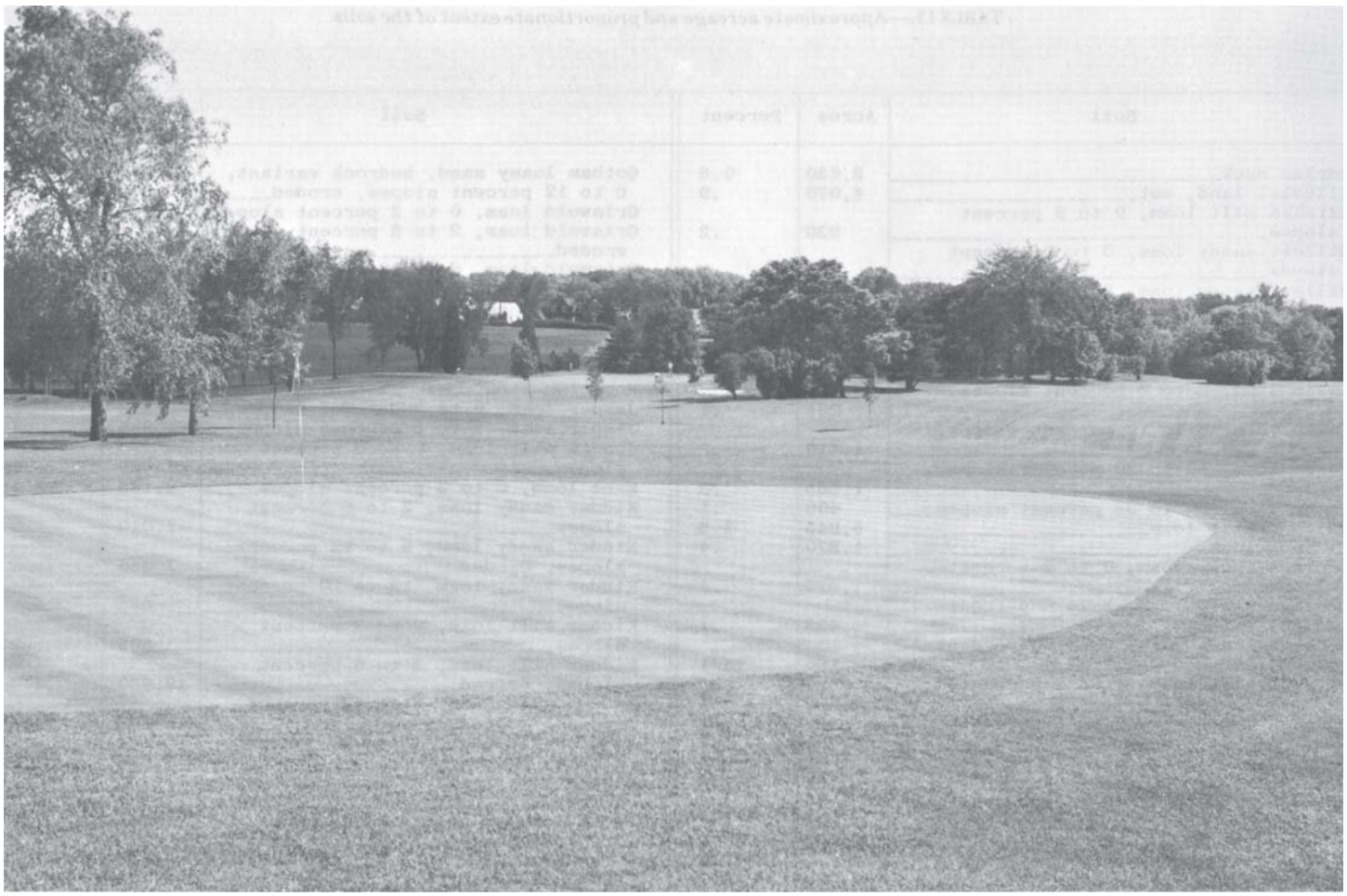

Figure 20.—Gently sloping Rockton soils used for a golf course.

Profile characteristics are variable. Texture of the surface layer ranges from sandy loam to silt loam or, in places, is muck. The substratum is layered loamy and sandy soil material that has layers of muck in some places.

Included with this land type in mapping were small areas of Mahalasville, Otter, and Sebewa soils. Also included were areas of better drained soils, many of which are in natural drainageways on the outwash plain east of the Rock River.

Alluvial land, wet, is subject to frequent overflow and commonly has not been cleared of woods. It is suitable for pasture, woods, or establishing food and cover for wildlife, such as furbearers and migratory waterfowl. Some areas are in cultivation where drainage ditches and dikes prevent prolonged flooding and where old stream channels have been filled. (Capability unit Vw-14; woodland group 4w2; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Aztalan Series

The Aztalan series consists of somewhat poorly drained, nearly level and gently sloping, loamy soils that are deep and are underlain by stratified calcareous silt and clay. The stratified silt and clay are lacustrine deposits. These soils are in glacial lakebeds and drainage basins. In many places they are adjacent to sloping, better drained soils of uplands or are in slightly elevated areas in the lake basins. Aztalan soils are saturated with water at a depth of 1 to 3 feet during wet periods.

In a representative profile, the surface layer is very dark brown silt loam about 10 inches thick. The subsoil is about 30 inches thick. It is brown, firm clay loam in the upper part; brown, firm heavy loam in the middle part; and light brownish-gray, firm silty clay loam in the lower part. Gray, dark grayish-brown, and yellowish-brown mottles are below a depth of 13 inches. The substratum is light-gray, calcareous, stratified silt and clay.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow. Depth of the root zone is limited by a seasonal high water table. Natural fertility is moderate.

Aztalan soils are used mainly for field crops. Drained areas are commonly used for corn, soybeans, and improved pasture. Undrained areas are used for pasture and woods.

TABLE 11.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Adrian muck	2,650	0.6	Gotham loamy sand, bedrock variant, 6 to 12 percent slopes, eroded	310	0.1
Alluvial land, wet	4,070	.9	Griswold loam, 0 to 2 percent slopes	160	(1/)
Aztalan silt loam, 0 to 3 percent slopes	920	.2	Griswold loam, 2 to 6 percent slopes, eroded	6,505	1.4
Billett sandy loam, 0 to 2 percent slopes	355	.1	Griswold loam, 6 to 12 percent slopes, eroded	5,200	1.1
Billett sandy loam, 2 to 6 percent slopes	2,025	.4	Griswold loam, 12 to 20 percent slopes, eroded	430	.1
Billett sandy loam, mottled subsoil variant, 0 to 3 percent slopes	735	.2	Hayfield loam	1,035	.2
Brookston silt loam	2,425	.5	Hebron loam, 0 to 3 percent slopes	935	.2
Casco loam, 2 to 6 percent slopes, eroded	235	.1	Houghton muck	6,140	1.3
Casco loam, 6 to 12 percent slopes, eroded	1,410	.3	Jasper loam, 0 to 2 percent slopes	820	.2
Casco loam, 12 to 20 percent slopes, eroded	1,565	.3	Jasper loam, 2 to 6 percent slopes	1,035	.2
Casco loam, 20 to 35 percent slopes	400	.1	Juneau silt loam, 0 to 3 percent slopes	1,020	.2
Colwood silt loam	5,945	1.3	Kane loam, 0 to 3 percent slopes	9,165	2.0
Darroch loam	1,870	.4	Kidder sandy loam, 2 to 6 percent slopes	1,010	.2
Dickman sandy loam, 0 to 2 percent slopes	1,975	.4	Kidder sandy loam, 6 to 12 percent slopes, eroded	1,250	.3
Dickman sandy loam, 2 to 6 percent slopes	425	.1	Kidder sandy loam, 12 to 20 percent slopes	685	.1
Dickman sandy loam, 6 to 12 percent slopes, eroded	160	(1/)	Kidder silt loam, 0 to 2 percent slopes	505	.1
Dresden silt loam, 0 to 2 percent slopes	5,010	1.1	Kidder silt loam, 2 to 6 percent slopes, eroded	19,630	4.3
Dresden silt loam, 2 to 6 percent slopes	14,450	3.1	Kidder silt loam, 6 to 12 percent slopes, eroded	16,195	3.5
Dresden silt loam, 6 to 12 percent slopes, eroded	5,465	1.2	Kidder silt loam, 12 to 20 percent slopes, eroded	4,650	1.0
Dresden silt loam, 12 to 25 percent slopes, eroded	1,635	.4	Kidder silt loam, 20 to 30 percent slopes	905	.2
Durand silt loam, 0 to 2 percent slopes	865	.2	Locke loam, 0 to 3 percent slopes	2.105	.5
Durand silt loam, 2 to 6 percent slopes, eroded	9,720	2.1	Lorenzo loam, 0 to 2 percent slopes	720	.2
Durand silt loam, 6 to 12 percent slopes, eroded	685	.1	Lorenzo loam, 2 to 6 percent slopes	2,370	.5
Edmund loam, 2 to 6 percent slopes, eroded	5,365	1.1	Lorenzo loam, 6 to 12 percent slopes, eroded	1,285	.3
Edmund loam, 6 to 12 percent slopes, eroded	10,670	2.3	Lorenzo loam, 12 to 20 percent slopes	515	.1
Edmund loam, 12 to 20 percent slopes, eroded	2,620	.6	Mahalasville silt loam	12,115	2.6
Edmund loam, 20 to 35 percent slopes	370	.1	Mahalasville silt loam, overwash	3,865	.8
Elburn silt loam, 0 to 3 percent slopes	9,245	2.0	Marsh	595	.1
Elburn silt loam, gravelly substratum, 0 to 3 percent slopes	885	.2	Marshan loam	5,640	1.2
Elburn silt loam, overwash, 0 to 3 percent slopes	3,695	.8	Maumee loamy sand	1,345	.3
Eleva sandy loam, 2 to 6 percent slopes	200	(1/)	Millington silt loam	1,170	.3
Eleva sandy loam, 6 to 12 percent slopes, eroded	685	.1	Navan silt loam	1,150	.2
Eleva sandy loam, 12 to 20 percent slopes	285	.1	Ogle silt loam, 0 to 2 percent slopes	1,360	.3
Eleva sandy loam, 20 to 35 percent slopes	365	.1	Ogle silt loam, 2 to 6 percent slopes	7,975	1.7
Flagg silt loam, 0 to 2 percent slopes	620	.1	Oshtemo sandy loam, 0 to 2 percent slopes	1,220	.3
Flagg silt loam, 2 to 6 percent slopes	4,385	1.0	Oshtemo sandy loam, 2 to 6 percent slopes	5,000	1.1
Gotham loamy sand, 0 to 2 percent slopes	1,355	.3	Oshtemo sandy loam, 6 to 12 percent slopes, eroded	2,055	.4
Gotham loamy sand, 2 to 6 percent slopes	2,055	.4	Oshtemo sandy loam, 12 to 25 percent slopes, eroded	835	.2
Gotham loamy sand, 6 to 12 percent slopes, eroded	615	.1	Oshtemo sandy loam, dark variant, 0 to 2 percent slopes	1,300	.3
Gotham loamy sand, 12 to 20 percent slopes	225	(1/)	Oshtemo sandy loam, dark variant, 2 to 6 percent slopes	2,155	.5
Gotham loamy sand, bedrock variant, 2 to 6 percent slopes, eroded	270	.1	Oshtemo sandy loam, dark variant, 6 to 12 percent slopes, eroded	680	.1
			Otter silt loam	2,885	.6
			Palms muck	1,625	.4
			Pecatonica silt loam, 0 to 2 percent slopes	380	.1
			Pecatonica silt loam, 2 to 6 percent slopes, eroded	10,150	2.2
			Pecatonica silt loam, 6 to 12 percent slopes, eroded	1,370	.3

See footnote at end of table.

TABLE 11.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Plano silt loam, 0 to 2 percent slopes	4,110	0.9	Sisson loam, 6 to 12 percent slopes, eroded	580	.1
Plano silt loam, 2 to 6 percent slopes	5,365	1.2	Sogn loam, 2 to 6 percent slopes	655	0.1
Plano silt loam, 6 to 12 percent slopes, eroded	270	.1	Sogn loam, 6 to 12 percent slopes, eroded	1,190	.3
Plano silt loam, gravelly substratum, 0 to 2 percent slopes	38,085	8.3	Sogn loam, 12 to 20 percent slopes	1,675	.4
Plano silt loam, gravelly substratum, 2 to 6 percent slopes	5,965	1.3	Sogn loam, 30 to 45 percent slopes	195	(1/)
Plano loam, loamy variant, 0 to 2 percent slopes	1,400	.3	Troxel silt loam, 0 to 3 percent slopes	5,470	1.2
Plano loam, loamy variant, 2 to 6 percent slopes	1,580	.3	Warsaw silt loam, 0 to 2 percent slopes	17,660	3.8
Ringwood silt loam, 2 to 6 percent slopes, eroded	4,780	1.0	Warsaw silt loam, 2 to 6 percent slopes	11,420	2.5
Ringwood silt loam, 6 to 12 percent slopes, eroded	825	.2	Warsaw silt loam, 6 to 12 percent slopes, eroded	2,025	.4
Rock land	600	.1	Watseka loamy fine sand	885	.2
Rockton loam, 2 to 6 percent slopes	7,375	1.6	Wauconda silt loam, 0 to 3 percent slopes	1,295	.3
Rockton loam, 6 to 12 percent slopes, eroded	4,345	1.0	Westville sandy loam, 0 to 2 percent slopes	735	.2
Rockton loam, 12 to 20 percent slopes, eroded	200	(1/)	Westville sandy loam, 2 to 6 percent slopes	4,360	1.0
Rodman-Lorenzo complex, 6 to 12 percent slopes, eroded	620	.1	Westville sandy loam, 6 to 12 percent slopes, eroded	540	.1
Rodman-Lorenzo complex, 20 to 30 percent slopes	4,875	1.1	Westville loam, 0 to 2 percent slopes	350	.1
Rodman-Lorenzo complex, 30 to 45 percent slopes	1,035	.2	Westville loam, 2 to 6 percent slopes, eroded	4,635	1.0
Rollin muck	100	(1/)	Westville loam, 6 to 12 percent slopes, eroded	2,590	.5
Rotamer loam, 2 to 6 percent slopes, eroded	255	.1	Whalan sandy loam, 2 to 6 percent slopes, eroded	1,515	.3
Rotamer loam, 6 to 12 percent slopes, eroded	2,600	.6	Whalan sandy loam, 6 to 12 percent slopes, eroded	590	.1
Rotamer loam, 12 to 20 percent slopes	1,275	.3	Whalan loam, 0 to 2 percent slopes	325	.1
Rotamer complex, 20 to 30 percent slopes	1,125	.2	Whalan loam, 2 to 6 percent slopes, eroded	2,115	.5
Rotamer complex, 30 to 45 percent slopes	235	.1	Whalan loam, 6 to 12 percent slopes, eroded	3,955	.9
St. Charles silt loam, 0 to 2 percent slopes	3,540	.8	Whalan loam, 12 to 20 percent slopes, eroded	625	.1
St. Charles silt loam, 2 to 6 percent slopes	11,535	2.5	Winnebago silt loam, 0 to 2 percent slopes	730	.2
St. Charles silt loam, 6 to 12 percent slopes, eroded	780	.2	Winnebago silt loam, 2 to 6 percent slopes, eroded	2,635	.6
St. Charles silt loam, 12 to 20 percent slopes	195	(1/)	Winnebago silt loam, 6 to 12 percent slopes, eroded	845	.2
St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes	5,155	1.1	Worthen silt loam, 0 to 3 percent slopes	1,955	.4
St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes	4,295	.9	Zurich silt loam, 0 to 2 percent slopes	380	.1
St. Charles silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	200	(1/)	Zurich silt loam, 2 to 6 percent slopes	905	.2
Sebewa silt loam	13,720	3.0	Zurich silt loam, 6 to 12 percent slopes, eroded	200	(1/)
Sisson loam, 0 to 2 percent slopes	435	.1	Gravel pits and quarries	1,665	.4
Sisson loam, 2 to 6 percent slopes	1,510	.3	Total	461,440	100.0

1/ Less than 0.05 percent.

Representative profile of Aztalan silt loam, 0 to 3 percent slopes, 530 feet southeast of Norwegian Creek and 400 feet east of farm gate, on the Green County line, SW¼–NW¼NW¼ sec. 6, T. 2 N., R. 10 E.:

Ap—0 to 10 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B1t—10 to 13 inches, dark-brown (10YR 4/3) clay loam; very dark gray (10YR 3/1) coatings of organic matter on ped faces; moderate, very fine, subangular blocky structure; firm; many thin clay films on ped faces and in pores and channels; neutral; clear, smooth boundary.

B21t—13 to 20 inches, brown (10YR 4/3) clay loam; common, medium, faint, dark grayish-brown (10YR 4/2) mottles and common, medium, prominent, yellowish-brown (10YR 5/6) mottles; moderate, fine and very fine, subangular blocky structure; firm; many thin clay films and flows on ped faces and in pores and channels; mildly alkaline; clear, wavy boundary.

B22t—20 to 26 inches, brown (10YR 5/3) clay loam; common, medium, distinct, gray (10YR 5/1) mottles and prominent, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; thin nearly continuous clay films on ped

faces and in pores and channels; moderately alkaline; clear, wavy boundary.

B23t—26 to 30 inches, brown (10YR 5/3) heavy loam; common, medium, distinct, gray (10YR 5/1) mottles and prominent, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; thin patchy clay films on ped faces; calcareous; abrupt, wavy boundary.

IIB3g—30 to 40 inches, light brownish-gray (2.5Y 6/2) silty clay loam; common, medium, prominent, yellowish-brown (10YR 5/6) mottles; weak, very thick, platy structure, parting to moderate, medium and fine, subangular blocky structure; firm; calcareous; clear, wavy boundary.

IICg—40 to 60 inches, light-gray (5Y 7/1), stratified silt and clay; common, medium, prominent, yellowish-brown (10YR 5/6) mottles; weak, thick, platy structure; firm; calcareous.

Depth to the underlying stratified silt and clay ranges from 30 to 42 inches. Depth to calcareous material is generally the same but in some places ranges to 48 inches. The A horizon ranges from 10 to 12 inches in thickness. It is very dark gray, very dark grayish brown, or very dark brown. The B1t and B2t horizons are heavy loam or clay loam and range from 12 to 20 inches in combined thickness. They have matrix colors of very dark grayish brown, brown, dark brown, or grayish brown. The IIB horizon is silty clay loam or stratified silt and clay and ranges from 8 to 16 inches in thickness. It has matrix colors of light brownish gray, light gray, or strong brown. The IIC horizon is stratified silt and clay or silty clay loam that has lenses of silty clay and silt loam. It is light gray or light brownish gray.

Aztalan soils are associated with Hebron, Navon, and Wauconda soils. Aztalan soils are more poorly drained than Hebron soils and are better drained than Navan soils. They have more clay and less sand in the substratum than Wauconda soils.

Aztalan silt loam, 0 to 3 percent slopes (AzA).—This nearly level and gently sloping soil occupies glacial lakebeds and drainage basins in irregularly shaped areas generally less than 30 acres in size.

Included with this soil in mapping were small areas of Darroch, Kane, and Navan soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile. Also included were areas that have a loam surface layer and areas that have sandy loam texture in the upper part of the subsoil. A symbol for sand has been used on the soil map to indicate areas that have a sandy loam or loamy sand surface layer. In some areas the substratum has lenses of clay loam or sand with the stratified silt and clay.

This Aztalan soil is somewhat poorly drained and is subject to ponding in some areas during wet periods and after heavy rain. The moderately slow permeability makes surface drainage necessary for dependable crop production.

If drained, this soil is suited to all the farm crops and most vegetable crops commonly grown in the county. Undrained areas are suited to pasture and wildlife habitat. (Capability unit IIw-2; woodland group 4w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Billett Series

The Billett series consists of well-drained, nearly level and gently sloping, loamy soils that are deep and are underlain by sand or sand and gravel. These soils are on sandy outwash plains and terraces. Billett soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark grayish-brown sandy loam about 8 inches thick. The subsoil is about 30 inches thick. It is dark yellowish-brown, friable heavy sandy loam in the upper part; brown, very friable sandy loam in the middle part; and yellowish-brown, very friable loamy sand in the lower part. The substratum is yellowish-brown sand.

These soils can hold about 5 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid. Depth of the root zone is limited by the underlying sand or sand and gravel. Natural fertility is moderate.

Most areas of Billett soils are used for corn, soybeans, hay, and pasture. Some small areas are wooded.

Representative profile of Billett sandy loam, 2 to 6 percent slopes, in a red pine plantation 150 feet east of the Green County line and 800 feet north of a quarry, NW¼–SW¼NW¼ sec. 30, T. 3 N., R. 10E.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) sandy loam; moderate, medium and fine, granular structure; very friable; slightly acid; abrupt, smooth boundary.

B21t—8 to 14 inches, dark yellowish-brown (10YR 4/4) heavy sandy loam; moderate, fine, subangular blocky structure; friable; clay bridging between sand grains; some clay films in pores and channels; slightly acid; clear, wavy boundary.

B22t—14 to 25 inches, brown (7.5YR 4/4) sandy loam; moderate, fine, subangular blocky structure; very friable; clay bridging between sand grains; medium acid; gradual, wavy boundary.

B31—25 to 33 inches, yellowish-brown (10YR 5/6) loamy sand; moderate, medium, subangular blocky structure; very friable; slightly acid; gradual, wavy boundary.

B32—33 to 38 inches, yellowish-brown (10YR 5/4) loamy sand; weak, medium, subangular blocky structure; very friable; slightly acid; clear, wavy boundary.

C—38 to 60 inches, yellowish-brown (10YR 5/4) sand; single grain; loose; neutral.

Depth to underlying sand or sand and gravel ranges from 30 to 50 inches. The Ap horizon ranges from 6 to 9 inches in thickness. It is very dark gray, very dark grayish brown, or dark brown. The B1 horizon is 0 to 6 inches thick. Where present, it is sandy loam and is brown or dark yellowish brown. The B21t and B22t horizons range from 10 to 25 inches in combined thickness. They are brown, dark yellowish brown, or yellowish brown. The B31 and B32 horizons are sandy loam or loamy sand and range from 12 to 24 inches in combined thickness. They are dark yellowish brown or yellowish brown. The C horizon is sand or sand and gravel and is yellowish brown or light yellowish brown.

Billett soils are associated with Dickman and Gotham soils and with soils of the Billett series, mottled subsoil variant. They have a thinner, dark-colored surface layer than the Dickman soils and have a more clayey subsoil than the Gotham and Dickman soils. Billett soils are better drained than soils of the Billett series, mottled subsoil variant.

Billett sandy loam, 0 to 2 percent slopes (BlA).—This nearly level soil is on sandy outwash plains and terraces. Most areas are about 10 to 40 acres in size and are elongated to irregular in shape. In the profile of this soil, the surface layer is commonly darker and 1 inch thicker than in the profile described as representative for the series. Depth to the sand substratum also is greater.

Included with this soil in mapping were small areas of Dickman, Gotham, Hayfield and Oshtemo soils, and soils of the Oshtemo series, dark variant, and Billett series, mottled subsoil variant. Also included were small areas that have a loam surface layer and areas that have a thicker, dark-colored surface layer. Some small included areas are underlain by lacustrine silt and fine sand, and some are more clayey in the subsoil. Also included were small areas in which the depth to ground water is from 3 to 5 feet and small areas of gently sloping soils.

This Billett soil is subject to soil blowing. Crop growth during most seasons is limited by low available water capacity. This soil is well suited to irrigation. Management practices are needed that regularly supply organic matter, conserve moisture, and control soil blowing.

Most of the acreage is used for crops. If management is good, this soil is suited to row crops, small grains, and hay.

Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production. (Capability unit IIIs-4; woodland group 3s2; wildlife group 1; shrub and vine group 2; recreation group 3)

Billett sandy loam, 2 to 6 percent slopes (BlB).—This gently sloping soil is on sandy outwash plains and terraces. The areas are generally about 10 to 60 acres in size and irregular in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Dickman, Gotham, Hayfield, and Oshtemo soils, as well as Oshtemo soils, dark variant, and Billett soils, mottled subsoil variant. Also included were small areas that have a loam surface layer and areas that have a thicker, dark-colored surface layer. Some small included areas are underlain by lacustrine silt and fine sand or glacial till, and some are more clayey in the subsoil. Also included were small areas where the depth to ground water is from 3 to 5 feet and small areas of nearly level and sloping soils.

This Billett soil is slightly susceptible to erosion and is subject to soil blowing. Crop growth during most seasons is limited by low available water capacity. This soil is suited to irrigation, especially in the less sloping areas. Management practices are needed that regularly add organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops, but some is wooded. If management is good, this soil is suited to row crops, small grains, and hay. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production. (Capability unit IIIs-4; woodland group 3s2; wildlife group 1; shrub and vine group 2; recreation group 3)

Billett Series, Mottled Subsoil Variant.

The Billett series, mottled subsoil variant, consists of somewhat poorly drained, nearly level and gently sloping, loamy soils that are moderately deep and deep and are underlain by sand or sand and gravel. These soils are on sandy outwash plains and terraces. Unless the soils are drained, they are saturated with water at depths of 1 to 3 feet during wet periods.

In a representative profile, the surface layer is very dark gray sandy loam about 8 inches thick. The subsoil is about 42 inches thick. It is brown, grayish-brown, and yellowish-brown, friable heavy sandy loam in the upper part; strong-brown, very friable very light loamy sand in the middle part; and strong-brown, very pale brown, and dark yellowish-brown, very friable medium and fine sand in the lower part. There are yellowish-brown mottles in the subsoil. The substratum is light-gray coarse and medium sand and is at a depth of about 50 inches.

These soils can hold about 5 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid. The depth of the root zone is limited by a seasonal high water table or, in drained areas, by the underlying sand or sand and gravel. Natural fertility is moderate.

Where drained, most areas of these soils are used for corn, soybeans, hay, and pasture. Undrained areas are used for unimproved pasture or wildlife habitat.

Representative profile of Billett sandy loam, mottled subsoil variant, 0 to 3 percent slopes, in a cultivated field 135 feet east of drainage ditch and 200 feet south of fence line, NW¼NE¼SW¼ sec. 18, T. 2 N., R. 10 E.:

Ap—0 to 8 inches, very dark gray (10YR 3/1) sandy loam; weak, fine and medium, crumb structure; very friable; neutral; abrupt, smooth boundary.

B21t—8 to 15 inches, brown (10YR 5/3) heavy sandy loam; many, coarse, faint and distinct, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, medium and fine, subangular blocky structure, breaking to single grain; friable; clay bridging between sand grains; slightly acid; gradual, smooth boundary.

B22t—15 to 26 inches, mixed grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/8) heavy sandy loam; weak, medium, subangular blocky structure, breaking to single grain; friable; clay bridging between sand grains and clay coatings on sand grains; medium acid; gradual, wavy boundary.

B31—26 to 33 inches, strong-brown (7.5YR 5/6) very light loamy sand; common, medium, distinct, grayish-brown (10YR 5/2) mottles; very weak, medium, subangular blocky structure, breaking to single grain; very friable; slightly acid; clear, smooth boundary.

B32—33 to 38 inches, mixed strong-brown (7.5YR 5/6) and very pale brown (10YR 7/4) medium and fine sand; very weak, medium, subangular blocky structure; very friable; slightly acid; gradual, smooth boundary.

B33—38 to 50 inches, mixed very pale brown (10YR 7/3) and dark yellowish-brown (10YR 4/4) medium and fine sand; very weak, medium, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

C—50 to 60 inches, light-gray (10YR 7/2) coarse and medium sand; single grain; loose; estimated 2 percent of horizon is gravel; neutral.

Depth to underlying sand or sand and gravel ranges from 30 to 55 inches. The Ap horizon ranges from 6 to 9 inches in thickness. It is black or very dark gray. The B1 horizon is 0 to 6 inches thick. Where present, it is sandy loam and is dark grayish brown, grayish brown, or brown. The B2t horizons range from 12 to 20 inches in combined thickness. They have matrix colors of dark grayish brown, grayish brown, brown, or yellowish brown, or they are a mixture of two or more of these colors. The B3 horizons are loamy sand or sand and range from 12 to 24 inches in combined thickness. They have matrix colors of strong brown, very pale brown, or dark yellowish brown, or they are a mixture of two or more of these colors. The C horizon is sand or sand and gravel and is light gray.

Billett soils, mottled subsoil variant, are associated with normal Billett soils and with Hayfield, Marshan, and Watseka soils. These variants are somewhat poorly drained, but normal Billett soils are well drained and Marshan soils are poorly drained. They are less clayey in the subsoil than Hayfield soils and are more clayey in the subsoil than Watseka soils.

Billett sandy loam, mottled subsoil variant, 0 to 3 percent slopes (BmA).—This nearly level and gently sloping soil is on sandy outwash plains and terraces. Most areas are about 10 to 30 acres in size and are elongated to irregular in shape.

Included with this soil in mapping were small areas of Billett, Dickman, Gotham, Hayfield, Marshan, and Watseka soils. Also included were small areas that have a loam or loamy sand surface layer and small areas that have a thicker, dark-colored surface layer than that of the soil having the representative profile. Other inclusions are small areas that are poorly drained and small areas that are underlain by lacustrine silt and fine sand.

This Billett soil is somewhat poorly drained, and some small areas are subject to ponding unless drained. Some areas of this soil receive runoff from adjacent uplands. Open-ditch or surface drainage is needed for best crop production. If drained, this soil is subject to soil blowing, and if the water table is lowered excessively, the beneficial effects of free water in the lower part of the soil are lost.

Where this soil is drained, most of the acreage is used for crops. If management is good, this soil is suited to row crops, small grains, and hay. Fertilization and protection from soil blowing are necessary for dependable crop production. Undrained areas are used for unimproved pasture

and wildlife habitat. (Capability unit IVw-5; woodland group 3w2; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Brookston Series

The Brookston series consists of poorly drained, nearly level, loamy soils that are deep and are underlain by calcareous gravelly sandy loam glacial till. These soils are in depressional areas on till plains. Unless they are drained, ground water is at or near the surface throughout the year.

In a representative profile, the surface layer is about 17 inches thick. It is black silt loam in the upper part and very dark gray heavy silt loam in the lower part. The subsoil is about 13 inches thick. It is dark-gray, firm clay loam in the upper part; light olive-brown, friable heavy loam in the middle part, and yellowish-brown, friable loam in the lower part. The substratum is light yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 30 inches. Olive-brown, grayish-brown, yellowish-brown, or brownish-yellow mottles are in the lower part of the surface layer and in the subsoil and substratum.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The depth of the root zone is limited by the high water table. Natural fertility is moderate.

Where the Brookston soils are drained, they are used for corn, soybeans, small grains, legumes, and other crops grown in the county. Undrained areas are used for pasture or wildlife habitat.

Representative profile of Brookston silt loam, 100 feet south of Hafeman Road, NW¼NW¼NE¼ sec. 36, T. 2 N., R. 10 E.:

Ap—0 to 10 inches, black (N 2/0) silt loam; moderate, medium, granular structure; friable; mildly alkaline; abrupt, smooth boundary.

A12—10 to 13 inches, black (10YR 2/1) silt loam; weak, fine, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

A3—13 to 17 inches, very dark gray (10YR 3/1) heavy silt loam; common, medium, faint, dark-gray (10YR 4/1) mottles and few, fine, prominent, olive-brown (2.5Y 4/4) mottles; weak, medium, subangular blocky structure; friable; moderately alkaline; clear, smooth boundary.

B21tg—17 to 21 inches, dark-gray (10YR 4/1) clay loam; common, medium, distinct, grayish-brown (2.5Y 5/2) mottles and few, fine, prominent, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; firm; thin patchy clay films on ped faces and in pores; moderately alkaline; clear, smooth boundary.

B22t—21 to 25 inches, light olive-brown (2.5Y 5/4) heavy loam; common, medium, distinct, grayish-brown (2.5Y 5/2) mottles and few, fine, faint, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable; thin patchy clay films on ped faces and in pores; clay bridging between sand grains; moderately alkaline; clear, smooth boundary.

B3—25 to 30 inches, yellowish-brown (10YR 5/6) loam; few, medium, prominent, light-gray (2.5Y 7/2) mottles and few, fine, faint, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; friable, moderately alkaline; clear, smooth boundary.

C—30 to 60 inches, light yellowish-brown (2.5Y 6/4) gravelly sandy loam till; many, medium, prominent, brownish-yellow (10YR 6/8) mottles; massive; very friable; calcareous.

Depth to the underlying calcareous gravelly sandy loam glacial till ranges from 24 to 40 inches. The silty mantle ranges from 12 to 20 inches in thickness. The A horizon ranges from 10 to 18 inches in thickness and is black or very dark gray. The B21tg horizon is silty clay loam, clay loam, or heavy loam and ranges from 2 to 12 inches in thickness. Matrix colors are dark gray, grayish brown, or light brownish gray. The B22t horizon is clay loam or heavy loam and ranges from 3 to 10 inches in thickness. Matrix colors are light brownish gray, grayish brown, or light olive brown. The B3 horizon is loam, sandy loam, or sandy clay loam and ranges from 3 to 9 inches in thickness. It has matrix colors of yellowish brown or light olive brown. Matrix colors of the C horizon are light yellowish brown or light olive brown.

Brookston soils are associated with Colwood, Locke, and Sebewa soils. They are more poorly drained than Locke soils. Unlike the Sebewa and Colwood soils, the Brookston soils are underlain by gravelly sandy loam till.

Brookston silt loam (0 to 2 percent slopes) (Br).— This nearly level soil is in depressional areas on till plains. The areas are generally less than 80 acres in size and irregular in shape.

Included with this soil in mapping were small areas of Colwood, Locke, Mahalasville, Palms, and Sebewa soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile. Also included were areas where the surface layer is loam or silty clay loam and small areas of gently sloping soils. In some small included areas the surface layer is muck. The till underlying this soil shows some evidence of stratification in many places, and in some small areas it has a texture of loam, clay loam, or silt loam.

This Brookston soil is poorly drained. It receives runoff from adjoining areas and is subject to ponding in some areas during wet periods and after heavy rain. It is suitable for tile drainage to remove excess water that limits its use for crop production.

If drained, this soil is suited to all the farm and vegetable crops commonly grown in the county. Undrained areas are used for pasture or wildlife habitat. (Capability unit IIw-1; woodland group 4w1; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Casco Series

The Casco series consists of well-drained, gently sloping to very steep soils that are underlain by stratified sand and gravel at a depth of 12 to 20 inches. These soils are on outwash plains and terraces. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is dark grayish-brown loam about 5 inches thick. The subsoil is about 13 inches thick. It is brown, firm clay loam in the upper part; brown, firm gravelly sandy clay loam in the middle part; and brown, very friable gravelly sandy loam in the lower part. The substratum is yellowish-brown, calcareous sand and gravel and is at a depth of about 18 inches.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate in the subsoil and rapid in the substratum. The depth of the root zone is limited by sand and gravel. Natural fertility is moderate.

Most areas of gently sloping and sloping Casco soils are used for corn, small grains, and legumes. In most places the moderately steep and steep soils are in pasture, woods, or wildlife habitat.

Representative profile of Casco loam, 2 to 6 percent slopes, eroded, 1,200 feet north of Fenrick Road and 3,170 feet east of Palzin Road, NW¼SW¼SW¼ sec. 17, T. 3 N., R. 12 E.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B21t—5 to 9 inches, brown (7.5YR 4/4) clay loam; weak, fine, subangular blocky structure; firm; clay films in pores and channels and on ped faces; dark grayish-brown worm casts and channels extending from the Ap horizon; neutral; clear, smooth boundary.

IIB22t—9 to 14 inches, brown (7.5YR 4/4) gravelly sandy clay loam; moderate, fine and very fine, subangular blocky structure; firm; clay bridging between sand grains; thin patchy clay films on ped faces; slightly acid; clear, smooth boundary.

IIB23t—14 to 18 inches, brown (7.5YR 4/4) gravelly sandy loam; weak, fine, subangular blocky structure; very friable; clay bridging between sand grains; neutral; abrupt, smooth boundary.

IIC—18 to 60 inches, yellowish-brown (10YR 5/4) sand and gravel; single grain; loose; calcareous.

Depth to underlying sand and gravel ranges from 12 to 20 inches. The A horizon ranges from 3 to 5 inches in thickness. It is very dark gray, very dark grayish brown, or dark grayish brown. The B2t horizon is 0 to 6 inches thick. Where present, it is heavy loam or clay loam and is dark yellowish brown or brown. The IIB2t horizon is clay loam or sandy clay loam but contains more sand directly above the C horizon. The content of gravel ranges from 10 to 25 percent, by volume. The IIB2t horizon is dark yellowish brown or brown and ranges from 6 to 15 inches in thickness.

Casco soils are associated with Dresden, Lorenzo, Oshtemo, and Rodman soils. Casco soils have a thinner, dark-colored surface layer than Lorenzo soils. Casco soils are thinner over sand and gravel than Dresden soils. They have a thinner solum and are finer textured than Oshtemo soils. Casco soils have a thicker solum and are finer textured than Rodman soils.

Casco loam, 2 to 6 percent slopes, eroded (CaB2).—This gently sloping soil is on low ridges and knobs and along natural drainageways on outwash plains. The areas are generally 5 to 15 acres in size and elongated in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, Lorenzo, and Rodman soils. Also included were small areas of a soil that has a silt loam or sandy loam surface layer, small areas of nearly level and sloping soils, and uneroded areas. Small included areas of severely eroded soils have gravel mixed in the surface layer. A symbol for gravel is used to indicate many of these areas on the soil map. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil. Also included were small areas that are more sandy and less clayey throughout the surface layer and subsoil than this soil and areas underlain by glacial till.

This Casco soil is slightly susceptible to erosion. Natural fertility is moderate. Crop growth is generally limited by low available water capacity. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops that are commonly grown in the county. This soil is suited to irrigation, especially in the less sloping areas. If irrigated this soil is suited to most farm crops and early season vegetable crops. (Capability unit IIIe-3; woodland group 3d1; wildlife group 3; shrub and vine group 2; recreation group 4)

Casco loam, 6 to 12 percent slopes, eroded (CaC2).—This sloping soil is on low ridges and knobs and along natural drainageways on outwash plains. The areas are generally 5 to 25 acres in size and elongated in shape.

In the profile of this soil, depth to the sand and gravel substratum is about 2 inches less than in the profile described as representative for the series. In addition, the surface layer is generally lighter colored and contains more sand.

Included with this soil in mapping were small areas of Dresden, Lorenzo, and Rodman soils. Also included were small areas that have a silt loam or sandy loam surface layer, small areas of gently sloping and moderately steep soils, and uneroded areas. Areas of severely eroded soils have gravel mixed in the surface layer. A gravel symbol is used to indicate many of these areas on the soil map. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile. Small areas that are more sandy and less clayey throughout the surface layer and subsoil than in that soil, as well as areas underlain by glacial till, were also included.

This Casco soil is moderately susceptible to erosion. Natural fertility is moderate. Crop growth is generally limited by low available water capacity. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops that are commonly grown in the county. Some areas are in permanent pasture. This soil is not suited to intensive cultivation, but it is fairly well suited to small grain and pasture if it is well managed. (Capability unit IVe-3; woodland group 3d1; wildlife group 3; shrub and vine group 2; recreation group 4)

Casco loam, 12 to 20 percent slopes, eroded (CaD2).—This moderately steep soil is on side slopes along narrow drainageways and along the edge of outwash plains and terraces. The areas are generally 5 to 25 acres in size and elongated in shape.

In the profile of this soil, depth to the sand and gravel substratum is about 3 inches less than in the profile described as representative for the series, and the surface layer is generally lighter colored and contains more sand.

Included with this soil in mapping were small areas of Dresden, Lorenzo, and Rodman soils. Also included were small areas that have a silt loam or sandy loam surface layer, small areas of sloping soils and steep soils, and uneroded areas. Areas of severely eroded soils have gravel mixed in the surface layer, and a gravel symbol is used to indicate many of these areas on the soil map. In drainageways and depressions the surface layer is thicker and darker than the one in the soil having the representative profile. Also included were small areas of a soil that is more sandy and less clayey throughout the surface layer and subsoil than that soil. Some included areas are underlain by glacial till.

This Casco soil has very rapid runoff and is severely susceptible to erosion. It is not suited to cultivation. Most of the acreage is used for pasture, woods, or wildlife habitat. Some areas are used as a source of sand and gravel. If management is good and grazing is controlled, this soil is suitable for permanent pasture. (Capability unit VIe-3; woodland group 3r1; wildlife group 3; shrub and vine group 2; recreation group 4)

Casco loam, 20 to 35 percent slopes (CaE).—This steep and very steep soil is on side slopes along narrow drainageways and along the edge of outwash plains and terraces. The areas are generally 5 to 20 acres in size and elongated in shape. Depth to the sand and gravel substratum is about 4 inches less in the profile of this soil than it is in the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, Lorenzo, and Rodman soils. Also included were small areas that have a silt loam or sandy loam surface layer, small areas of moderately steep soils, and a few eroded areas where most of the original surface layer has been removed by erosion. In drainageways and depressions the surface layer is thicker and darker colored than that of the

soil having the representative profile, and small included areas are more sandy and less clayey throughout the surface layer and subsoil. Also included were areas underlain by glacial till and a few small areas having slopes up to 40 percent.

This Casco soil is not suited to cultivation. Runoff is very rapid, and the hazard of erosion is very severe.

Most of the acreage is in woods. Some areas are used as a source of sand and gravel. This soil is better suited to use as woods and wildlife habitat than to use for cultivated crops or pasture. (Capability unit VIIe-4; woodland group 3r1; wildlife group 3; shrub and vine group 2; recreation group 4)

Colwood Series

The Colwood series consists of poorly drained, nearly level, loamy soils that are deep and are underlain by stratified lacustrine deposits of calcareous silt and fine sand. These soils are in glacial lakebeds and drainage basins. Ground water is at or near the surface throughout the year unless these soils are drained.

In a representative profile, the surface layer is about 14 inches thick. It is black silt loam in the upper part and very dark gray heavy loam in the lower part. The subsoil is about 21 inches thick. It is dark grayish-brown, friable light clay loam in the upper part; light olive-brown, friable clay loam in the middle part; and light olive-brown, very friable heavy sandy loam in the lower part. There are very dark grayish-brown, yellowish-brown, and strong-brown mottles in the subsoil. The substratum is light-gray, calcareous, stratified silt and fine sand that has yellowish-brown mottles and is at a depth of about 35 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The depth of the root zone is limited by the water table. Natural fertility is moderate.

Colwood soils are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county. Undrained areas are used for unimproved pasture and wildlife habitat.

Representative profile of Colwood silt loam in a cultivated field, 450 feet west of the junction of Cemetery and Murray Roads, NE¼NE¼SE¼ sec. 19, T. 2 N., R. 12 E.:

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

A3g—10 to 14 inches, very dark gray (10YR 3/1) heavy loam; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles; weak, fine and very fine, subangular blocky structure; very friable; neutral; clear, wavy boundary.

B1g—14 to 23 inches, dark grayish-brown (2.5Y 4/2) light clay loam; common, fine, distinct, very dark grayish-brown (10YR 3/2) and yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; slightly acid; gradual, wavy boundary.

B2—23 to 29 inches, light olive-brown (2.5Y 5/4) clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) and very dark grayish-brown (10YR 3/2) mottles; moderate, medium, subangular blocky structure; friable; mildy alkaline; clear, wavy boundary.

B3—29 to 35 inches, light olive-brown (2.5Y 5/4) heavy sandy loam; common, medium, faint, grayish-brown (10YR 5/2) mottles and common, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; very friable; some evidence of stratification; moderately alkaline; clear, wavy boundary.

IICg—35 to 60 inches, light-gray (2.5Y 7/2), stratified silt and fine sand; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; firm; calcareous.

Depth to the underlying, calcareous, stratified silt and fine sand ranges from 24 to 40 inches. The A horizon is silt loam or loam and ranges from 10 to 17 inches in thickness. It is black, very dark gray, or very dark brown. The B horizon is clay loam, sandy clay loam, silty clay loam, silt loam, loam, or heavy sandy loam and is stratified in the lower part. It ranges from 12 to 23 inches in thickness and has matrix colors of grayish brown, dark grayish brown, olive gray, and light olive brown. The IIC horizon has matrix colors of light gray, gray, or light brownish gray.

Colwood soils are associated with Brookston, Darroch, and Navan soils. Colwood soils are more poorly drained than the Darroch soils. They are coarser textured in the lower part of the subsoil and in the substratum than Navan soils. Colwood soils have a finer textured substratum than Brookston soils.

Colwood silt loam (0 to 2 percent slopes) (Co).—This nearly level soil is in glacial lakebeds and drainage basins in irregularly shaped areas. Many areas are more than 40 acres in size. In approximately 60 percent of the acreage, the surface layer is silt loam, and in 40 percent it is loam.

Included with this soil in mapping were small areas of Darroch, Mahalasville, Navan, Palms, and Sebewa soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile. In some small included areas in the northeastern part of the county, the surface layer is less than 10 inches thick. Also included were areas that have a silty clay loam or sandy loam surface layer and areas of a soil that has less sand in the subsoil than the soil having the representative profile. Some included areas do not show evidence of stratification in the subsoil. Also included were some small areas of gently sloping soils.

This Colwood soil is poorly drained. It receives runoff from adjoining areas and is subject to ponding during wet periods and after heavy rain. It can be used for crops if excess water is removed by artificial drainage. Tile drainage can be used if measures are taken to prevent the underlying sand from entering the tiles.

Drained areas of this soil are suited to all the farm and vegetable crops commonly grown in the county. Undrained areas are used for pasture and wildlife habitat. (Capability unit IIw-1; woodland group 4w1; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Darroch Series

The Darroch series consists of somewhat poorly drained, nearly level soils that are deep and are underlain by stratified lacustrine deposits of calcareous silt and fine sand. These soils are in glacial lakebeds and drainage basins. They are commonly adjacent to the more sloping, better drained soils on uplands or in slightly elevated areas in the lake basins. Unless they are drained, the Darroch soils are saturated with water at depths of 1 to 3 feet during wet periods.

In a representative profile, the surface layer is about 14 inches thick. It is very dark brown loam in the upper part and very dark grayish-brown loam in the lower part. The subsoil is about 22 inches thick. It is dark grayish-brown, friable loam in the upper part; yellowish-brown, friable light clay loam in the middle part; and yellowish-brown, friable stratified silt and fine sand in the lower part. There are yellowish-brown mottles throughout the subsoil and grayish-brown mottles in the lower part. The substratum is light-gray, calcareous, stratified silt and fine sand that has yellow and light yellowish-brown mottles and is at a depth of about 36 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The depth of the root zone is limited by the seasonal high water table. Natural fertility is moderate.

Representative profile of Darroch loam in a cultivated field, 75 feet south of Caledonia Road and 675 feet east of line fence, NE¼NE¼NW¼ sec. 15, T. 4 N., R. 11 E.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) loam; moderate, medium, subangular blocky structure; very friable; neutral; abrupt, smooth boundary.

A12—8 to 14 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

B1—14 to 20 inches, dark grayish-brown (10YR 4/2) loam; few, fine, faint, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B2t—20 to 28 inches, yellowish-brown (10YR 5/4) light clay loam; common, fine, faint, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; clay bridging between sand grains; few, thin, patchy clay films; slightly acid; clear, smooth boundary.

IIB3—28 to 36 inches, yellowish-brown (10YR 5/4), stratified silt and fine sand; common, medium, distinct, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; neutral; clear, smooth boundary.

IICg—36 to 60 inches, light-gray (10YR 7/2), stratified silt and fine sand; common, medium, distinct, yellow (10YR 7/6) and light yellowish-brown (10YR 6/4) mottles; massive; friable; calcareous.

Depth to the underlying, calcareous, stratified silt and fine sand ranges from 30 to 42 inches. The A horizon is loam or fine sandy loam and ranges from 10 to 15 inches in thickness. It is black, very dark brown, or very dark grayish brown. The B1 horizon is loam, sandy loam, or silt loam and ranges from 4 to 12 inches in thickness. It has matrix colors of dark grayish brown, brown, or light olive brown. The B2t horizon is clay loam, silty clay loam, sandy clay loam, or loam and ranges from 7 to 11 inches in thickness. It has matrix colors of yellowish brown, dark yellowish brown, brown, olive brown, or light olive brown. The IIB3 horizon is silt loam, silty clay loam, or silt and fine sand and is stratified. It ranges from 3 to 14 inches in thickness. It has matrix colors of yellowish brown or light yellowish brown. The IIC horizon has matrix colors of light gray, light yellowish brown, yellowish brown, or pale brown.

Darroch soils are associated with Colwood, Jasper, Sisson, and Wauconda soils, but they are more poorly drained than Jasper and Sisson soils. Darroch soils are better drained than Colwood soils. They have more sand in the upper part of the solum than Wauconda soils.

Darroch loam (0 to 2 percent slopes) (Da).—This nearly level soil is in glacial lakebeds and drainage basins in irregularly shaped areas generally less than 40 acres in size.

Included with this soil in mapping were small areas of Colwood, Jasper, Kane, Sisson, and Wauconda soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile. Also included were small areas where the texture of the surface layer is silt loam or sandy loam. In some areas the depth of the solum is greater than 42 inches. The surface layer is thinner or lighter colored in some areas than the one in the soil having the representative profile. Some areas do not show evidence of stratification in the subsoil. Also included were some small areas of gently sloping soils.

This Darroch soil is somewhat poorly drained. It receives runoff from adjoining areas and is subject to ponding in some areas during wet periods and after heavy rain. It can be used for crops if excess water has been removed by artificial drainage. Tile drainage can be used if measures are taken to prevent the underlying sand from entering the tiles.

If drained, this soil is suited to all the farm and vegetable crops commonly grown in the county. Undrained areas are used for pasture and wildlife habitat. (Capability unit IIw-2; woodland group 4w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Dickman Series

The Dickman series consists of somewhat excessively drained, nearly level to sloping, loamy soils that are moderately deep and deep over sand. These soils are on sandy outwash plains and terraces. They are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is about 20 inches thick. It is black sandy loam in the upper part and very dark gray sandy loam in the lower part. The subsoil is about 16 inches thick. It is very dark grayish-brown to dark grayish-brown, very friable loamy sand in the upper part; yellowish-brown, very friable loamy fine sand in the middle part; and yellowish-brown, loose, medium and fine sand in the lower part. The substratum is brownish-yellow medium and fine sand and is at a depth of about 36 inches. There are brownish-yellow mottles in the substratum.

These soils can hold about 5 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid. The depth of the root zone is limited by the underlying sand. Natural fertility is low.

Most areas of Dickman soils are used for corn, soybeans, hay, and pasture. Some areas are used for plantations of pine trees.

Representative profile of Dickman sandy loam, 0 to 2 percent slopes, in a cultivated field 90 feet north of fence behind stone house and 500 feet east of line fence, SW¼–SW¼SW¼ sec. 8, T. 1 N., R. 10 E.:

Ap—0 to 8 inches, black (10YR 2/1) sandy loam; weak, medium, crumb structure; very friable; neutral; abrupt, smooth boundary.

A12—8 to 13 inches, black (10YR 2/1) sandy loam; very weak, fine, crumb structure, breaking to single grain; very friable; neutral; clear, wavy boundary.

A3—13 to 20 inches, very dark gray (10YR 3/1) sandy loam; very weak, medium, crumb structure, breaking to single grain; very friable; slightly acid; abrupt, wavy boundary.

B21—20 to 23 inches, very dark grayish-brown (10YR 3/2) to dark grayish-brown (10YR 4/2) loamy sand; weak, medium, crumb structure, breaking to single grain; very friable; few small pebbles; medium acid; clear, wavy boundary.

B22—23 to 32 inches, yellowish-brown (10YR 5/4) loamy fine sand; very weak, medium, crumb structure, breaking to single grain; very friable; few small pebbles; medium acid; clear, wavy boundary.

B3—32 to 36 inches, yellowish-brown (10YR 5/4) medium and fine sand; very weak, fine and medium, crumb structure, breaking to single grain; loose; few small pebbles; medium acid; clear, wavy boundary.

C1—36 to 55 inches, brownish-yellow (10YR 6/6) medium and fine sand; single grain; loose; slightly acid; gradual, wavy boundary.

C2—55 to 60 inches, yellow (10YR 8/6) medium and fine sand; common, medium, distinct, brownish-yellow (10YR 6/8) mottles single grain; loose; neutral.

Thickness of the solum ranges from 26 to 50 inches, and depth to sand ranges from 24 to 36 inches. The dark-colored surface layer and subsoil have a combined thickness of less than 24 inches. The Ap and A12 horizons range from 11 to 22 inches in combined thickness. They are black, very dark brown, or very dark gray. The A3 horizon is 0 to 10 inches thick. Where present, it is sandy loam and is very dark gray, very dark grayish brown, or dark brown. The B1 horizon ranges from 3 to 10 inches in thickness and is very dark grayish brown, dark brown, dark grayish brown, or dark yellowish brown. The B2 horizon ranges from 7 to 20 inches in thickness and is very dark grayish brown, brown, dark yellowish brown, or yellowish brown. The B3 horizon is

loamy sand, fine sand, or medium and fine sand and ranges from 3 to 10 inches in thickness. It is dark yellowish brown or yellowish brown. The C horizon is fine sand or medium and fine sand. It is yellowish brown, light yellowish brown, brownish yellow, or yellow.

Dickman soils are associated with Billett, Gotham, and Watseka soils. Dickman soils have a thicker, darker colored surface layer than Gotham soils. Dickman soils have a thicker, dark-colored surface layer and are more sandy in the upper part of the subsoil than Billett soils. They are better drained than Watseka soils.

Dickman sandy loam, 0 to 2 percent slopes (DcA).—This nearly level soil is on sandy outwash plains and terraces. Most of the acreage is in areas from 100 to 500 acres in size, though some areas are only 10 to 100 acres. The areas are irregular in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett, Gotham. Hayfield and Watseka soils and soils of the Billett series, mottled subsoil variant. Also included were small areas in which ground water is at a depth of 3 to 5 feet and small areas in which the solum is more than 50 inches thick. Other small included areas are gently sloping. Many areas of the soil have a loamy sand surface layer.

This Dickman soil is highly susceptible to soil blowing. Natural fertility is low. Crop growth during most seasons is limited by a low available water capacity. This soil is suited to irrigation. Management practices are need that regularly add organic matter, conserve moisture, and control soil blowing.

Most of the acreage is used for crops. If managed properly, this soil is suited to row crops, small grain, pasture, and hay. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production. (Capability unit IVs-3; woodland group 3s1; wildlife group 3; shrub and vine group 2; recreation group 9)

Dickman sandy loam, 2 to 6 percent slopes (DcB).—This gently sloping soil is on sandy outwash plains and terraces. Most areas of this soil are from 10 to 60 acres in size and are elongated to irregular in shape. In the profile of this soil, the surface layer is about 3 inches thinner than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett, Gotham, Hayfield, and Watseka soils, and soils of the Billett series, mottled subsoil variant. Also included were small areas in which ground water is at a depth of 3 to 5 feet and small areas in which the solum is more than 50 inches thick. Other small included areas are nearly level and sloping, and some are moderately eroded. Many inclusions are of a soil that has a loamy sand surface layer.

This Dickman soil is slightly susceptible to erosion and is highly susceptible to soil blowing. Natural fertility is low. Crop growth during most seasons is limited by low available water capacity. This soil is suited to irrigation, and less sloping areas are especially well suited. Management practices are needed that regularly return organic matter to the soil, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. If managed properly, this soil is suited to row crops, small grains, pasture, and hay. Fertilization, supplemental irrigation, and protection from wind damage are necessary for dependable crop production. (Capability unit IVs-3; woodland group 3s1; wildlife group 3; shrub and vine group 2; recreation group 9)

Dickman sandy loam, 6 to 12 percent slopes, eroded (DcC2).—This sloping soil is on sandy outwash plains and terraces. Most areas are 10 to 80 acres in size and elongated. In the profile of this soil, the surface layer is about 10 inches thinner than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett and Gotham soils. Also included were small areas in which the solum is more than 50 inches thick and small areas of gently sloping and moderately steep soils. Other inclusions are small uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion. Many inclusions are of a soil that has a loamy sand surface layer.

This Dickman soil is moderately susceptible to erosion and is highly susceptible to soil blowing. Natural fertility is low. Crop growth during most seasons is limited by low available water capacity. Management practices are needed that regularly supply additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. If managed properly, this soil can be used for corn, small grains, pasture, and hay, but it is not well suited to these uses. (Capability unit IVs-3; woodland group 3s1; wildlife group 3; shrub and vine group 2; recreation group 9)

Dresden Series

The Dresden series consists of well-drained, nearly level to steep, loamy soils that are underlain by sand and gravel at a depth of 24 to 40 inches. These soils are on outwash plains and terraces. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 8 inches thick. The subsoil is about 26 inches thick. It is dark yellowish-brown, friable heavy loam in the upper part; dark-brown, firm clay loam in the middle part; and dark-brown, firm gravelly sandy clay loam in the lower part. The substratum is light yellowish-brown, calcareous sand and gravel and is at a depth of about 34 inches.

These soils can hold about 7 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate in the subsoil and rapid in the substratum. Depth of the root zone is limited by sand and gravel. Natural fertility is moderate.

Most areas of nearly level to sloping Dresden soils are used for corn, small grains, legumes, and other crops commonly grown in the county. In most places the steeper soils are in pasture or woods.

Representative profile of Dresden silt loam, 0 to 2 percent slopes, 130 feet south of U. S. Highway No. 14 and 25 feet west of a gravel pit, NE¼NE¼SW¼ sec. 32, T. 4 N., R. 11 E.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and medium, granular structure; friable; neutral; abrupt, smooth boundary.

B21t—8 to 19 inches, dark yellowish-brown (10YR 4/4) heavy loam; moderate; fine, subangular blocky structure; friable; thin patchy clay films on some ped faces; slightly acid; clear, wavy boundary.

B22t—19 to 25 inches, dark-brown (7.5YR 4/4) clay loam; moderate, fine, subangular blocky structure; firm; thin patchy clay films on ped faces; slightly acid; clear, wavy boundary.

IIB23t—25 to 34 inches, dark-brown (7.5YR 4/4) gravelly sandy clay loam; moderate, fine, subangular blocky structure; firm; thick continuous clay films on most ped faces and in pores; slightly acid; clear, wavy boundary.

IIC—34 to 60 inches, light yellowish-brown (10YR 6/4) sand and gravel; single grain; loose; calcareous.

Depth to underlying sand and gravel ranges from 24 to 40 inches. The A horizon is loam or silt loam and ranges from 7 to 9 inches in thickness. It is very dark brown or very dark grayish brown. The B1 horizon is 0 to 5 inches thick. Where present, it is brown loam or silt loam. The B2t horizon is silty clay loam, loam, or clay loam in the upper part and is heavy loam or clay loam in the lower part. It ranges from 10 to 20 inches in thickness and is dark yellowish brown or dark brown. The IIB2t horizon is clay loam, gravelly clay loam, or gravelly sandy clay loam and ranges from 5 to 12 inches in thickness. It is dark yellowish brown, dark brown, or brown.

Dresden soils are associated with Casco, Kane, Oshtemo, and Warsaw soils. Dresden soils lack the thick, dark-colored surface layer of Warsaw soils. They have a thicker solum than Casco soils. Dresden soils have a thinner solum and are finer textured than Oshtemo soils. They are better drained than Kane soils.

Dresden silt loam, 0 to 2 percent slopes (DrA).—This nearly level soil is on outwash plains. The areas are generally 40 to 200 acres in size and irregular in shape. In approximately 65 percent of the acreage, the surface layer is silt loam, and in 35 percent it is loam. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Kane, Oshtemo, St. Charles, and Warsaw soils and areas that have a sandy loam surface layer. In drainageways and depressions the surface layer is thicker and darker colored than that of this soil, and in some areas the subsoil is mottled. Also included were small areas where the silty mantle ranges from 20 to 36 inches in thickness, and areas where the solum ranges from 40 to 60 inches in thickness. In some areas the sand and gravel outwash is underlain by stratified silt and fine sand, generally at depths below 45 inches. Also included were small areas of gently sloping soils.

Runoff is slow on this Dresden soil. Management practices that improve tilth and supply regular additions of organic matter will increase water infiltration. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. It is well suited to irrigation and, if additional water is supplied, can be used for more intensive production of garden and truck crops. (Capability unit IIs-1; woodland group 2d2; wildlife group 1; shrub and vine group 1; recreation group 1)

Dresden silt loam, 2 to 6 percent slopes (DrB).—This gently sloping soil is on low ridges and knobs on outwash plains and terraces. On the outwash plains, the areas are generally 15 to 50 acres in size and irregular in shape. Along terraces the areas generally are long, narrow strips adjacent to the steeper uplands. In approximately 65 percent of the acreage, the surface layer is silt loam, and in 35 percent it is loam. In the profile of this soil, depth to the sand and gravel substratum is about 2 inches less than it is in the profile described as representative for the series.

Included with this soil in mapping were small areas of Casco, Kane, Oshtemo, St. Charles, and Warsaw soils and areas that have a sandy loam surface layer. Also included were moderately eroded areas where the surface layer is lighter colored and in some places has dark yellowish-brown subsoil material mixed with the surface layer. In drainageways and depressions the surface layer is thicker and darker colored than that of the soil having the representative profile, and in some areas the subsoil is mottled. Also included were small areas where the silty mantle ranges from 20 to 36 inches in thickness and areas where the solum ranges from 40 to 60 inches in thickness. In some areas the sand and gravel outwash is underlain by stratified silt and fine sand or glacial till, generally at depths of more than 45 inches.

This Dresden soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. It is suited to irrigation, and less sloping areas are especially well suited. If irrigated, this soil can be used for more intensive production of garden and truck crops. (Capability unit IIe-2; woodland group 2d2; wildlife group 1; shrub and vine group 1; recreation group 1)

Dresden silt loam, 6 to 12 percent slopes, eroded (DrC2).—This sloping soil is on low ridges and knobs on outwash plains and on terraces generally adjacent to the uplands. It is also on the side slopes of narrow drainageways. The areas are generally 5 to 40 acres in size and elongated in shape. Approximately 60 percent of the acreage has a silt loam surface layer, and 40 percent has a loam surface layer.

In the profile of this soil, depth to the sand and gravel substratum is about 4 inches less than in the profile described as representative for the series. In addition, the surface layer is more clayey and, in most places, more sandy. It is also lighter colored and in many places has dark yellowish-brown material from the subsoil mixed with the original surface layer through plowing.

Included with this soil in mapping were areas of uneroded soils and a few small areas of severely eroded soils where nearly all of the original surface layer has been removed by erosion. Also included were small areas of Casco, Kidder, and Warsaw soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Also included were areas where the silty mantle ranges from 20 to 36 inches in thickness, and areas where the solum ranges from 40 to 60 inches. In some areas the sand and gravel outwash is underlain by stratified silt and fine sand or glacial till, generally at depths of more than 45 inches. Other small included areas are gently sloping or moderately steep. Some areas have a sandy loam surface layer. In a few small areas the sand and gravel outwash is underlain by bedrock at depths below 5 feet.

This Dresden soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. If properly managed, this soil is suited to all of the farm crops commonly grown in the county (Capability unit IIIe-2; woodland group 2d2; wildlife group 1; shrub and vine group 1; recreation group 1)

Dresden silt loam, 12 to 25 percent slopes, eroded (DrD2).—This moderately steep and steep soil is on side slopes along narrow drainageways and on the edge of outwash plains and terraces. The areas are generally 5 to 25 acres in size and elongated. In approximately 55 percent of the acreage the surface layer is silt loam, and in 45 percent it is loam.

In the profile of this soil, depth to the sand and gravel substratum is about 6 inches less than in the profile described for the series. In addition, the surface layer contains more sand and clay, is lighter colored, and, in many places, has dark yellowish-brown subsoil material mixed with the original surface layer through plowing.

Included with this soil in mapping were areas of uneroded soils, most of which are wooded, and a few small areas of severely eroded soils where almost all the original surface

layer has been removed by erosion. Also included were small areas of Casco, Oshtemo, and Warsaw soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile and is generally recent alluvium. Also included were areas where the silty mantle ranges from 20 to 36 inches in thickness, and areas where the solum ranges from 40 to 60 inches in thickness. In some areas the sand and gravel outwash is intermixed with glacial till. In a few small areas, the sand and gravel outwash is underlain by bedrock at depths below 5 feet. Other inclusions are small areas of sloping soils and very steep soils. Some small included areas have a sandy loam surface layer.

This Dresden soil has very rapid runoff and is highly susceptible to erosion. Most of the acreage is in hay, pasture, or woods. Row crops are grown in some of the less sloping areas. Many areas that were cultivated are now in pasture or woods. This soil is not suited to row crops, unless erosion is controlled. It is better suited to close-growing crops or trees. (Capability unit IVe-2; woodland group 2r1; wildlife group 1; shrub and vine group 1; recreation group 1)

Durand Series

The Durand series consists of well drained and moderately well drained, nearly level to sloping, loamy soils that are deep and are underlain by gravelly sandy loam glacial till. These soils are saturated with water at depths of 3 to 5 feet during wet periods.

In a representative profile, the surface layer is about 12 inches thick. It is very dark gray silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The subsoil is about 56 inches thick. It is brown, firm silty clay loam in the upper part; dark-brown, firm clay loam in the middle part; and dark-brown, friable sandy clay loam in the lower part. The substratum is light yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 68 inches.

These soils hold about 11 inches of water for plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Durand silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 30 feet south of Waite Road and 35 feet east of fence line, NE¼NW¼SW¼ sec. 33, T. 2 N., R. 14 E.:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A3—8 to 12 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure and moderate, fine, subangular blocky structure; very friable; slightly acid; abrupt, smooth boundary.

B1t—12 to 25 inches, brown (10YR 4/3) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; clay films on some ped faces and in most pores; few small pebbles; strongly acid; gradual, wavy boundary.

IIB21t—25 to 31 inches, dark-brown (7.5YR 4/4) clay loam; weak, medium, prismatic structure, parting to weak, medium, subangular blocky structure; firm; some coating on ped surfaces from B1t horizon; many thin clay films on some ped faces and in pores; few small pebbles; medium acid; clear, wavy boundary.

IIB22t—31 to 60 inches, dark-brown (7.5YR 4/4) sandy clay loam; weak, medium, prismatic structure, parting to weak, medium, subangular blocky structure; friable; dark reddish-brown (5YR 3/2) clay flows in old channels and films on some ped faces; few small pebbles; medium acid; gradual, wavy boundary.

IIB23t—60 to 68 inches, dark-brown (7.5YR 4/4) sandy clay loam; weak, medium, prismatic structure, parting to weak, medium, subangular blocky structure; friable; dark reddish-brown (5YR 3/4) clay flows in a few channels; clay bridging between sand grains; medium acid; abrupt, smooth boundary.

IIC—68 to 74 inches, light yellowish-brown (10YR 6/4) gravelly sandy loam; massive; very friable; calcareous.

Depth to calcareous gravelly sandy loam till ranges from 48 to 80 inches. The silty mantle ranges from 15 to 25 inches in thickness. The A horizon ranges from 10 to 18 inches in thickness. It is very dark gray, very dark grayish brown, very dark brown, or black. The B1t horizon is silty clay loam or heavy silt loam and ranges from 4 to 20 inches in thickness. It is brown, dark yellowish brown, or dark brown. The IIB2t horizon is clay loam or sandy clay loam and ranges from 18 to 40 inches in thickness. It is dark brown, brown, strong brown, reddish brown, or dark yellowish brown. The IIB3 horizon is 0 to 10 inches thick. Where present, it is sandy clay loam or sandy loam and is brown, strong brown, or dark yellowish brown. Profiles that lack base colors having a hue of 5YR in some part of the B horizon have clay films of that hue. Mottles occur in the lower part of the subsoil in some profiles.

Durand soils are associated with Ogle, Pecatonica, and Winnebago soils. They have a darker colored or thicker surface layer than Pecatonica soils. They have less sand in the upper part of the subsoil than Winnebago soils. Durand soils have a thinner silty mantle than Ogle soils.

Durand silt loam, 0 to 2 percent slopes (DuA).—This nearly level soil is on till plains and on broad, till-covered ridgetops and valley floors in areas where the bedrock is relatively shallow. The areas are generally less than 50 acres in size and are irregular in shape. In the profile of this soil, depth to the gravelly sandy loam substratum is about 3 inches more and the surface layer is thicker than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Ogle, Pecatonica, Rockton, and Winnebago soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Some areas of this soil have a silty mantle up to 36 inches thick. Also included were areas where the subsoil is more sandy than the one in the soil having the representative profile, and areas where the subsoil is less red than that soil. In some areas this soil is underlain by stratified silt and sand, sand, sand and gravel, or dolomite bedrock rather than glacial till. Other inclusions are small areas of gently sloping soils and some small areas in which the underlying till has a texture of silt loam, loam, or clay loam.

This Durand soil has few limitations and can be cropped intensively if management practices are used to supply regular additions of organic matter and to maintain good tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Durand silt loam, 2 to 6 percent slopes, eroded (DuB2).—This gently sloping soil is on till plains and on broad, till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The areas generally are less than 80 acres in size and are irregular in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Ogle, Pecatonica, Ringwood, Rockton, and Winnebago soils. In drainageways and depressions the surface layer is thicker than the one in this soil, and in some areas the subsoil is mottled. Some areas of this soil have a silty mantle up to 36 inches thick. Also included were areas where the subsoil is more sandy than the one in this soil, and areas where the subsoil is less red. In some areas this soil is underlain by

sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of nearly level and sloping soils and some small areas where the underlying till is silt loam, loam, or clay loam. Other inclusions are areas of uneroded soils and small areas of severely eroded soils where most of the original surface layer has been removed by erosion.

This Durand soil is only slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Durand silt loam, 6 to 12 percent slopes, eroded (DuC2).—This sloping soil is on till plains and till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The areas are generally less than 30 acres in size and are irregular in shape. In the profile of this soil, depth to the gravelly sandy loam substratum is about 10 inches less than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Ogle, Pecatonica, Ringwood, Rockton, and Winnebago soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. Some areas of this soil have a silty mantle up to 36 inches thick. Also included were areas where the subsoil is more sandy than the one in the soil having the representative profile, and areas where the subsoil is less red than the one in that soil. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of gently sloping and moderately steep soils, and some small areas in which the underlying till is loam, silt loam, or clay loam. Other inclusions are areas of uneroded soils and small areas of severely eroded soils where most of the original surface layer has been removed by erosion.

This Durand soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. Under proper management this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Edmund Series

The Edmund series consists of well-drained, gently sloping to very steep, loamy soils that are underlain by dolomite bedrock at depths of 12 to 20 inches. The dolomite is generally soft and weathered in the upper few inches and fragmentary and creviced in the upper few feet. Subsoil material generally fills these crevices. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark grayish-brown loam about 8 inches thick. The subsoil is about 9 inches thick. It is brown, firm clay loam in the upper part and reddish-brown, very firm clay in the lower part. The underlying dolomite is pale yellow, calcareous, fragmentary, and creviced. It is at a depth of about 17 inches.

These soils can hold about 3 inches of water available to plants between the surface and the depth to dolomite. Permeability is moderate. The depth of the root zone is generally limited by the dolomite, but some roots extend into crevices that are filled with subsoil material. Natural fertility is moderate.

Most areas of gently sloping and sloping Edmund soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep to very steep Edmund soils are in pasture or woods.

Representative profile of Edmund loam, 2 to 6 percent slopes, eroded, in a cultivated field, 265 feet east of County Road K and 530 feet north of wooded line fence, NW¼ SW¼SW¼ sec. 31, T. 2 N., R. 11 E.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, granular structure; very friable; slightly acid; abrupt, smooth boundary.

B21t—8 to 13 inches, brown (7.5YR 4/4) clay loam; weak, fine and medium, subangular blocky structure; firm; clay films on most ped faces and in pores and old root channels; slightly acid; abrupt, smooth boundary.

IIB22t—13 to 17 inches, reddish-brown (5YR 4/4) clay; moderate, fine and medium, subangular blocky structure; very firm; clay films on most ped faces and in pores and old root channels; neutral; gradual, smooth boundary.

IIR—17 inches +, pale-yellow (2.5Y 8/4) dolomite bedrock; fragmentary and creviced.

Depth to dolomite ranges from 12 to 20 inches. The A horizon is loam or silt loam and ranges from 6 to 14 inches in thickness. It is very dark brown, very dark grayish brown, or dark brown. The B2t horizon is silty clay loam, clay loam, silty clay, or clay and ranges from 6 to 14 inches in thickness. It is brown, dark brown, dark yellowish brown, dark reddish brown, or reddish brown. The percentage of coarse fragments ranges from 1 to 15 percent in the solum. These include angular chert, rounded gravel, and dolomite fragments up to 2 feet in length.

Edmund soils are associated with Rockton, Sogn, and Whalan soils. Edmund soils have a thicker solum and are deeper to dolomite than Sogn soils. They have a Bt horizon that is lacking in Sogn soils. Edmund soils have a thinner solum and are shallower to dolomite than Rockton or Whalan soils.

Edmund loam, 2 to 6 percent slopes, eroded (EdB2).—This gently sloping soil is on broad ridgetops and upper side slopes. The areas are generally 20 to 160 acres in size and are elongated in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were uneroded areas and areas that have a silt loam surface layer. Also included were areas of soils that formed in less clayey residuum and are more sandy than this Edmund soil. Other inclusions are areas of severely eroded soils where most of the original surface layer has been removed by erosion. The surface layer in these areas is brown silty clay loam, clay loam, silty clay, or clay and contains dolomite fragments in some places. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil, and in some areas the subsoil is mottled. Other inclusions are small areas that have a sandy loam or loamy sand surface layer, and these generally are indicated on the soil map by the symbol for sand spots. Small areas of bedrock outcrops generally are indicated on the soil map by the symbol for rock outcrop. Small areas of Rockton, Sogn, and Whalan soils and small areas of nearly level and sloping soils also were included.

This Edmund soil has moderate permeability. In the more eroded areas it is in poor tilth, and tillage is further hampered by dolomite fragments in some areas. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. Because of the very low available water capacity and shallow root zone, this soil is not well suited to row crops. It is better suited to hay and pasture. In the more sloping eroded areas, however, surface

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crusting commonly reduces the emergence of small-seeded crops, such as alfalfa. (Capability unit IIIe-3; woodland group 3d1; wildlife group 3; shurb and vine group 2; recreation group 11)

Edmund loam, 6 to 12 percent slopes, eroded (EdC2).—This sloping soil is on narrow ridgetops and side slopes. The areas are generally 15 to 80 acres in size and are elongated in shape. The profile of this soil is about 2 inches thinner than the profile described as representative for the series.

Included in mapping were uneroded areas and areas in which the surface layer is silt loam. Also included were some areas of severely eroded soils where most of the original surface layer has been removed by erosion. The surface layer in these areas is brown silty clay loam, clay loam, silty clay, or clay and contains dolomite fragments in some places. Other inclusions are areas of soils that formed in less clayey residuum and are more sandy than the soil having the profile described as representative for the series. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Other inclusions are small areas that have a sandy loam or loamy sand surface layer. These areas are generally indicated on the soil map by the symbol for sand spots. Small areas of bedrock outcrops generally are indicated by the symbol for rock outcrop on the soil map. Small areas of Rockton, Sogn, and Whalan soils and small areas of gently sloping and moderately steep soils also were included.

This Edmund soil has moderate permeability. In the more eroded areas it is in poor tilth, and tillage is further hampered by dolomite fragments in some areas. Management practices are needed that conserve moisture, reduce runoff, improve tilth and control erosion.

Most of the acreage is used for crops. Because of very low available water capacity and shallow root zone, this soil is not well suited to row crops. It is better suited to hay and pasture. In the more eroded areas, however, surface crusting commonly reduces the emergency of small-seeded crops, such as alfalfa. (Capability unit IVe-3; woodland group 3d1; wildlife group 3; shrub and vine group 2; recreation group 11)

Edmund loam, 12 to 20 percent slopes, eroded (EdD2).—This moderately steep soil is on side slopes in bedrock areas that have been deeply incised by natural drainageways. The areas are generally 10 to 60 acres in size and are elongated in shape. The profile of this soil is about 2 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were areas that have a silt loam surface layer and uneroded areas. Also included were some areas of severely eroded soils where most of the original surface layer has been removed by erosion. The surface layer in these areas is brown silty clay loam, clay loam, silty clay, or clay and contains dolomite fragments in some places. Other inclusions are areas of soils that formed in less clayey residuum and are more sandy than the soil having the profile described as representative for the series. Also, in drainageways the surface layer is thicker and darker colored than the one in that soil. Other inclusions are small areas that have a sandy loam or loamy sand surface layer, and these generally are indicated on the soil map by the symbol for sand spots. Small areas of bedrock outcrops are generally indicated on the soil map by the symbol for rock outcrop. In some areas the soil on the lower part of slopes is underlain by sandstone bedrock. Small areas of Eleva, Rockton, Sogn, and Whalan soils and small areas of sloping and steep soils also were included.

This Edmund soil has moderate permeability. In the more eroded areas it has poor tilth, and tillage is further hampered by dolomite fragments in some areas. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Some of the acreage is used for row crops, but most of it is in pasture or woods. Because of very low available water capacity, shallow root zone, and severe erosion hazard, this soil is not suited to row crops. It can be used for close-growing crops or woods. (Capability unit VIe-3; woodland group 3r1; wildlife group 3; shrub and vine group 2; recreation group 11)

Edmund loam, 20 to 35 percent slopes (EdE).—This steep and very steep soil is on side slopes in bedrock areas that have been deeply incised by natural drainageways. The areas are generally 5 to 20 acres in size and are elongated in shape. The profile of this soil is about 2 inches thinner than the profile described as representative for the series. In addition, the surface layer is darker colored and is slightly less clayey.

Included with this soil in mapping were areas that have a silt loam surface layer and small eroded areas. Other inclusions are areas of soils that are more sandy throughout the solum than the soil having the profile described as representative for the series and have only a thin layer of clayey residuum. In drainageways the surface layer is thicker and darker colored than the one in the soil having the representative profile. Also included were small areas that have a sandy loam or loamy sand surface layer and small areas of bedrock outcrops. Bedrock fragments are mixed throughout the solum in some areas. In some areas the soil on the lower part of slopes is underlain by sandstone bedrock. Small areas of Eleva, Rockton, Sogn, and Whalan soils and small areas of soils having slopes greater than 35 percent also were included.

This Edmund soil has moderate permeability. It is subject to very severe erosion. Most of the acreage is in woods, but some areas are in pasture. Because of very low available water capacity and a severe erosion hazard, this soil is better suited to woods and wildlife habitat than to most other uses. (Capability unit VIIe-4; woodland group 3r1; wildlife group 3; shrub and vine group 2; recreation group 11)

Elburn Series

The Elburn series consists of deep, somewhat poorly drained, silty soils that are underlain by gravelly sandy loam glacial till. These nearly level and gently sloping soils are on flood plains and in drainageways, depressions, and old lake basins. Unless they are drained, they are saturated with water at a depth of 1 to 3 feet during wet periods.

In a representative profile, the surface layer is about 15 inches thick. It is black silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The subsoil is about 55 inches thick. It is brown and light brownish-gray, friable and firm light silty clay loam in the upper part; light yellowish-brown, friable heavy silt loam in the middle part; and yellowish-brown and dark-brown, friable light loam and sandy loam in the lower part. The substratum is yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 70 inches. There are dark-gray, yellowish-brown, light brownish-gray, and brown mottles in the subsoil and yellowish-brown mottles in the substratum.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. Depth of the root zone is limited by the seasonal saturation with water. Natural fertility is high.

Where these soils are drained, most areas are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county. Undrained areas are used for unimproved pasture, woodland, and wildlife habitat.

Representative profile of Elburn silt loam, 0 to 3 percent slopes, in a cultivated field, 80 feet west of State Route 140 and 200 feet north of a farm driveway, 2 1/2 miles south of Clinton, SE¼SE¼NW¼ sec. 29, T. 1 N., R. 14 E.:

Ap—0 to 11 inches, black (10YR 2/1) silt loam; moderate, fine, subangular blocky structure; very friable; many earthworm casts; slightly acid; abrupt, smooth boundary.

A12—11 to 15 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, subangular blocky structure; very friable; medium acid; clear, smooth boundary.

B1t—15 to 24 inches, brown (10YR 5/3) light silty clay loam; common, fine, distinct, dark-gray (10YR 4/1) and yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; friable; thin continuous clay films on ped faces and in pores and channels; medium acid; gradual, smooth boundary.

B21tg—24 to 45 inches, light brownish-gray (2.5Y 6/2) light silty clay loam; many, medium, distinct, dark-gray (10YR 4/1) and yellowish-brown (10YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; firm; many iron and manganese concretions; thin, patchy, very dark gray (10YR 3/1) clay films on some ped faces and in old root channels; neutral; gradual, smooth boundary.

B22t—45 to 60 inches, light yellowish-brown (2.5Y 6/4) heavy silt loam; many, medium, distinct, light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure; friable; thin, patchy, very dark gray (10YR 3/1) clay films on some vertical ped faces and in old root channels; calcareous; clear, smooth boundary.

IIB31—60 to 64 inches, yellowish-brown (10YR 5/4) light loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable; calcareous; clear, smooth boundary.

IIB32—64 to 70 inches, dark-brown (10YR 4/3) sandy loam; many, fine, faint, brown (7.5YR 4/4) mottles; weak, medium, subangular blocky structure; friable; calcareous; clear, smooth boundary.

IIC—70 to 80 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; many, fine, faint, yellowish-brown (10YR 5/6) mottles; massive; friable; calcareous.

Depth to calcareous gravelly sandy loam till ranges from 50 to 70 inches. The silty mantle ranges from 40 to 60 inches in thickness, and the combined thickness of the A horizons ranges from 12 to 18 inches. The A11, or the Ap horizon is black, very dark brown, very dark gray, or very dark grayish brown. The A12 horizon is very dark brown, very dark gray, or very dark grayish brown. The B1t and B2t horizons are heavy silty loam or silty clay loam and range from 25 to 50 inches in combined thickness. They have matrix colors of brown, grayish brown, light brownish gray, or light yellowish brown. The IIB3 horizons are clay loam, loam or sandy loam and range from 3 to 10 inches in thickness. They have matrix colors of brown, dark brown, yellowish brown, light yellowish brown, or light brownish gray. The IIC horizon is gravelly sandy loam till or stratified silt and fine sand and is brown or yellowish brown.

Elburn soils are associated with Mahalasville, Plano, and Troxel soils. Elburn soils are more poorly drained than Plano and Troxel soils and lack the thick, dark-colored A horizon of Troxel soils. Elburn soils are better drained than Mahalasville soils.

Elburn silt loam, 0 to 3 percent slopes (ElA).—This soil occurs in elongated and irregularly shaped tracts on flood plains and in drainageways, depressions and old lake beds. Many areas of this soil are more than 40 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Mahalasville, Plano, St. Charles, and Wauconda soils. Also included were small areas that have a silty clay loam surface layer, areas that have a light-colored surface layer, and areas that are underlain by dolomite bedrock at a depth of 4 to 6 feet. Other inclusions are areas that are underlain by sand and gravel, areas in which the silty mantle is less than 40 inches thick, and areas that have slopes of as much as 5 percent. Some small areas have recent silty overwash.

This Elburn soil is somewhat poorly drained and is subject to ponding in some areas during wet periods and after heavy rain. It is suitable for tile drainage. Both surface drainage and tile drainage are used to remove excess water rapidly.

If drained, this soil is suited to all of the farm and vegetable crops commonly grown in the county. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IIw-2; woodland group 4w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Elburn silt loam, gravelly substratum, 0 to 3 percent slopes (EmA).—This soil occurs in elongated and irregularly shaped tracts on flood plains and in drainageways and depressions on outwash plains. Most areas of this soil are 10 to 40 acres in size. This soil differs from the one having the profile described as representative for the series in having a substratum of sand and gravel.

Included with this soil in mapping were small areas of Mahalasville, Plano, St. Charles, and Wauconda soils. Also included were small areas that have a light-colored surface layer and areas that are underlain by dolomite bedrock at a depth of 4 to 6 feet. Other inclusions are small areas that are underlain by glacial till or lacustrine silt and fine sand, areas in which the silty mantle is less than 40 inches thick, and areas that have slopes of as much as 5 percent. Some small areas have recent silty overwash.

This Elburn soil is somewhat poorly drained and is subject to ponding in some areas during wet periods and after heavy rain. It is suitable for tile drainage. Where tile is placed in the underlying sand and gravel, it fills with sand unless special installation practices are used. Both surface and tile drainage are used to remove excess water rapidly.

If drained, this soil is suited to all the farm and vegetable crops commonly grown in the county. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IIw-2; woodland group 4w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Elburn silt loam, overwash, 0 to 3 percent slopes (EoA).—This soil is on flood plains and in drainageways, depressions, and old lake basins. Most areas are elongated in shape, but some are irregular, and they range from 10 to 100 acres in size. In the profile of this soil the surface layer is thicker than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Mahalasville, Troxel, and Worthen soils. Also included were small areas in which the solum has more sand or clay than the one in the profile described as representative for the series, as well as small areas where the silty overwash is lighter colored.

This Elburn soil is somewhat poorly drained and is subject to flooding and ponding during wet periods and after heavy rain. It is suitable for tile drainage. Both surface and tile drainage are used to remove excess water rapidly.

If drained, this soil is suited to all of the farm and vegetable crops commonly grown in the county. For dependable

crop production, the soil also should be protected from flooding. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IIw-2; woodland group 4w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Eleva Series

The Eleva series consists of well-drained, gently sloping to very steep loamy soils that are underlain by sandstone bedrock at depths of 20 to 40 inches. These soils formed in residuum from weathered sandstone bedrock. They are in the more deeply incised bedrock areas where natural drainageways have been cut through the dolomite cap and into the underlying sandstone. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is dark grayish-brown sandy loam about 6 inches thick (fig. 21). The subsoil is about 22 inches thick. It is dark yellowish-brown, friable sandy loam in the upper part and yellowish-brown, very friable loamy sand in the lower part. The substratum is light yellowish-brown, loose sand about 5 inches thick. The underlying sandstone is banded very pale brown and light brown, is fragmentary and creviced, and is at a depth of about 33 inches.

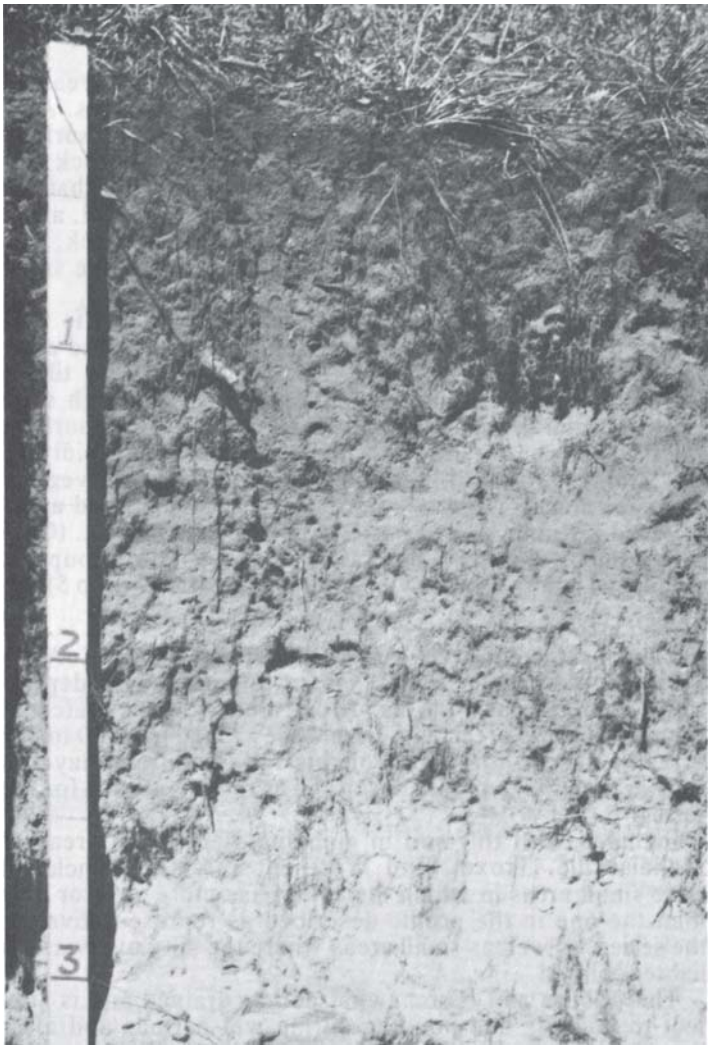

Figure 21.—Soil profile of an Eleva soil that is underlain by sandstone bedrock at a depth of about 3 feet

These soils can hold about 3 inches of water available to plants between the surface and the depth to bedrock. Permeability is moderately rapid. The depth of the root zone is generally limited by the sandstone, but some roots extend into crevices that are filled with sand. Natural fertility is moderate.

Most areas of gently sloping and sloping Eleva soils are used for corn, small grains, legumes, and other crops commonly grown in the county. In most places the steeper soils are in pasture or woods.

Representative profile of Eleva sandy loam, 6 to 12 percent slopes, eroded, in a cultivated field, 50 feet east of Croak Road and 30 feet north of park entrance, SW¼SW¼SE¼ sec. 7, T. 3 N., R. 10. E.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, coarse, subangular blocky structure; very friable; slightly acid; abrupt, smooth boundary.

B1—6 to 10 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, coarse, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—10 to 15 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, coarse, subangular blocky structure; friable; clay bridging between sand grains; clay flows in some channels; slightly acid; clear, smooth boundary.

B22t—15 to 25 inches, dark yellowish-brown (10YR 4/4) heavy sandy loam; weak, coarse, subangular blocky structure; friable; clay bridging between sand grains; clay flows in some channels; slightly acid; clear, smooth boundary.

B3—25 to 28 inches, yellowish-brown (10YR 5/4) loamy sand; weak, coarse and medium, subangular blocky structure; very friable; slightly acid; abrupt, smooth boundary.

IIC—28 to 33 inches, light yellowish-brown (10YR 6/4) sand; single grain; loose; about 5 percent of horizon is sandstone fragments, mostly less than 1 inch in diameter; medium acid.

IIR—33 inches+, very pale brown (10YR 7/4) and light-brown (7.5YR 6/4), banded sandstone; fragmentary and creviced; medium acid.

Depth to sandstone ranges from 20 to 40 inches. The Ap horizon ranges from 5 to 8 inches in thickness and is dark grayish brown, grayish brown or brown. Where not cultivated, the A1 horizon ranges from 1 to 4 inches in thickness and is very dark grayish brown. The A2 horizon, where present, ranges from 1 to 4 inches in thickness and is dark grayish brown, grayish brown, or brown. The B1 horizon ranges from 4 to 12 inches in thickness. It is dark yellowish brown, brown, or strong brown. The B2t horizon is sandy loam or loam and ranges from 11 to 20 inches in thickness. It is dark yellowish brown or brown. The B3 horizon, where present, is as much as 5 inches thick and is yellowish brown or light yellowish brown. The IIC horizon, where present, is as much as 6 inches thick and is light yellowish brown or brownish yellow. The underlying sandstone is soft and weathered in the upper few inches and fragmentary and creviced in the upper few feet. Loose sand fills these crevices.

Eleva soils are associated with Rockton and Whalan soils and soils of the Gotham series, bedrock variant. Eleva soils are more sandy than Rockton and Whalan soils and are underlain by sandstone rather than dolomite. Eleva soils are less sandy than Gotham soils, bedrock variant, and are underlain by sandstone rather than dolomite.

Eleva sandy loam, 2 to 6 percent slopes (EvB).—This gently sloping soil is on foot slopes adjacent to the steeper uplands and the ends of narrow ridgetops. The areas are generally less than 15 acres in size and are elongated in shape. The profile of this soil is about 4 inches thicker and has a darker colored surface layer than the profile described as representative for the series.

Included with this soil in mapping were moderately eroded areas that have subsoil material mixed in the surface layer, small areas of nearly level soils, and small areas that have a loam surface layer. Also included were small areas

where the profile is more clayey in the subsoil than the profile described as representative for the series and part of the subsoil is weathered glacial till. Other inclusions are small areas that are more sandy throughout the solum than the one in the soil having the representative profile. In some small areas the depth to sandstone is less than 20 inches, and in other small areas its depth is more than 40 inches. Sandstone fragments are mixed in the subsoil in some areas. Dolomite fragments are mixed in this soil where it is adjacent to steeper areas of Edmund, Rockton, Sogn, or Whalan soils. Small areas of these soils also were included.

This Eleva soil is slightly susceptible to erosion and is subject to soil blowing. Natural fertility is moderate, but crop growth during most seasons is limited by low available water capacity. The soil is suited to irrigation, especially in the less sloping areas. Management practices are needed that regularly return organic matter to the soil, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. If management is good, this soil is suited to corn, small grains, and hay. (Capability unit IIIs-4; woodland group 3s2; wildlife group 1; shrub and vine group 2; recreation group 10)

Eleva sandy loam, 6 to 12 percent slopes, eroded (EvC2).—This sloping soil is on foot slopes adjacent to the steeper uplands and the ends of narrow ridgetops. The areas are generally less than 25 acres in size and are elongated in shape. This soil has the profile described for the series.

Included with this soil in mapping were uneroded areas, small areas of gently sloping and moderately steep soils, and small areas that have a loam surface layer. Also included were small areas where the subsoil is more clayey than the one in this soil and where part of the subsoil is weathered glacial till. Other inclusions are small areas that are more sandy throughout the solum than this soil. In some small areas the depth to sandstone is less than 20 inches, and in other small areas it is more than 40 inches. Sandstone fragments are mixed in the subsoil in some areas. Dolomite fragments are mixed in this soil where it is adjacent to steeper areas of Edmund, Rockton, Sogn, or Whalan soils. Small areas of these soils also were included. The underlying sandstone is glauconitic in some areas.

This Eleva soil is moderately susceptible to erosion and is subject to soil blowing. Natural fertility is moderate. Crop growth during most seasons is limited by low available water capacity. Management practices are needed to provide regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. This soil is not suited to intensive cultivation, but it is fairly well suited to small grains and hay if it is well managed. (Capability unit IIIe-7; woodland group 3s2; wildlife group 1; shrub and vine group 2; recreation group 10)

Eleva sandy loam, 12 to 20 percent slopes (EvD).—This moderately steep soil is on side slopes in bedrock areas that have been deeply incised by natural drainageways. Most areas of this soil are less than 40 acres in size and are long, narrow tracts generally on the lower part of the slopes and adjacent to the valley floor. The profile of this soil is about 2 inches thinner and has a darker colored surface layer than the profile described as representative for the series.

Included in mapping were moderately eroded areas that have subsoil material mixed in the surface layer, small areas of sloping and steep soils, and small areas that have a loam surface layer. Also included were small areas that are more clayey in the subsoil than the soil having the representative profile, and part of the subsoil is weathered glacial till. Other inclusions are small areas that are more sandy throughout the solum than the soil having the representative profile. In some areas the depth to sandstone is less than 20 inches, and in other small areas it is more than 40 inches. Limestone fragments are mixed in this soil where it is adjacent to Edmund, Rockton, Sogn, or Whalan soils. Small areas of these soils also were included. The underlying sandstone is glauconitic in some areas.

This Eleva soil is highly susceptible to erosion and is subject to soil blowing. Most areas are in pasture or woodland. Good management practices, such as controlled grazing, renovation, and topdressing, help improve pastures. Because of the high susceptibility to erosion and the hazard of soil blowing, this soil is better suited to woods or wildlife habitat than to most other uses. (Capability unit IVe-7; woodland group 3r2; wildlife group 1; shrub and vine group 2; recreation group 10)

Eleva sandy loam, 20 to 35 percent slopes (EvE).—This steep and very steep soil is on side slopes in bedrock areas that have been deeply incised by natural drainageways. Most areas of this soil are less than 30 acres in size and are long, narrow tracts between the valley floor and the dolomite capped ridgetops. The profile of this soil is about 2 inches thinner and has a darker colored surface layer than the profile described as representative for the series.

Included with this soil in mapping were a few moderately eroded areas, small areas of moderately steep soils, and small areas that have a loam surface layer. Also included were small areas that are more clayey in the subsoil than the soil having the representative profile, and part of the subsoil is weathered glacial till. Other inclusions are small areas that are more sandy throughout the solum than the soil having the representative profile. In some areas the depth to sandstone is less than 20 inches, and in other small areas it is more than 40 inches. Sandstone fragments are mixed in the subsoil and crop out in some areas. Dolomite fragments are mixed in this soil in some areas. Small areas of Edmund, Rockton, Sogn, or Whalan soils also were included and so were a few areas of steeper soils that have slopes up to 45 percent.

This Eleva soil is highly susceptible to erosion and is subject to soil blowing. Most areas are in woods, but a few areas are in pasture. The soil is too steep for cultivated crops and is better suited to woods and wildlife habitat. (Capability unit VIe-7; woodland group 3r2; wildlife group 1; shrub and vine group 2; recreation group 10)

Flagg Series

The Flagg series consists of well-drained, nearly level and gently sloping, silty soils that are deep and are underlain by gravelly sandy loam glacial till. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is about 74 inches thick. It is yellowish-brown, very friable to firm silty clay loam in the upper part and brown and reddish-brown, firm and friable sandy clay loam in the lower part. The substratum is light yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 82 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is

high. Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Flagg silt loam, 2 to 6 percent slopes, 255 feet west of Pearson Road and 45 feet north of State Line Road, SE¼SW¼SE¼ sec. 35, T. 1 N., R. 14 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and fine, granular structure; very friable; many roots; moderately alkaline; abrupt, smooth boundary.

B1t—8 to 19 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, very fine, subangular blocky structure; very friable; thin patchy clay films on some ped faces; neutral; gradual, wavy boundary.

B21t—19 to 31 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, prismatic structure, parting to moderate, medium and fine, subangular blocky structure; firm; clay films on ped faces and in pores and channels; strongly acid; gradual, wavy boundary.

B22t—31 to 45 inches, yellowish-brown (10YR 5/4) light silty clay loam; moderate, medium, subangular blocky structure; friable; clay films on ped faces and in pores and channels; strongly acid; clear, wavy boundary.

IIB23t—45 to 50 inches, brown (7.5YR 4/4) heavy sandy clay loam; moderate, medium, subangular blocky structure; firm; thick reddish-brown (5YR 4/4) clay films in pores and channels and bridging sand grains; very pale brown (10YR 7/3 when dry) silt coats on some ped faces; slightly acid; clear, wavy boundary.

IIB24t—50 to 64 inches, brown (7.5YR 4/4) and reddish-brown (5YR 4/4) sandy clay loam; weak, medium, subangular blocky structure; friable; clay bridging between sand grains; reddish-brown (5YR 4/4) clay films in pores and channels; slightly acid; gradual, wavy boundary.

IIB25t—64 to 82 inches, brown (7.5YR 4/4) light sandy clay loam; weak, medium, subangular blocky structure; friable; clay bridging between sand grains; neutral; clear, wavy boundary.

IIC—82 to 92 inches, light yellowish-brown (10YR 6/4) gravelly sandy loam; massive; very friable; about 15 percent of horizon is gravel; calcareous.

Depth to calcareous gravelly sandy loam till ranges from 5 to 8 feet. The silty mantle ranges from 30 to 50 inches in thickness. The A horizon ranges from 5 to 13 inches in thickness. The Ap horizon is dark grayish brown and ranges from 5 to 10 inches in thickness. Where the soils have not been cultivated, the A1 horizon is black, very dark gray, or very dark grayish brown and ranges from 3 to 5 inches in thickness. In uncultivated areas, the A2 horizon is grayish brown or dark grayish brown and ranges from 2 to 10 inches in thickness. The B1t horizon is silt loam or silty clay loam and ranges from 5 to 15 inches in thickness. It is yellowish brown, brown, or dark yellowish brown. The B2t horizon is silty clay loam and heavy silt loam and ranges from 16 to 40 inches in thickness. It is yellowish brown, dark brown, or dark yellowish brown. The IIB2t horizon is clay loam or sandy clay loam and ranges from 20 to 50 inches in thickness. It is brown or reddish brown. Profiles that lack base colors having a hue of 5YR in the lower part of the B horizon have clay films of that hue. The IIC horizon is light yellowish brown or yellowish brown.

Flagg soils are associated with Ogle, Pecatonica, and St. Charles soils. Flagg soils have redder colors in the lower part of the B horizon and are more deeply weathered into the till than St. Charles soils. They have a thicker silty mantle than Pecatonica soils. Flagg soils have a lighter colored or thinner, dark-colored surface layer than Ogle soils.

Flagg silt loam, 0 to 2 percent slopes (FlA).—This nearly level soil is on till plains and on broad, till-covered ridgetops and valley floors in areas where bedrock is relatively shallow. These areas are generally less than 60 acres in size and irregular in shape. Depth to the gravelly sandy loam substratum is about 3 inches more than it is in the soil having the representative profile. Also, the surface layer is thicker.

Included with this soil in mapping were small areas of Ogle, Pecatonica, and St. Charles soils. In some areas the surface layer is darker colored than the one in the profile described as representative for the series. Also, in drainageways and depressions the surface layer is thicker and darker colored than the one in that soil. In some areas the subsoil is mottled. Some areas of this soil have a silty mantle that is more than 50 inches thick. Also included were areas where the lower part of the subsoil is more sandy than the one in the soil having the representative profile, and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by stratified silt and fine sand, sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of gently sloping soils and some small areas where the underlying till is silt loam, loam, or clay loam.

This Flagg soil has few limitations and can be cultivated intensively if regular additions of organic matter are supplied and the soil is kept in good tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-3; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreational group 1)

Flagg silt loam, 2 to 6 percent slopes (FlB).—This gently sloping soil is on till plains and on broad, till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The areas are irregular in shape and range from 20 to more than 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Ogle, Pecatonica, St. Charles, and Whalan soils. In some areas the surface layer is darker colored than the one in this soil, and in drainageways and depressions the surface layer is thicker and darker colored. In some areas the subsoil is mottled. Some areas have a silty mantle more than 50 inches thick. Also included were areas where the lower part of the subsoil is more sandy than the one in the soil having the representative profile, and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by stratified silt and fine sand, sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of nearly level and sloping soils and some small areas where the underlying till has textures of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This Flagg soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Gotham Series

The Gotham series consists of deep, somewhat excessively drained, nearly level to moderately steep, sandy soils. These soils are nearly level to sloping where they are on sandy outwash plains and terraces, and they are gently sloping to moderately steep where they formed in sandy deposits on uplands adjacent to the outwash plains and terraces. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark grayish-brown loamy sand about 7 inches thick. The subsoil is about 31 inches thick. It is dark yellowish-brown, very friable loamy sand in the upper part; brown, loose very light loamy sand in the middle part; and strong-brown, loose medium sand in the lower part. The substratum is brown medium and coarse sand and is at a depth of about 38 inches.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability is rapid. Depth of the root zone is limited by the underlying sand. Natural fertility is low.

Most areas of Gotham soils are used for corn, soybeans, hay, and pasture. Some areas, especially the steeper ones, are in woods. Some areas are used for plantations of pine trees.

Representative profile of Gotham loamy sand, 2 to 6 percent slopes, in a cultivated field, 370 feet north of woods behind buildings and 120 feet east of fence line, NE¼NW¼NW¼ sec. 8, T. 1 N., R. 10 E.:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) loamy sand; very weak, medium, crumb structure; very friable; slightly acid; abrupt, smooth boundary.

B21t—7 to 12 inches, dark yellowish-brown (10YR 4/4) loamy sand; weak, medium, crumb structure, breaking to single grain; very friable; clay bridging between sand grains; clay coatings on sand grains; slightly acid; clear, smooth boundary.

B22t—12 to 22 inches, brown (7.5YR 4/4) very light loamy sand; very weak, medium, crumb structure, breaking to single grain; loose; some very weak clay bridging between sand grains; clay coatings on sand grains; mildly alkaline; gradual, wavy boundary.

B3—22 to 38 inches, strong-brown (7.5YR 5/6) medium sand; single grain; loose; mildly alkaline; gradual, wavy boundary.

C—38 to 64 inches, brown (10YR 4/3) medium and coarse sand; single grain; loose; about 2 percent of horizon is gravel, mostly less than 1 inch in diameter; mildly alkaline.

Depth to underlying sand ranges from 30 to 40 inches. The Ap horizon ranges from 6 to 9 inches in thickness. It is very dark gray, very dark grayish brown, or dark brown. In wooded areas the A horizon ranges from 6 to 9 inches in thickness and is black or very dark brown in the upper part and very dark grayish brown or dark brown in the lower part. The B1 horizon is 0 to 12 inches thick. Where present, it is loamy sand and is dark brown, dark yellowish brown, or yellowish brown. The B2t horizons range from 9 to 15 inches in combined thickness. They contain slightly more clay than the Ap and B3 horizons. They are strong brown, dark yellowish brown, brown, or yellowish brown. The B3 horizon ranges from 6 to 16 inches in thickness. It is brown or strong brown. The C horizon is brown or yellowish brown. In some areas, the C horizon has brown or strong-brown bands of loamy sand or light sandy loam less than 1 inch thick.

Gotham soils are associated with bedrock variants of the Gotham series and with Billett, Dickman, and Watseka soils. They lack the dolomite bedrock that underlies the bedrock variants of the Gotham series. Gotham soils have a thinner, dark-colored surface layer than Dickman soils. They are coarser textured than Billett soils. Gotham soils are better drained than Watseka soils.

Gotham loamy sand, 0 to 2 percent slopes (GoA).—This nearly level soil is on sandy outwash plains and terraces. The areas are generally 10 to 120 acres in size and elongated to irregular in shape. The profile of this soil has a surface layer that is darker colored than in the profile described as representative for the series. In addition, it is about 2 inches deeper to the sand substratum.

Included with this soil in mapping were small areas of Billett, Dickman, and Oshtemo soils; Watseka soils, mottled subsoil variant; and Oshtemo soils, dark variant. Also included were some areas that have a solum more than 40 inches thick and small areas that are underlain by glacial till at depths of 4 to 6 feet. Other inclusions are small areas that have ground water at depths of 3 to 5 feet and small areas of gently sloping soils.

This Gotham soil is subject to soil blowing. Natural fertility is low. Crop growth during most seasons is limited by low available water capacity. This soil is suited to irrigation. Management practices are needed that supply regular additions of organic matter, conserve moisture, and control soil blowing.

Most of the acreage is used for crops, but some small areas are in woods. If managed properly, this soil is suited to row crops, small grains, and hay. Fertilization, supplemental irrigation, and protection from soil blowing help insure dependable crop production. (Capability unit IVs-3; woodland group 3s1; wildlife group 3; shrub and vine group 2; recreation group 9)

Gotham loamy sand, 2 to 6 percent slopes (GoB).—This gently sloping soil is on sandy outwash plains and terraces and in sandy deposits on broad ridgetops and side slopes. These areas are generally 5 to 120 acres in size and are elongated to irregular in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett, Dickman, Oshtemo, and Watseka soils; Oshtemo soils, dark variant; and Gotham soils, bedrock variant. Also included were small areas of nearly level and sloping soils, areas that have ground water at depths of from 3 to 5 feet, and areas that have a lighter colored surface layer than the one in this soil.Other inclusions are areas that have a solum that is more than 40 inches thick and small areas that are underlain by dolomite bedrock or glacial till at depths of 4 to 6 feet. Also included were moderately eroded areas and some small severely eroded areas where most of the original surface layer has been removed by erosion.

This Gotham soil is slightly susceptible to erosion and is subject to soil blowing. Natural fertility is low. Crop growth during most seasons is limited by low available water capacity. This soil is suited to irrigation, especially in the less sloping areas. Management practices are needed that supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops, but some is in woods. If managed properly, this soil is suited to row crops, small grains, and hay. Fertilization, supplemental irrigation, and protection from soil blowing help to insure dependable crop production. (Capability unit IVs-3; woodland group 3s1; wildlife group 3; shrub and vine group 2; recreation group 9)

Gotham loamy sand, 6 to 12 percent slopes, eroded (GoC2).—This sloping soil is on sandy outwash plains and terraces and in sandy deposits on narrow ridgetops and side slopes. The areas are generally 5 to 40 acres in size. In the profile of this soil, depth to the sand substratum is about 4 inches less than in the profile described for the series.

Included with this soil in mapping were small areas of Billett, Dickman, and Oshtemo soils; Oshtemo soils, dark variant; and Gotham soils, bedrock variant. Also included were small areas of gently sloping and moderately steep soils and areas that are underlain by dolomite bedrock or glacial till at depths of 4 to 6 feet. Other inclusions are areas that have a solum more than 40 inches thick, uneroded areas, and some small, severely eroded areas where most of the original surface layer has been removed by erosion. Some included areas have a lighter colored surface layer than the one in the soil having the representative profile.

This Gotham soil is moderately susceptible to erosion and is subject to soil blowing. Natural fertility is low. Crop growth during most seasons is limited by low available water capacity. Management practices are needed that supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops, but a considerable part of it is in woods. If managed properly, this soil can be used for row crops, small grains, and hay, but it is poorly suited to those crops. (Capability unit IVs-3; woodland

group 3s1; wildlife group 3; shrub and vine group 2; recreation group 9)

Gotham loamy sand, 12 to 20 percent slopes (GoD).—This moderately steep soil is on side slopes on the sandy uplands and along the edge of terraces. The areas are generally 5 to 40 acres in size. In the profile of this soil, depth to the sand substratum is about 6 inches less than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett, Dickman, and Oshtemo soils; Oshtemo soils, dark variant; and Gotham soils, bedrock variant. Also included were small areas of sloping and steep soils and areas that are underlain by dolomite bedrock or glacial till at depths of 4 to 6 feet. Other inclusions are areas that have a solum more than 40 inches thick, some moderately eroded areas, and some small, severely eroded areas where most of the original surface layer has been removed by erosion. Some included areas have a lighter colored surface layer than the one in the soil having the representative profile.

This Gotham soil is highly susceptible to erosion and is subject to soil blowing. It is not suited to cultivation. Most areas of this soil are used for woods, pasture, or wildlife habitat. Some areas are used as a source of sand. This soil is suited to woods or to permanent pasture if management is good and grazing is controlled. (Capability unit VIe-7; woodland group 3r2; wildlife group 3; shrub and vine group 2; recreation group 9)

Gotham Series, Bedrock Variant

The Gotham series, bedrock variant, consists of somewhat excessively drained, gently sloping and sloping, sandy soils that are underlain by dolomite bedrock at depths of 24 to 40 inches. These soils are windblown sands underlain by a thin layer of residuum from weathered dolomite. They are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark gray loamy sand about 9 inches thick. The subsoil is about 27 inches thick. It is brown, very friable and friable loamy sand in the upper part and brown, firm sandy clay loam in the lower part. The underlying dolomite is pale yellow, calcareous, fragmentary, and creviced and is at a depth of about 36 inches.

These soils can hold about 4 inches of water available to plants between the surface and the depth to bedrock. Permeability is moderately rapid. The depth of the root zone is generally limited by the dolomite, but some roots extend into crevices that are filled with residual material. Natural fertility is low.

Most areas of these soils are used for corn, soybeans, and pasture. Some areas are wooded, especially those that are steeper or where the loamy sand is thickest.

Representative profile of Gotham loamy sand, bedrock variant, 2 to 6 percent slopes, eroded, in a cultivated field, 30 feet south of Mill Pond Road and 1,200 feet east of Smyth School Road, NE¼NW¼NW¼ sec. 36, T. 1 N., R. 11 E.:

Ap—0 to 9 inches, very dark gray (10YR 3/1) loamy sand; grayish brown (10YR 5/2) when dry; weak, fine and very fine, crumb structure, breaking to single grain; very friable; abundant fine roots; neutral; abrupt, smooth boundary.

B1—9 to 28 inches, brown (10YR 4/3) loamy sand; light yellowish brown (10YR 6/4) when dry; weak, fine and medium, crumb structure, breaking to single grain; very friable; few roots; neutral; clear, smooth boundary.

B21t—28 to 33 inches, brown (7.5YR 4/4) loamy sand; strong brown (7.5YR 5/6) when dry; weak, medium, subangular blocky structure; friable; few roots; clay bridging between sand grains; slightly acid; clear, smooth boundary.

IIB22t—33 to 36 inches, brown (7.5YR 4/4) sandy clay loam; moderate, fine and medium, subangular blocky structure; firm; clay bridging between sand grains; clay films in channels and pores and on some ped faces; neutral; clear, wavy boundary.

IIR—36 inches +, pale-yellow (2.5Y 8/4) dolomite bedrock; fragmentary and creviced.

Depth to dolomite ranges from 24 to 40 inches. Thickness of the loamy sand mantle ranges from 22 to 36 inches. The Ap horizon ranges from 7 to 12 inches in thickness and is very dark gray or very dark grayish brown. The A horizon in eroded areas ranges from 6 to 8 inches in thickness and is black or very dark brown in the upper part and dark brown or very dark grayish brown in the lower part. The B1 horizon ranges from 8 to 30 inches in thickness. It is brown, dark brown, dark yellowish brown, or yellowish brown. The B2t horizon ranges from 4 to 8 inches in thickness. It is dark brown or brown. The IIB2t horizon is sandy loam, sandy clay loam, or clay loam and ranges from 2 to 18 inches in thickness. It is brown, dark brown, or reddish brown and contains rounded quartz pebbles and angular chert fragments. The upper few inches of dolomite is soft and weathered, and it is fragmentary and creviced in the upper few feet. Subsoil material generally fills these crevices.

Soils of the Gotham series, bedrock variant, are associated with normal Gotham soils and with Eleva soils. These bedrock variants differ from normal Gotham soils in being underlain by dolomite bedrock. They are more sandy than Eleva soils and are underlain by dolomite, whereas Eleva soils are underlain by sandstone.

Gotham loamy sand, bedrock variant, 2 to 6 percent slopes, eroded (GpB2).—This gently sloping soil is on broad ridgetops and side slopes. The areas are generally 10 to 50 acres in size and are elongated in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were uneroded areas, small areas of nearly level and sloping soils, and small areas that have a sandy loam or sand surface layer. Also included were small areas that have clay residuum above the dolomite and areas where the sandy mantle is more than 40 inches thick. In areas that have a thicker sandy mantle, the sands are clean and uncoated above the dolomite residuum. Other inclusions are small areas of Edmund, Gotham, Rockton, Sogn, and Whalan soils.

This Gotham soil is slightly susceptible to erosion and is subject to soil blowing. Natural fertility is low. Crop growth during most seasons is limited by low available water capacity. This soil is suited to irrigation, especially in the less sloping areas. Management practices are needed that regularly return organic matter to the soil, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. Some areas are wooded. If managed properly, this soil is suited to row crops, small grains, and hay. Fertilization, supplemented irrigation, and protection from soil blowing help insure dependable crop production. (Capability unit IVs-3; woodland group 3s1; wildlife group 3; shrub and vine group 2; recreation group 9)

Gotham loamy sand, bedrock variant, 6 to 12 percent slopes, eroded (GpC2).—This sloping soil is on narrow ridgetops and side slopes. The areas are generally 5 to 30 acres in size and elongated in shape. This soil is about 4 inches thinner than the one in the profile described as representative for the series.

Included with this soil in mapping were uneroded areas, small areas of gently sloping and moderately steep soils, and areas that have a sandy loam or sand surface layer. Also included were small areas that have clay residuum above the dolomite and areas where the sandy mantle is more than 40 inches thick. In areas that have a thicker sandy mantle, the

sands are clean and uncoated above the dolomite residuum. Other inclusions are areas of Edmund, Gotham, Rockton, Sogn, and Whalan soils.

This Gotham soil is moderately susceptible to erosion and is subject to soil blowing. Natural fertility is low. Crop growth during most seasons is limited by low available water capacity. Management practices are needed that regularly add organic matter to the soil, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops, but a considerable part of it is in woods. If managed properly, this soil can be used for row crops, small grains, and hay, but it is not well suited to these uses. (Capability unit IVs-3; woodland group 3s1; wildlife group 3; shrub and vine group 2; recreation group 9)

Griswold Series

The Griswold series consists of well-drained, nearly level to moderately steep, loamy soils that are deep and are underlain by calcareous gravelly sandy loam glacial till. These soils are not saturated with water long enough to affect crop growth.

In a representative profile, the surface layer is about 11 inches thick. It is very dark-brown loam in the upper part and very dark grayish-brown loam in the lower part. The subsoil is about 19 inches thick. It is brown, firm heavy loam in the upper part; dark yellowish-brown, firm clay loam and sandy clay loam in the middle part; and dark yellowish-brown, friable heavy sandy loam in the lower part. The substratum is yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 30 inches.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is moderate. Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Griswold loam, 2 to 6 percent slopes, eroded, in a cultivated field, 1,585 feet east of Fox Road and 790 feet south of Condon Road, SW¼NE¼NW¼ sec. 36, T. 4 N., R. 11 E.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) loam; weak, medium, subangular blocky structure; firm; neutral; abrupt, smooth boundary.

A12—8 to 11 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

B1—11 to 13 inches, brown (10YR 4/3) heavy loam; weak, medium, subangular blocky structure; firm; neutral; abrupt, smooth boundary.

B21t—13 to 21 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; thin discontinuous clay films on ped faces; clay flows in pores; 3 percent of horizon is gravel; slightly acid; clear, wavy boundary.

B22t—21 to 26 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; moderate, medium and fine, subangular blocky structure; firm; thin patchy clay films on some ped faces; clay bridging between sand grains; 8 percent of horizon is gravel; slightly acid; clear, wavy boundary.

B3t—26 to 30 inches, dark yellowish-brown (10YR 4/4) heavy sandy loam; weak, fine and medium, subangular blocky structure; friable; clay bridging between sand grains; 8 percent of horizon is gravel; slightly acid; clear, wavy boundary.

C—30 to 60 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; very friable; 15 percent of horizon is gravel; calcareous.

Depth to calcareous gravelly sandy loam glacial till ranges from 20 to 40 inches. The A horizon is silt loam or loam and ranges from 10 to 18 inches in thickness. It is black, very dark brown, very dark gray, very dark grayish brown, or dark brown. The B1 horizon is loam, silt loam, or clay loam and ranges from 2 to 8 inches in thickness. The B2t horizon is clay loam, sandy clay loam, or loam and ranges from 6 to 24 inches in thickness. It is dark yellowish brown, yellowish brown, or brown. The B3 horizon is 0 to 8 inches thick. Where present, it is sandy loam or sandy clay loam.

Griswold soils are associated with Kidder, Locke, and Ringwood soils. Griswold soils have a darker colored or thicker, dark-colored surface layer than Kidder soils. They have more sand in the upper part of the subsoil than Ringwood soils. Griswold soils are better drained than Locke soils.

Griswold loam, 0 to 2 percent slopes (GrA).—This nearly level soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 5 to 80 acres in size. In approximately 55 percent of the acreage, the surface layer is loam, and in 45 percent it is silt loam. In the profile of this soil, the depth to the gravelly sandy loam substratum is about 5 inches more than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Kidder, Ringwood, Rotamer, and Winnebago soils. In drainageways and depressions the surface layer is thicker than the one in the soil that has the representative profile, and in some areas the subsoil is mottled. In some areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of gently sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam.

This Griswold soil has few limitations. If management practices are used that supply regular additions of organic matter and maintain tilth, this soil can be cultivated intensively. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 2)

Griswold loam, 2 to 6 percent slopes, eroded (GrB2).—This gently sloping soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 10 to more than 100 acres in size. In approximately 60 percent of the acreage, the surface layer is loam, and in 40 percent it is silt loam. This soil has the profile described as representative for the series.

Included with ths soil in mapping were small areas of Kidder, Ringwood, Rotamer, and Winnebago soils. In drainageways and depressions the surface layer is thicker than the one in this soil, and in some areas the subsoil is mottled. In some areas, generally marked on the soil map by the symbol for sand spots, the surface layer is sandy loam. In some areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of nearly level and sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This Griswold soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 2)

Griswold loam, 6 to 12 percent slopes, eroded (GrC2).—This sloping soil is on till plains and on lower side slopes in

areas where the bedrock is relatively shallow. The areas are generally elongated in shape and range from 5 to 40 acres in size. In approximately 60 percent of the acreage, the surface layer is loam, and in 40 percent it is silt loam. In the profile of this soil, the surface layer is about 1 inch thinner than in the profile described as representative for the series, and this layer contains some subsoil material.

Included with this soil in mapping were small areas of Kidder, Ringwood, Rotamer, and Winnebago soils and Rotamer soils, thin variant. In drainageways and depressions, the surface layer is thicker than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. In some areas, generally marked on the soil map by the symbol for sand spots, the surface layer is sandy loam. In some small areas this soil is underlain by dolomite bedrock, stratified silt and fine sand, or sand and gravel rather than glacial till. Also included were some small areas of gently sloping and moderately steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This Griswold soil is moderately susceptible to erosion. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage of this soil is used for crops. Under proper management, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 2)

Griswold loam, 12 to 20 percent slopes, eroded (GrD2).—This moderately steep soil is on breaks along drainageways on till plains. It is also on till-covered side slopes in areas where bedrock is relatively shallow. The areas are generally less than 25 acres in size and elongated in shape. In approximately 65 percent of the acreage, the surface layer is loam, and in 35 percent it is silt loam. In the profile of this soil, depth to the gravelly sandy loam substratum is about 3 inches less than in the profile described for the series.

Included with this soil in mapping were small areas of Kidder, Ringwood, and Rotamer soils and Rotamer soils, thin variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil that has the representative profile. Some areas of this soil have a silty mantle up to 20 inches thick. In some small areas the surface layer is sandy loam. Also included were some small areas of sloping and steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and some small, severely eroded areas where most of the original surface layer has been removed by erosion.

This Griswold soil is highly susceptible to erosion. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage of this soil is used for farm crops, pasture, and woods. The soil is better suited to pasture and close-growing crops than it is to row crops. If it is used for row crops, it is very susceptible to further erosion, and good management practices are needed. (Capability unit IVe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 2)

Hayfield Series

This series consists of somewhat poorly drained, nearly level, loamy soils that are moderately deep and are underlain by loamy sand or sand. These soils are on outwash plains and terraces. Unless drained, these soils are saturated with water at depths of 1 to 3 feet during wet periods.

In a representative profile, the surface layer is very dark gray loam about 9 inches thick. The subsurface layer is brown light loam about 2 inches thick. The subsoil is about 19 inches thick. It is yellowish-brown, very friable loam in the upper part and brown, very friable sandy loam in the lower part. The subsoil has grayish-brown, light grayish-brown, light brownish-gray, yellowish-brown, and strong-brown mottles. The substratum is yellowish-brown fine and medium sand that has a few bands of brown sand. It is at a depth of about 30 inches.

These soils can hold about 7 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate in the subsoil and rapid in the substratum. Depth of the root zone is limited by the seasonal saturation with water or, in drained areas, by the underlying sand. Natural fertility is moderate.

Where these soils are drained, most areas are used for corn, soybeans, small grains, and legumes. Undrained areas are used for unimproved pasture and wildlife habitat.

Representative profile of Hayfield loam in a cultivated field, 30 feet south of Douglas Road and 30 feet west of long driveway, NE¼NE¼SW¼ sec. 30, T. 1 N., R. 10 E.:

Ap—0 to 9 inches, very dark gray (10YR 3/1) loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

A2—9 to 11 inches, brown (10YR 5/3) light loam; weak, medium, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

B21t—11 to 18 inches, yellowish-brown (10YR 5/4) heavy loam; few, fine, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very friable; thin patchy clay films on some ped faces; clay flows in pores and channels; medium acid; gradual, wavy boundary.

B22t—18 to 25 inches, yellowish-brown (10YR 5/4) loam; common, medium, faint, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; very friable; thin patchy clay films on some ped faces; clay flows in pores and channels; medium acid; clear, smooth boundary.

IIB3t—25 to 30 inches, brown (10YR 5/3) sandy loam; common, medium, distinct, strong-brown (7.5YR 5/6) and light brownish-gray (2.5Y 6/2) mottles; weak, medium, subangular blocky structure; very friable; black (10YR 2/1) clay flows in a few channels; clay bridging between sand grains; neutral; clear, smooth boundary.

IIC—30 to 60 inches, yellowish-brown (10YR 5/4) fine and medium sand; few layers of brown (7.5YR 4/4) sand; single grain; loose; most sand grains are uncoated; neutral.

Depth to underlying sand ranges from 24 to 40 inches. The Ap horizon ranges from 6 to 9 inches in thickness. It is very dark gray, very dark grayish brown, or dark brown. The A2 horizon ranges from 2 to 5 inches in thickness. It is brown, dark grayish brown, or grayish brown. The B1 horizon is 0 to 8 inches thick. Where present, it has matrix colors of brown, yellowish brown, or light yellowish brown. The B21t and B22t horizons are sandy clay loam or loam and range from 8 to 15 inches in combined thickness. They have matrix colors of yellowish brown, dark yellowish brown, or brown. The IIB3t horizon is light loam or sandy loam and ranges from 4 to 6 inches in thickness. It has matrix colors of brown or yellowish brown. The IIC horizon is loamy sand or sand. It has matrix colors of yellowish brown, light yellowish brown, or very pale brown.

Hayfield soils are associated with Marshan and Watseka soils and Billett soils, mottled subsoil variant. Hayfield soils have more clay in their solum than do Watseka soils and Billett soils, mottled subsoil variant. Hayfield soils are somewhat poorly drained, but Marshan soils are poorly drained.

Hayfield loam (0 to 2 percent slopes) (Ha).—This nearly level soil is on outwash plains and terraces. Most areas are from 10 to 100 acres in size and elongated to irregular in shape.

Included with this soil in mapping were small areas of Billett, Dickman, Kane, and Marshan soils. Also included were small areas that have a sandy loam or loamy sand surface layer and small areas that have a thicker, dark-colored surface layer than the one in the profile described as representative for the series. Other inclusions are small areas that are underlain by lacustrine silt and fine sand or sandstone bedrock and small areas of gently sloping soils.

This Hayfield soil is somewhat poorly drained and, in some areas, is subject to ponding during wet periods unless drained. Some areas receive runoff from adjacent uplands. Open-ditch or surface drainage is needed for dependable crop production. If the water table is lowered excessively, this soil loses the beneficial effects of free water in the lower part of the soil.

Where this soil is drained, most of the acreage is used for crops. If properly managed, this soil is suited to all of the farm and most of the vegetable crops commonly grown in the county. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IIw-5; woodland group 3w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Hebron Series

The Hebron series consists of deep, moderately well drained and well drained, nearly level and gently sloping soils in glacial lakebeds and drainage basins. These soils commonly are adjacent to the more sloping soils on uplands or in elevated areas in glacial lake basins. They are loamy soils underlain by lacustrine deposits of stratified silty clay loam. They are saturated with water at depths of 3 to 5 feet during wet periods.

In a representative profile, the surface layer is dark grayish-brown loam about 7 inches thick. The subsoil is about 25 inches thick. It is brown, firm heavy clay loam in the upper part; dark yellowish-brown, firm heavy clay loam in the middle part; and dark yellowish-brown, very firm to friable silty clay loam in the lower part. The substratum is light yellowish-brown, calcareous silty clay loam and is at a depth of about 32 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow. The root zone is deep. Natural fertility is moderate.

Hebron soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Hebron loam, 0 to 3 percent slopes, 250 feet west of Gempler Road and 925 feet south of County Road B, SE1/4NW1/4NW¼ sec. 31, T. 3 N., R. 10E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, platy structure, parting to moderate, very fine, subangular blocky structure; friable; moderately alkaline; abrupt, smooth boundary.

B21t—7 to 10 inches, brown (7.5YR 4/4) heavy clay loam; moderate, fine and very fine, subangular blocky structure; firm; clay films on ped faces and in pores and channels; mildly alkaline; clear, wavy boundary.

B22t—10 to 23 inches, dark yellowish-brown (10YR 4/4) heavy clay loam; moderate, fine, subangular blocky structure; firm; clay films on ped faces and in pores and channels; neutral; clear, wavy boundary.

IIB23t—23 to 32 inches, dark yellowish-brown (10YR 4/4) heavy silty clay loam; moderate, fine and very fine, subangular blocky structure; very firm; thick continuous clay films on ped faces and in pores and channels; mildy alkaline; clear, wavy boundary.

IIC1—32 to 55 inches, light yellowish-brown (10YR 6/4) light silty clay loam; moderate, medium and thin, platy structure; friable; weakly stratified with layers of silt loam, clay loam, and silty clay; many light-gray (5Y 7/2) silt coatings on peds; few pebbles; calcareous; clear, smooth boundary.

IIC2—55 to 60 inches, light yellowish-brown (10YR 6/4) silty clay loam; weak, thick, platy structure; firm; weakly stratified with layers of silt loam, clay loam, and silty clay; calcareous.

Depth to underlying stratified silty clay loam ranges from 24 to 40 inches. Depth to calcareous material is generally the same but ranges to as much as 48 inches. The A horizon ranges from 6 to 9 inches in thickness. In plowed areas the A horizon is dark grayish brown, and in unplowed areas it is very dark grayish brown in the upper part and brown in the lower part. The B21t and B22t horizons are heavy loam or clay loam and range from 14 to 30 inches in combined thickness. They are brown, dark brown, dark yellowish brown, or reddish brown. The IIB horizon is silty clay loam or silty clay and ranges from 2 to 10 inches in thickness. It is dark yellowish brown, brown, or reddish brown. The lower part of the B horizon is mottled in some areas. The IIC horizon is light yellowish brown and brown.

Hebron soils are associated with Aztalan, Navan, and Sisson soils. Hebron soils are better drained and have a lighter colored or a thinner, dark-colored surface layer than Aztalan and Navan soils. Hebron soils are finer textured in the lower part of the solum and in the substratum than Sisson soils.

Hebron loam, 0 to 3 percent slopes (HeA).—This soil is in glacial lakebeds and drainage basins in irregularly shaped areas generally less than 30 acres in size.

Included with this soil in mapping were small areas of Aztalan and Sisson soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil that has the representative profile. It is also thicker and darker colored in the surface layer where it is mapped adjacent to well-drained soils that have a dark-colored surface layer. Also included were small areas where the upper part of the subsoil is silty and areas that are silt loam in the surface layer. The symbol for sand spots has been used on the soil map to indicate areas where the surface layer is sandy loam or loamy sand.

This Hebron soil is well drained and moderately well drained. Permeability is moderately slow. Erosion is only a slight hazard. Management practices are needed that reduce runoff, improve tilth, and control soil losses.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Houghton Series

The Houghton series consists of deep, very poorly drained muck soils. These nearly level soils are on flood plains, on low terraces, and in slight depressional areas. Ground water is at or near the surface throughout the year unless this soil is drained.

In a representative profile, the upper 39 inches is black muck. The lower part of the profile, between depths of 39 and 65 inches, is very dark brown muck.

These soils can hold about 18 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid throughout. The depth of the root zone is limited by the water table. Natural fertility is low.

Where drained, these soils are used for corn and pasture. Undrained areas are too wet to be farmed and are used for unimproved pasture and wildlife habitat.

Representative profile of Houghton muck in a cultivated field, 115 feet west of State Route 213, NE1/4NE1/4SW1/4 sec. 34, T. 4 N., R. 10 E.:

Oa1—0 to 8 inches, black (N 2/0) sapric material; trace of herbaceous fibers where not rubbed; weak, fine, crumb structure; nonsticky; mildly alkaline; abrupt, smooth boundary.

Oa2—8 to 22 inches, black (N 2/0) sapric material; about 2 percent of horizon is herbaceous fiber; weak, fine and medium, granular structure; nonsticky; mildly alkaline; gradual, smooth boundary.

Oa3—22 to 30 inches, black (N 2/0 to 5YR 2/1 where rubbed) sapric material; about 5 percent of horizon is herbaceous fiber; massive; nonsticky; mildly alkaline; clear, smooth boundary.

Oa4—30 to 39 inches, black (5YR 2/1) sapric material; about 15 percent of horizon is herbaceous fiber; massive; nonsticky; few woody fragments; mildly alkaline; clear, smooth boundary.

Oa5—39 to 65 inches, very dark brown (10YR 2/2) sapric material; about 10 percent of horizon is herbaceous fiber; massive; nonsticky; mildly alkaline.

The solum is organic throughout. The depth to the underlying sandy and loamy deposits is more than 51 inches.

The organic layer in Houghton soils is thicker than that in the associated Adrian, Palms, and Rollin soils.

Houghton muck (0 to 2 percent slopes) (Ho).—This nearly level soil occurs in elongated tracts along the smaller flood plains and in irregularly shaped areas on larger flood plains and in old lake basins.

Included with this soil in mapping were small areas of Adrian, Otter, and Palms soils. Also included were areas that have loamy and clayey mineral strata in the muck layer, areas that have layers of peat in the lower part of the profile, areas that have slopes up to 4 percent, and areas that have been covered with silty overwash. Areas that have 16 to 40 inches of silty overwash are indicated on the soil map by the symbol for silty overwash.

Houghton muck is ponded in spring and after heavy rain. Surface drains are used to dispose of excess water rapidly. This soil is also suitable for tile drainage. Cultivated areas are subject to soil blowing and burning. If the water table is lowered excessively, the organic matter decomposes very rapidly in cultivated areas and subsidence becomes a problem.

Where this soil has been drained, it is used for pasture and corn and is suited to certain vegetable crops, such as beets and carrots. (Capability unit IIIw-9; woodland group 5w3; wildlife group 6; not placed in a shrub and vine group; recreation group 8)

Jasper Series

The Jasper series consists of deep, well-drained, nearly level and gently sloping soils in glacial lakebeds and drainage basins. These are loamy soils underlain by stratified lacustrine deposits of calcareous silt and fine sand. They are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark gray loam about 10 inches thick. The subsoil is about 37 inches thick. It is dark yellowish-brown, friable loam in the upper part; dark yellowish-brown, friable sandy clay loam in the middle part; and yellowish-brown, friable silt loam in the lower part. The substratum is very pale brown, calcareous, stratified silt and fine sand that has yellow mottles and is at a depth of about 47 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is moderate.

Jasper soils are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Jasper loam, 2 to 6 percent slopes, in a cultivated field, 100 feet north of Footville-Hanover Road and 925 feet east of Dunbar Road, SE1/4SW1/4 SW1/4 sec. 2, T. 2 N., R. 11E.:

Ap—0 to 10 inches, very dark gray (10YR 3/1) loam; moderate, fine and medum, granular structure; very friable; neutral; abrupt, smooth boundary.

B1—10 to 14 inches, dark yellowish-brown (10YR 4/4) loam; weak, medium, subangular blocky structure; friable; neutral; clear, smooth boundary.

B21t—14 to 18 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; weak, medium, subangular blocky structure; friable; clay bridging between sand grains; clay flows in pores and channels; slightly acid; clear, wavy boundary.

B22t—18 to 29 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; weak, medium, subangular blocky structure; friable; clay bridging between sand grains; clay flows in pores and channels; slightly acid; abrupt, smooth boundary.

IIB31—29 to 33 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; clay flows in a few small channels; medium acid; clear, smooth boundary.

IIB32—33 to 47 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium and coarse, subangular blocky structure; friable; bands of brown (7.5YR 4/4) sandy loam up to 1 inch thick; clay flows in a few small channels; slightly acid; abrupt, smooth boundary.

IIC—47 to 60 inches, very pale brown (10YR 7/3), stratified silt and fine sand; many, coarse, distinct, yellow (10YR 7/6) mottles; massive; very friable; calcareous.

Depth to the underlying, calcareous, stratified silt and fine sand ranges from 36 to 48 inches. The A horizon ranges from 10 to 14 inches in thickness. It is very dark gray, very dark brown, or very dark grayish brown. The B1 horizon ranges from 2 to 6 inches in thickness. It is dark yellowish-brown or dark brown. The B2t horizon is sandy clay loam or loam and ranges from 16 to 29 inches in thickness. It is dark yellowish brown or brown. The IIB2 horizon is silt loam or stratified silt and fine sand and ranges from 6 to 20 inches in thickness. It is yellowish brown or brown. The IIC horizon is very pale brown or light yellowish brown.

Jasper soils are associated with Darroch and Sisson soils and Plano soils, loamy variant. Jasper soils are better drained than Darroch soils. They have a darker colored or thicker, dark-colored surface layer than Sisson soils. Jasper soils are underlain by silt and fine sand, but the Plano soils, loamy variant, are underlain by stratified sand and gravel.

Jasper loam, 0 to 2 percent slopes (JaA).—This nearly level soil occupies glacial lakebeds and drainage basins. The areas are generally irregular in shape and less than 30 acres in size. In the profile of this soil, the surface layer is about 4 inches thicker than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Darroch, Plano, and Warsaw soils and Plano soils, loamy variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil that has the representative profile, and in some areas the subsoil is mottled. Also included were areas where the surface layer is silt loam or sandy loam and areas where the solum is more than 48 inches thick. Also included were some areas where a layer of loamy sand or sand is in the subsoil above the silty lower part of the subsoil. Some small areas of gently sloping soils also were included.

This Jasper soil has few limitations and can be cropped intensively if management practices are used to supply regular additions of organic matter and to maintain tilth.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 2)

Jasper loam, 2 to 6 percent slopes (JaB).—This gently sloping soil occupies glacial lakebeds and drainage basins. The areas are generally irregular in shape and less than 40 acres in size. This soil has the profile described for the series.

Included with this soil in mapping were small areas of Darroch, Sisson, and Warsaw soils and Plano soils, loamy variant. In drainageways and depressions the surface layer is thicker and darker colored than in this soil, and in some areas the subsoil is mottled. Also included were areas where the surface layer is silt loam or sandy loam and areas where the solum is more than 48 inches thick. Also included were some areas where a layer of loamy sand or sand occurs in the subsoil above the silty lower part of the subsoil. Some small areas of sloping and nearly level soils also were included.

This Jasper soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 2)

Juneau Series

The Juneau series consists of deep, well drained and moderately well drained, silty soils that are underlain by an older, buried soil. These nearly level and gently sloping soils occur on foot slopes and in natural drainageways. Most areas are nearly level. Some areas of these soils are saturated with water at depths of 3 to 5 feet during wet periods.

In a representative profile, the surface layer is dark grayish-brown silt loam about 33 inches thick. The subsurface layer is dark-gray silt loam about 8 inches thick. The subsoil extends to a depth greater than 60 inches. It is brown, firm silty clay loam that has yellowish-brown and dark grayish-brown mottles.

These soils hold about 12 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county. These soils are subject to occasional flooding of short duration and, in sloping areas, are slightly susceptible to erosion.

Representative profile of Juneau silt loam, 0 to 3 percent slopes, in a cultivated field, 50 feet east of U. S. Highway No. 51 and 1,050 feet south of Manogue Road, SW¼ NW¼NW¼ sec. 36, T. 4 N., R. 12 E.:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; midly alkaline; abrupt, smooth boundary.

A12—9 to 17 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thin, platy structure; very friable; mildy alkaline; clear, smooth boundary.

A13—17 to 33 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thick and medium, platy structure; very friable; mildly alkaline; clear, smooth boundary.

A2gb—33 to 41 inches, dark-gray (10YR 4/1) silt loam; weak, thin, platy structure; very friable; mildly alkaline; abrupt, smooth boundary.

B21tb—41 to 54 inches, brown (10YR 4/3) silty clay loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; thick continuous clay films on ped faces and in pores and channels; neutral; clear, smooth boundary.

B22tb—54 to 60 inches, brown (10YR 5/3) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine, prismatic structure, parting to moderate, fine, subangular blocky structure; firm; thick continuous dark grayish-brown (10YR 4/2) clay films on ped faces and in pores and channels; slightly acid.

Depth to the buried soil is 6 to 10 feet. The silty overwash ranges from 24 to 36 inches in thickness. The A11, or the Ap horizon is 6 to 12 inches thick. It is dark grayish brown or brown. The A12 horizon is 6 to 10 inches thick. It is dark grayish brown or brown. The A13 horizon is 10 to 16 inches thick. It is dark grayish brown or brown. The buried A horizon is absent in some areas. Where present, it is 6 to 10 inches thick and dark gray, very dark gray, or very dark grayish brown. The B21tb horizon is heavy silt loam or silty clay loam and 10 to 15 inches thick. It is brown, dark yellowish brown, or yellowish brown. The B22tb horizon is brown, dark yellowish brown, or yellowish brown. Mottles are lacking in the buried B horizon in some areas.

Juneau soils have a lighter colored surface layer than the associated Troxel and Worthen soils.

Juneau silt loam, 0 to 3 percent slopes (JuA).—This soil is mainly in long, narrow areas along natural drainageways and at the base of slopes where sediment has been deposited by runoff. Most areas are 10 to 30 acres in size.

Included in mapping were small areas of Troxel and Worthen soils. Also included were small areas that have less than 24 inches of light-colored overwash, areas that have a loam or sandy loam surface layer, areas that have loam or sandy loam strata in the overwash, areas where the light-colored overwash is underlain by a dark-colored buried soil, and areas that have slopes of up to 5 percent.

This Juneau soil can be cultivated intensively if flooding and erosion are controlled. It is used for all common crops and also for pasture. (Capability unit I-2; woodland group 2o2; wildlife group 7; shrub and vine group 1; recreation group 7)

Kane Series

The Kane series consists of somewhat poorly drained, nearly level and gently sloping, loamy soils that are underlain by stratified sand and gravel at depths of 20 to 40 inches. These soils are on outwash plains and terraces. They are saturated with water at a depth of 1 to 3 feet during wet periods unless they are drained.

In a representative profile, the surface layer is very dark brown loam about 11 inches thick. The subsoil is about 23 inches thick. It is brown, friable and firm loam in the upper part; grayish-brown, firm clay loam in the middle part; and dark yellowish-brown, friable sandy loam in the lower part. The subsoil has yellowish-brown and grayish-brown mottles throughout. The substratum is mottled pale-brown and brownish-yellow, calcareous sand and gravel and is at a depth of about 34 inches.

These soils hold about 7 inches of water for plants between the surface and a depth of 5 feet. Permeability is moderate in the subsoil and rapid in the substratum. Depth of the root zone is limited by the seasonal high water table or, in drained areas, by sand and gravel. Natural fertility is moderate.

Where these soils are drained, most areas are used for corn, soybeans, small grains, and legumes. Undrained areas are generally used for pasture or wildlife habitat.

Representative profile of Kane loam, 0 to 3 percent slopes, 50 feet north of Porter Road and 200 feet west of bridge, SE¼NW¼SW¼ sec. 28, T. 4 N., R. 10 E.:

Ap—0 to 11 inches, very dark brown (10YR 2/2) loam; weak, medium, subangular blocky structure; very friable; mildly alkaline; abrupt, smooth boundary.

B1—11 to 17 inches, brown (10YR 4/3) loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; very dark brown (10YR 2/2) material in old root channels and worm holes; mildly alkaline; clear, smooth boundary.

B21t—17 to 25 inches, brown (10YR 5/3) heavy loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; clay films in pores and some ped faces; few, small, iron-manganese concretions; mildly alkaline; clear, smooth boundary.

B22tg—25 to 31 inches, grayish-brown (10YR 5/2) clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; clay bridging between sand grains; thin clay films on some ped faces and pores; few, small, iron-manganese concretions; mildly alkaline; clear, smooth boundary.

IIB3—31 to 34 inches, dark yellowish-brown (10YR 4/4) sandy loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; friable; mildly alkaline; clear, wavy boundary.

IIC—34 to 60 inches, mottled pale-brown (10YR 6/3) and brownish-yellow (10YR 6/6) sand and gravel; small pockets of very pale brown (10YR 8/3) and yellow (10YR 8/6) material; single grain; loose; calcareous.

Depth to underlying calcareous sand and gravel ranges from 20 to 40 inches. The A horizon is loam or silt loam and ranges from 10 to 13 inches in thickness. It is very dark grayish brown, black, or very dark brown. The B1 horizon is loam or silt loam and ranges from 3 to 7 inches in thickness. The B2t horizon is heavy loam or clay loam and ranges from 7 to 18 inches in thickness. It has matrix colors of brown or grayish brown. The IIB3 horizon, where present, is sandy loam or sandy clay loam and contains up to 20 percent gravel. It has matrix colors of dark yellowish brown or yellowish brown and ranges from 0 to 5 inches in thickness. The IIC horizon has matrix colors of pale brown, brownish yellow, very pale brown, and yellow, and in some profiles it is a mixture of two or more of these colors.

Kane soils are associated with Dresden, Sebewa, and Warsaw soils. The Kane soils are better drained than Sebewa soils but are not so well drained as Warsaw or Dresden soils.

Kane loam, 0 to 3 percent slopes (KaA).—This nearly level and gently sloping soil is on outwash plains and stream terraces. The areas are generally 20 to 200 acres in size and are elongated in shape. In approximately 55 percent of the acreage, the surface layer is loam, and in 45 percent it is silt loam.

Included with this soil in mapping were small areas of Darroch, Dresden, Hayfield, Locke, Sebewa, and Warsaw soils. Also included were small areas that have a sandy loam surface layer, small areas where the soil has slopes of as much as 5 percent, and areas where the silty mantle ranges up to 36 inches in thickness. In some areas the depth to calcareous sand and gravel is more than 40 inches.

This Kane soil is subject to ponding during wet periods unless drained. Some areas receive runoff from adjacent uplands. Open-ditch or surface drainage is used for dependable crop production. Tile drainage can be used if measures are taken to prevent the underlying sand from filling the tile. If the water table is lowered excessively by ditching, this soil loses the beneficial effects of free water in the lower part of the soil.

If drained, this soil is suited to all the farm and vegetable crops commonly grown in the county. Undrained areas are used for pasture and wildlife habitat. (Capability unit IIw-5; woodland group 4w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Kidder Series

The Kidder series consists of deep, well-drained, nearly level to steep, loamy soils underlain by calcareous gravelly sandy loam glacial till. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 7 inches thick (fig. 22). The subsoil is about 23 inches thick. It is brown and dark-brown, friable loam in the upper part; dark-brown, firm clay loam and sandy clay loam in the middle part; and dark yellowish-brown, friable sandy loam in the lower part. The substratum is brown, calcareous gravelly sandy loam and is at a depth of about 30 inches.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is moderate.

Most areas of nearly level to sloping Kidder soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of the moderately steep and steep soils are used for pasture, woods, or close-growing crops.

Representative profile of Kidder silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 140 feet north of Schmidt Road and 185 feet west of line fence SE¼ SE¼–NE¼ sec. 1, T. 4 N., R. 13 E.:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; light brownish gray (10YR 6/2) when dry; moderate, fine and very fine, subangular blocky structure; friable; common, fine, fibrous roots; common, fine and medium, continuous , mostly exped, dendritic pores; neutral; abrupt, smooth boundary.

Figure 22.—Profile of a Kidder soil that is underlain by gravelly sandy loam glacial till at a depth of about 30 inches.

B1—7 to 11 inches, brown (10YR 4/3) and dark-brown (7.5YR 4/4) loam; weak, fine and medium, subangular blocky structure; friable; common, fine, fibrous roots; common, very fine and fine and few, medium, continuous, mostly exped, dendritic pores; neutral; clear, smooth boundary.

B21t—11 to 17 inches, dark-brown (7.5YR 4/4) clay loam; moderate, fine and medium, subangular blocky structure; firm; few, fine, fibrous roots; common, fine and very fine and few, medium, continuous, mostly exped, dendritic pores; few thin clay films on ped faces and in pores; clay bridging of sand grains; neutral; clear, wavy boundary.

B22t—17 to 28 inches, dark-brown (7.5YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; firm; few, fine, fibrous roots; common, fine and very fine, continuous, mostly exped, dendritic pores; few thin clay films on ped faces and in pores; clay bridging of sand grains; neutral; clear, wavy boundary.

B3t—28 to 30 inches, dark yellowish-brown (10YR 3/4) sandy loam; weak, medium, subangular blocky structure; friable; few, fine and very fine, continuous, obliquely oriented, inped and exped pores; very few thin clay films on some ped faces; thin clay bridging of sand grains; neutral; clear, wavy boundary.

C—30 to 60 inches, brown (10YR 5/3) gravelly sandy loam; massive; friable; few, fine and very fine, continuous, obliquely oriented pores; calcareous.

Depth to calcareous gravelly sandy loam glacial till ranges from 20 to 40 inches. The Ap horizon is silt loam, loam, or sandy loam and ranges from 6 to 9 inches in thickness. It is very dark grayish brown, dark grayish brown, or dark brown. Colors that have a moist value of 3 have a dry value of more than 5.5. Where these soils have not been cultivated, the A1 horizon is black, very dark brown, very dark gray, or very dark grayish brown and ranges from 3 to 5 inches in thickness. The A2 horizon is 0 to 6 inches thick. Where present, it is brown loam, silt loam, or sandy loam. The B1 horizon is loam, silt loam, or sandy clay loam and ranges from 3 to 6 inches in thickness. The B2t horizon is clay loam or sandy clay loam and ranges from 10 to 22 inches in thickness. It is brown, dark brown, or dark yellowish brown. The B3 horizon is 0 to 4 inches thick. Where present, it is dark yellowish-brown or dark-brown sandy clay loam, loam, or sandy loam. The C horizon is brown or yellowish brown.

Kidder soils are associated with Griswold, Locke, Rotamer, and St. Charles soils. Kidder soils have a thicker solum than Rotamer soils. They have a lighter colored or thinner, dark-colored surface layer than Griswold soils. They lack the thick silty mantle of St. Charles soils. Kidder soils are better drained than Locke soils.

Kidder sandy loam, 2 to 6 percent slopes (KdB).—This gently sloping soil is on till plains, till-covered ridgetops, and valley floors. The profile of this soil contains more sand in the surface layer and the upper part of the subsoil than the profile described as representative for the series.

Included with this soil in mapping were small areas of Griswold, Oshtemo, Rotamer, and Westville soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil, and in some areas the subsoil is mottled. In some small areas the surface layer is loam, and in some areas it is darker colored than the one in this soil. In some small areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some areas of nearly level soils, some small areas of sloping soils, and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Some areas of this soil have been eroded, and some have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones.

This Kidder soil is slightly susceptible to erosion and is subject to soil blowing during dry periods. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion and soil blowing.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Kidder sandy loam, 6 to 12 percent slopes, eroded (KdC2).—This sloping soil is on till plains, moraines and till-covered ridgetops, and side slopes. This soil has more sand in the surface layer and the upper part of the subsoil than the soil having the profile described for the series.

Included with this soil in mapping were small areas of Griswold, Oshtemo, Rotamer, and Westville soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. Also, in some small areas the surface layer is loam, and in some areas it is darker colored than in that soil. In other small areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of gently sloping soils and some areas of moderately steep soils. In some small areas the underlying till has a texture of loam, silt loam, or clay loam. Other inclusions are uneroded areas and small, severely eroded areas where most of the original surface layer has been removed by erosion. Some areas of this soil have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones.

This Kidder soil is moderately susceptible to erosion and is subject to soil blowing during dry periods. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion and soil blowing.

Most of the acreage is used for crops. If managed properly, this soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIIe-1; woodland group 2o2; wildlife group 1; shrub and vine group 1; recreation group 2)

Kidder sandy loam, 12 to 20 percent slopes (KdD).—This moderately steep soil is on moraines and along drainageways on till plains. It has more sand in the surface layer and the upper part of the subsoil than the soil having the profile described as representative for the series.

Included with this soil in mapping were small areas of Griswold, Oshtemo, Rotamer, Westville, and Rotamer, thin variant soils. In drainageways and depressions the surface layer is thicker and darker colored than the one described in the representative profile, and in some of these areas the subsoil is mottled. Also, in some small areas the surface layer is loam, and in some areas it is darker colored than that soil. In some small areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Some small areas of sloping soils and some areas of steep soils also were included. In some small areas the underlying till has a texture of silt loam, loam, or clay loam. Some areas of this soil have been eroded, and some have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones.

This Kidder soil is highly susceptible to erosion and is subject to soil blowing during dry periods. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion and soil blowing.

Most of the acreage is used for woods and pasture, but some areas are used for crops. The soil is suited for pasture, woods, and close-growing crops. If it is used for row crops, it is very susceptible to erosion, and good management is

needed to control erosion. (Capability unit IVe-1; woodland group 2r1; wildlife group 1; shrub and vine group 1; recreation group 2)

Kidder silt loam, 0 to 2 percent slopes (KeA).—This nearly level soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 5 to 80 acres in size. In approximately 65 percent of the acreage, the surface layer is silt loam, and in 35 percent it is loam. In the profile of this soil, the solum is about 5 inches thicker than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Griswold, St. Charles, and Westville soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Some areas of this soil have a silty mantle more than 13 inches thick. In some small areas the surface layer is sandy loam. In some areas the surface layer is darker colored than the one in the profile described as representative for the series. In some small areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of gently sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam.

This Kidder soil has few limitations and can be cultivated intensively if management practices are used to return organic matter regularly and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Kidder silt loam, 2 to 6 percent slopes, eroded (KeB2).—This gently sloping soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 10 to more than 100 acres in size. In approximately 65 percent of the acreage, the surface layer is silt loam, and in 35 percent it is loam. This soil has the profile described as representative for the series.

Included in mapping were small areas of Griswold, Rotamer, St. Charles, and Westville soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil, and in some areas the subsoil is mottled. In some small areas the surface layer is sandy loam, and some areas have a silty mantle more than 13 inches thick. In some small areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of nearly level and sloping soils and some small areas where the underlying till is silt loam, loam, or clay loam. In some areas the surface layer is darker colored than the one in this soil. Other inclusions are uneroded areas and small, severely eroded areas where most of the original surface layer has been removed by erosion. Some areas of this soil have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones.

This Kidder soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Kidder silt loam, 6 to 12 percent slopes, eroded (KeC2).—This sloping soil is on till plains, moraines, and lower side slopes in areas where bedrock is relatively shallow. The areas are irregular in shape and range from 5 to more than 100 acres in size. In approximately 65 percent of the acreage, the surface layer is silt loam, and in 40 percent it is loam. In the profile of this soil, the surface layer is about 1 inch thinner than in the profile described as representative for the series, and it contains some subsoil material.

Included with this soil in mapping were small areas of Griswold, Rotamer, St. Charles, and Westville soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. In some areas this soil has a silty mantle more than 13 inches thick, and in some areas it has a sandy loam surface layer. In some small areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of gently sloping and moderately steep soils and some small areas where the underlying till has a texture of silt loam, loam, and clay loam. In some areas the surface layer is darker colored than the one in the profile described as representative for the series. Other inclusions are uneroded areas and small, severely eroded areas where most of the original surface layer has been removed by erosion. Some areas of this soil have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones.

This Kidder soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Kidder silt loam, 12 to 20 percent slopes, eroded (KeD2).—This moderately steep soil is on breaks along drainageways on till plains and moraines. It is also on till-covered side slopes in areas where bedrock is relatively shallow. The areas range from 5 to more than 100 acres in size, and they are irregular in shape. In approximately 55 percent of the acreage, the surface layer is silt loam, and in 45 percent it is loam. In the profile of this soil, depth to the gravelly sandy loam substratum is about 3 inches less than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Griswold, Rotamer, and St. Charles soils and Rotamer soils, thin variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile. In some areas this soil has a silty mantle more than 13 inches thick. In some small areas the surface layer is sandy loam. Also included were some small areas that are underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. In addition, there are some small areas of sloping and steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small, severely eroded areas where most of the original surface layer has been removed by erosion. Some areas of this soil have cobblestones and boulders on the surface and throughout the soil. Most areas that

have boulders on the surface are indicated on the soil map by the symbol for stones.

This Kidder soil is highly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for farm crops, pasture, and woods. This soil is better suited to pasture, woods, and close-growing crops than to row crops. If it is used for row crops, good management is needed to control further erosion. (Capability unit IVe-1; woodland group 2r1; wildlife group 1; shrub and vine group 1; recreation group 1)

Kidder silt loam, 20 to 30 percent slopes (KeE).—This steep soil is on breaks along drainageways on till plains and moraines. The areas are commonly elongated in shape and range from 5 to more than 40 acres in size. In approximately 55 percent of the acreage, the surface layer is silt loam, and in 45 percent it is loam. In the profile of this soil, depth to the gravelly sandy loam substratum is about 5 inches less than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Griswold, Rodman, and Rotamer soils and Rotamer soils, thin variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile. In some areas the surface layer is sandy loam. Also included were some areas that are underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock rather than glacial till. Other inclusions are some small areas of moderately steep and very steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Also included were some eroded areas. Some areas of this soil have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones.

This Kidder soil is very highly susceptible to erosion, and runoff is very rapid. Most of the acreage is used for woods or pasture. This soil is not suited to cultivated crops, but it is suited to pasture, woods, or wildlife habitat. If this soil is used for pasture, grazing should be controlled to maintain a good sod and prevent gullying. (Capability unit VIe-1; woodland group 2r1; wildlife group 1; shrub and vine group 1; recreation group 1)

Locke Series

The Locke series consists of deep, somewhat poorly drained, nearly level and gently sloping, loamy soils that are underlain by calcareous gravelly sandy loam glacial till. These soils are commonly at the edge of depressional areas on till plains adjacent to the more sloping, better drained soils on uplands. Locke soils are saturated with water at depths of 1 to 3 feet during wet periods unless drained.

In a representative profile, the surface layer is black loam about 8 inches thick. The subsoil is about 28 inches thick. It is dark grayish-brown, firm sandy clay loam in the upper part and yellowish-brown, friable sandy loam in the lower part. The substratum is pale-brown, calcareous gravelly sandy loam and is at a depth of about 36 inches. There are strong-brown, yellowish-brown, yellowish-red, or grayish-brown mottles in the subsoil and substratum.

These soils can hold about 9 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The depth of the root zone is limited by the seasonal high water table. Natural fertility is moderate.

Where drained, Locke soils are used for corn, soybeans, small grains, legumes, and other common crops. Undrained areas are used for pasture, woods, or wildlife habitat.

Representative profile of Locke loam, 0 to 3 percent slopes, in a cultivated field, 150 feet south of State Route 81 and 200 feet east of small woodlot, NE¼NW¼NE¼ sec. 32, T.1 N., R. 12 E.:

Ap—0 to 8 inches, black (10YR 2/1) loam; moderate, medium and fine, granular structure; very friable; mildy alkaline; abrupt, smooth boundary.

B21t—8 to 12 inches, dark grayish-brown (10YR 4/2) sandy clay loam; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; firm; thin patchy clay films on ped faces and in pores; clay bridging between sand grains; slightly acid; clear, smooth boundary.

B22t—12 to 20 inches, dark grayish-brown (10YR 4/2) sandy clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles and few, fine, distinct, yellowish-red (5YR 4/8) mottles; moderate, medium and fine, subangular blocky structure; firm; thin patchy clay films on ped faces and in pores; clay bridging between sand grains; neutral; clear, wavy boundary.

B23t—20 to 28 inches, yellowish-brown (10YR 5/4) heavy sandy loam; common, medium, faint, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; few, thin, patchy clay films on ped faces and in pores; clay bridging between sand grains; neutral; gradual, wavy boundary.

B3—28 to 36 inches, yellowish-brown (10YR 5/4) sandy loam; common, medium, faint, yellowish-brown (10YR 5/6) mottles and few, medium, faint, grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; clay bridging between sand grains; neutral; clear, smooth boundary.

C—36 to 60 inches, pale-brown (10YR 6/3) gravelly sandy loam; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very friable; calcareous.

Depth to the calcareous gravelly sandy loam glacial till ranges from 20 to 40 inches. The A horizon is 6 to 9 inches thick. It is black, very dark brown, very dark gray, very dark grayish brown, or dark brown. The A2 horizon is 0 to 8 inches thick. Where present, it is loam or sandy loam and has matrix colors of brown or pale brown. The B2t horizon is sandy clay loam and heavy loam and 10 to 20 inches thick. It has matrix colors of dark grayish brown, brown, yellowish brown, or dark yellowish brown. The B3 horizon is 0 to 10 inches thick. Where present, it is light sandy clay loam or sandy loam and has matrix colors of yellowish brown, brown, or grayish brown. The C horizon has matrix colors of yellowish brown, pale brown, or light yellowish brown and contains from 15 to 30 percent gravel.

Locke soils are associated with Brookston, Griswold, and Kidder soils. Locke soils are more poorly drained than Griswold and Kidder soils and are better drained than Brookston soils.

Locke loam, 0 to 3 percent slopes (LkA).—This soil is on the edge of depressional areas on till plains in elongated areas generally less than 50 acres in size.

Included in mapping were small areas of Brookston, Darroch, Griswold, Kane, and Kidder soils. In some drainageways and depressions and other areas, the surface layer is more than 9 inches thick. Also included were small areas where the surface layer is silt loam or sandy loam. In some areas the solum is more than 40 inches thick, and in some small areas the underlying till is silt loam, loam, or clay loam. Also included were small areas underlain by sand and gravel or stratified silt and fine sand rather than glacial till.

This Locke soil is somewhat poorly drained. It receives runoff from adjoining areas and is subject to ponding in some areas during wet periods and after heavy rain. It is suited to tile drainage, and drainage is needed for dependable crop production.

If drained, this soil is suited to all the farm and vegetable crops commonly grown in the county. Undrained areas are used for pasture, woods, or wildlife habitat. (Capability unit IIw-2; woodland group 3w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

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Lorenzo Series

The Lorenzo series consists of well-drained, nearly level to moderately steep, loamy soils that are underlain by stratified sand and gravel at a depth of 12 to 20 inches. These soils are on outwash plains and terraces. They are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is about 10 inches thick. It is black loam in the upper part and very dark gray loam in the lower part. The subsoil is about 7 inches thick. It is very dark grayish-brown, firm gravelly light clay loam in the upper part and dark yellowish-brown, loose very gravelly loamy sand in the lower part. The substratum is yellowish-brown, calcareous sand and gravel and is at a depth of about 17 inches.

These soils can hold about 4 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate in the subsoil and rapid in the substratum. The depth of the root zone is limited by sand and gravel. Natural fertility is moderate.

Most areas of nearly level to sloping Lorenzo soils are used for corn, small grains, and legumes. In most places the moderately steep soils are in pasture or are idle.

Repesentative profile of Lorenzo loam, 2 to 6 percent slopes, in a cultivated field, 100 feet west of Burdick Road and 660 feet north of railroad tracks, NE¼SE¼NE¼ sec. 17, T. 3 N., R. 12 E.:

Ap—0 to 7 inches, black (10YR 2/1) loam; moderate, medium and fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A12—7 to 10 inches, very dark gray (10YR 3/1) loam; moderate, medium, granular structure; friable; slightly acid; clear, smooth boundary.

B2t—10 to 15 inches, very dark grayish-brown (10YR 3/2) gravelly light clay loam; moderate, medium and fine, subangular blocky structure; firm; thin patchy films on ped faces and in pores and channels; estimated 15 to 20 percent of horizon is gravel; slightly acid; clear, smooth boundary.

B3—15 to 17 inches, dark yellowish-brown (10YR 3/4) very gravelly loamy sand; very weak, coarse, subangular blocky structure, parting to single grain; loose; thin patchy clay films on pebbles; clay coatings on sand grains; neutral; abrupt, smooth boundary.

C—17 to 60 inches, yellowish-brown (10YR 5/4) sand and gravel; single grain; loose; calcareous.

Depth to underlying sand and gravel ranges from 12 to 20 inches. The A horizon ranges from 6 to 11 inches in thickness. It is black, very dark brown, very dark gray, very dark grayish brown, or dark brown. The B2t horizon is heavy loam or light clay loam that is 5 to 20 percent gravel, by volume. It ranges from 4 to 10 inches in thickness and is very dark grayish brown or dark brown. The B3 horizon is gravelly or very gravelly and is loam, sandy loam, or loamy sand. It ranges from 1 to 3 inches in thickness and is dark yellowish brown or brown.

Lorenzo soils are associated with Casco, Rodman, and Warsaw soils and Oshtemo soils, dark variant. Lorenzo soils have a thicker, darker colored surface layer than Casco soils. They are thinner over sand and gravel than Warsaw soils but are thicker than Rodman soils. Lorenzo soils have a thinner solum and are finer textured than Oshtemo soils, dark variant.

Lorenzo loam, 0 to 2 percent slopes (LoA).—This nearly level soil is on outwash plains. The areas are generally 5 to 40 acres in size and irregular in shape. In the profile of this soil, depth to the sand and gravel substratum is about 2 inches more than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Casco, Rodman, and Warsaw soils. Also included were small areas that have a silt loam or sandy loam surface layer and small areas of gently sloping soils. Also included were small areas where the profile is more sandy and less clayey than the profile described as representative for the series.

This Lorenzo soil has slow runoff. Crop growth is generally limited by low available water capacity. Management practices are needed that conserve moisture and improve tilth.

Most of the acreage is used for crops that are commonly grown in the county. This soil is suited to irrigation. If irrigated, it is suited to most farm crops and early season vegetable crops. (Capability unit IIIs-4; woodland group 3d1; wildlife group 3; shrub and vine group 2; recreation group 4)

Lorenzo loam, 2 to 6 percent slopes (LoB).—This gently sloping soil is on low ridges and knobs and along natural drainageways on outwash plains. The areas are generally 10 to 50 acres in size and elongated in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Casco, Rodman, and Warsaw soils. Also included were small areas that have a silt loam or sandy loam surface layer, small areas of nearly level and sloping soils, and moderately eroded areas where the dark-colored surface layer is not as thick and is slightly more clayey than the one in this soil. Small areas of severely eroded soils have gravel mixed in the surface layer. The symbol for gravel has been used to indicate many of these areas on the soil map. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil. In addition, small areas that are more sandy and less clayey than that soil were included.

This Lorenzo soil is slightly susceptible to erosion. Crop growth is generally limited by low available water capacity. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage of this soil is used for crops that are commonly grown in the county. The soil is suited to irrigation, especially in the less sloping areas. If irrigated, this soil is suited to most farm crops and early season vegetable crops. (Capability unit IIIe-3; woodland group 3d1; wildlife group 3; shrub and vine group 2; recreation group 4)

Lorenzo loam, 6 to 12 percent slopes, eroded (LoC2).—This sloping soil is on low ridges and knobs and along natural drainageways on outwash plains. The areas are generally 5 to 40 acres in size and elongated in shape. In the profile of this soil, depth to the sand and gravel substratum is about 4 inches less than in the profile described as representative for the series. In addition, the dark-colored surface layer is thinner, more clayey, and generally more sandy.

Included with this soil in mapping were small areas of Casco, Rodman, and Warsaw soils. Also included were small areas that have a silt loam or sandy loam surface layer and small areas of gently sloping and moderately steep soils. Other inclusions are uneroded areas and a few, small, severely eroded areas where most of the original surface layer has been removed by erosion and where the surface layer is gravelly. The symbol for gravel has been used to indicate many of these areas on the soil map. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile. Also, small included areas are more sandy and less clayey throughout the solum than that soil.

This Lorenzo soil is moderately susceptible to erosion. Crop growth is generally limited by low available water capacity. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops that are commonly grown in the county. Some areas are in permanent pasture. This soil is not suited to intensive cultivation, but it is fairly

well suited to small grains and pasture if it is well managed. (Capability unit IVe-3; woodland group 3d1; wildlife group 3; shrub and vine group 2; recreation group 4)

Lorenzo loam, 12 to 20 percent slopes (LoD).—This moderately steep soil is on side slopes along narrow drainageways and the edge of outwash plains and terraces. It is also on ridges and knobs on the outwash plains. The areas are generally 5 to 20 acres in size and elongated in shape. In the profile of this soil, depth to the sand and gravel substratum is about 5 inches less than in the profile described as representative for the series. In addition, the dark-colored surface layer is thinner.

Included with this soil in mapping were small areas of Casco, Rodman, and Warsaw soils. Also included were areas that have a sandy loam surface layer and small areas of sloping and steep soils. Other inclusions are uneroded areas and severely eroded areas where most of the original surface layer has been removed by erosion and the surface layer is gravelly. The symbol for gravel has been used to indicate many of these areas on the soil map. In drainageways the surface layer is thicker and darker colored than the one in the soil having the representative profile. Also, small included areas are more sandy and less clayey throughout the solum than that soil.

This Lorenzo soil has very rapid runoff and is highly susceptible to erosion. It is not suited to cultivation. Most of the acreage is used for hay, pasture, or wildlife habitat. Some areas are used as a source of sand and gravel. If management is good and grazing is controlled, this soil is suitable for permanent pasture. (Capability unit VIe-3; woodland group group 3r1; wildlife group 3; shrub and vine group 2; recreation group 4)

Mahalasville Series

The Mahalasville series consists of deep, poorly drained, silty soils. These nearly level soils are on flood plains and in drainageways, depressions, and old lake basins. Ground water is at or near the surface throughout the year unless this soil is drained.

In a representative profile, the surface layer is about 15 inches thick. It is black silt loam in the upper part and black light silty clay loam in the lower part. The subsoil is about 45 inches thick. It is dark-gray, firm silty clay loam in the upper part; olive-gray, firm silty clay loam and heavy silt loam in the middle part; and olive-gray, friable silt loam in the lower part. There are yellowish-brown and olive mottles in the subsoil. The upper part of the substratum is light-gray, calcareous silt loam and is at a depth of about 60 inches. The lower part of the substratum is mixed dark grayish-brown, grayish-brown, and yellowish-brown, calcareous sand and gravel and is at a depth of about 70 inches. There are yellowish-brown, brownish-yellow, dark grayish-brown, and grayish-brown mottles in the substratum.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. Depth of the root zone is limited by the water table. Natural fertility is moderate.

Where these soils are drained, most areas are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county. Undrained areas are used for unimproved pasture and wildlife habitat.

Representative profile of Mahalasville silt loam in a cultivated field, 250 feet north of County Road W and 200 feet west of fence line, SW¼SE¼SW¼ sec. 28, T. 1 N., R. 14 E.:

Ap—0 to 7 inches, black (10YR 2/1) silt loam; moderate, medium and fine, granular structure; friable; neutral; abrupt, smooth boundary.

A12—7 to 15 inches, black (N 2/0) light silty clay loam; weak, very fine, subangular blocky structure; firm; neutral; clear, smooth boundary.

B21tg—15 to 19 inches, dark-gray (10YR 4/1) silty clay loam; few, fine, distinct, yellowish-brown (10YR 5/6) and olive (5Y 5/3) mottles; weak, fine and very fine, prismatic structure, parting to moderate, very fine, subangular blocky structure; firm; thin continuous clay films on ped faces and in pores and channels; mildly alkaline; clear, smooth boundary.

B22tg—19 to 22 inches, olive-gray (5Y 4/2) silty clay loam; many, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium and fine, prismatic structure, parting to moderate, fine and very fine, subangular blocky structure; firm; thin continuous clay films on ped faces and in pores and channels; some root channels filled with very dark brown (10YR 2/2) soil material; mildy alkaline; clear, smooth boundary.

B23tg—22 to 33 inches, olive-gray (5Y 5/2) heavy silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine and very fine, prismatic structure, parting to moderate, medium and fine, subangular blocky structure; firm; thin discontinuous clay films on some ped faces and in some pores and channels; some root channels filled with very dark brown (10YR 2/2) soil material; moderately alkaline; gradual, smooth boundary.

B3g—33 to 60 inches, olive-gray (5Y 5/2) silt loam; many, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure; friable; moderately alkaline; gradual, wavy boundary.

C1g—60 to 70 inches, light-gray (5Y 7/1) silt loam; common, medium, distinct, brownish-yellow (10YR 6/6) mottles and few, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very friable; weakly stratified with very thin lenses of silt and fine sand; calcareous; clear, smooth boundary.

IIC2g—70 to 80 inches, mixed dark grayish-brown (10YR 4/2), grayish-brown (10YR 5/2), and yellowish-brown (10YR 5/4) sand and gravel; single grain; loose; calcareous.

Depth to carbonates ranges from 36 to 60 inches. The combined thickness of the A horizons ranges from 11 to 21 inches. The A12 horizon is silt loam or silty clay loam and is black or very dark brown. The B2t horizons are heavy silt loam or silty clay loam and range from 10 to 30 inches in combined thickness. They have matrix colors of gray, dark gray, dark grayish brown, olive gray, or grayish brown. The B3 horizon ranges from 8 to 30 inches in thickness. It has matrix colors of gray, olive gray, light brownish gray, or light yellowish brown. The C1 horizon is silt loam or silt and fine sand and is stratified. It has matrix colors of light gray, gray, or dark gray. The IIC2 horizon is sandy loam, loamy sand, sand, or sand and gravel. It has matrix colors of gray, dark grayish brown, grayish brown, or yellowish brown and in some profiles is a mixture of 2 or more of these colors.

Mahalasville soils are associated with Elburn, Marshan, Navan, and Otter soils. Mahalasville soils are more poorly drained than Elburn soils. They have more silt and less sand in the solum than do Marshan and Navan soils. Mahalasville soils do not have as thick a dark-colored surface layer as Otter soils.

Mahalasville silt loam (0 to 2 percent slopes) (Ma).—This nearly level soil occurs in elongated tracts along natural drainageways and smaller flood plains and in irregularly shaped areas on larger stream flood plains and in old lake basins. Most areas of this soil are 20 to 200 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Colwood, Elburn, Marshan, and Otter soils. Also included were small areas that have a muck or silty clay loam surface layer, areas of a soil that has more clay in the subsoil than this soil, and areas that have recent silty overwash. Other inclusions are small areas where protrusions of the dark-colored surface layer extend into the subsoil, areas that are underlain by dolomite bedrock at a depth of 4 to 6 feet, and

areas underlain at a depth of less than 40 inches by sand, sand and gravel, gravelly sandy loam, or silt and fine sand.

This Mahalasville soil is poorly drained and is subject to ponding during wet periods and after heavy rain. It is suitable for tile drainage. Both surface and tile drainage are used to remove excess water rapidly.

If drained, this soil is suited to all of the farm and vegetable crops commonly grown in the county. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IIw-1; woodland group 4w1; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Mahalasville silt loam, overwash (0 to 2 percent slopes) (Mb).—This nearly level soil occurs in elongated tracts along drainageways and smaller flood plains and in irregularly shaped areas in depressions and old lake basins. Most areas of this soil are 10 to 100 acres in size. In the profile of this soil, the surface layer is thicker than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Elburn and Otter soils. Other inclusions are small areas in which the solum has more sand or clay than the one in the profile described as representative for the series. Also included were small areas in which the silty overwash is lighter colored than that of the soil having the representative profile.

This Mahalasville soil is poorly drained and is subject to flooding and ponding during wet periods and after heavy rain. It is suitable for tile drainage. Both surface and tile drainage are used to remove excess water rapidly.

If drained, this soil is suited to all the farm and vegetable crops commonly grown in the county. For dependable crop production, it should also be protected from flooding. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IIw-1; woodland group 4w1; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Marsh

Marsh (0 to 2 percent slopes) (Mc) consists of nearly level, mostly circular, depressional areas that have a water table above or near the surface throughout the year.

Included with this land type in mapping were small areas of Adrian, Houghton, and Palms soils. Also included were small areas of open water.

Marsh is too wet for the growth of common farm crops and pasture and generally is not suited to drainage, because of its low position on the landscape. It is suitable as recreational areas and wildlife habitat, particularly for fur-bearing animals and migratory waterfowl. (Capability unit VIIIw-15; woodland group 5w5; wildlife group 5b; not placed in a shrub and vine group; recreation group 8)

Marshan Series

The Marshan series consists of poorly drained, nearly level, loamy soils that are moderately deep and are underlain by sand or sand and gravel. These soils are on outwash plains and terraces. Ground water is at or near the surface throughout the year, unless this soil is drained.

In a representative profile, the surface layer is about 16 inches thick. It is black loam in the upper part and black clay loam in the lower part. The subsoil is about 21 inches thick. It is dark-gray, firm clay loam in the upper part; dark-gray, yellowish-brown, light olive-gray, and gray, firm clay loam in the middle part; and light olive-gray and gray, friable sandy clay loam and light sandy clay loam in the lower part. The surface layer and subsoil have black, light olive-brown, yellowish-brown, light olive-gray, olive-brown, and gray mottles. The substratum is light brownish gray, moderately alkaline sand and some gravel and is at a depth of about 37 inches.

These soils can hold about 7 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, except in the substratum, where it is rapid. Depth of the root zone is limited by the high water table or, in drained areas, by the underlying sand or sand and gravel. Natural fertility is moderate.

Where these soils are drained, most areas are used for corn, soybeans, small grains and legumes. Undrained soils are used for unimproved pasture and wildlife habitat.

Representative profile of Marshan loam in a cultivated field, 75 feet south of Douglas Road and 100 feet east of drainage ditch, NW¼NE¼SW¼ sec. 29, T. 1 N., R. 10 E.:

Ap—0 to 8 inches, black (N 2/0) loam; weak, thick, platy structure, parting to moderate, medium and fine, granular structure; friable; moderately alkaline; abrupt, smooth boundary.

A12—8 to 16 inches, black (N 2/0) clay loam; many, fine, distinct, olive-brown (2.5Y 4/4) mottles; moderate, coarse and medium, granular structure; firm; neutral; clear, smooth boundary.

B21g—16 to 21 inches, dark-gray (10YR 4/1) clay loam; many, medium, distinct, light olive-brown (2.5Y 5/6) mottles and common, medium, distinct, black (10YR 2/1) mottles; weak, fine and very fine, subangular blocky structure; firm; mildy alkaline; clear, smooth boundary.

B22g—21 to 25 inches, mixed yellowish-brown (10YR 5/6), light olive-gray (5Y 6/2), and gray (10YR 5/1) clay loam; weak, fine and very fine, subangular blocky structure; firm; mildly alkaline; clear, smooth boundary.

B23g—25 to 30 inches, light olive-gray (5Y 6/2) sandy clay loam; common, medium,, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure; friable; krotovina 1 inch in diameter filled with dark-gray (10YR 4/1) material; moderately alkaline; clear, wavy boundary.

B3g—30 to 37 inches, gray (5Y 5/1) light sandy clay loam; few; medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; friable; moderately alkaline; clear, wavy boundary.

IIC—37 to 51 inches, light brownish-gray (10YR 6/2) sand and some gravel; single grain; loose; fragments of wood from roots of trees and shrubs; moderately alkaline.

Depth to the underlying sand or sand and gravel ranges from 24 to 40 inches. The dark-colored surface layer ranges from 12 to 24 inches in thickness. The Ap horizon ranges from 7 to 11 inches in thickness. The A12 horizon is loam or clay loam and ranges from 2 to 13 inches in thickness. It has matrix colors of black or very dark gray. The B21g horizon is heavy loam or clay loam and ranges from 4 to 10 inches in thickness. It has matrix colors of dark gray or gray. The B22g horizon is heavy loam or clay loam and ranges from 3 to 10 inches in thickness. It has matrix colors of yellowish brown, light olive gray, gray, dark gray, or strong brown and in some places is a mixture of two or more of these colors. The B23g horizon is heavy loam, sandy clay loam, or clay loam and ranges from 4 to 10 inches in thickness. It has matrix colors of light olive gray, dark gray, grayish brown or yellowish brown. The B3g horizon is loam, sandy loam, or light sandy clay loam and ranges from 4 to 8 inches in thickness. It has matrix colors of dark gray, gray, light brownish gray, grayish brown, or yellowish brown. The IIC horizon has matrix colors of light brownish gray, grayish brown, or light gray.

Marshan soils are associated with Hayfield, Mahalasville, and Maumee soils and Billett soils, mottled subsoil variant. Marshan soils are more poorly drained than Hayfield soils and Billett soils, mottled subsoil variant. They have more clay and less sand in their solum than Maumee soils. Marshan soils are shallower to underlying sand than Mahalasville soils and lack the thick silty mantle of Mahalasville soils.

Marshan loam (0 to 2 percent slopes) (Md).—This nearly level soil is on outwash plains and terraces. Most areas are from 10 to 300 acres in size and elongated to irregular in shape.

Included with this soil in mapping were small areas of Adrian, Colwood, Hayfield, Maumee, and Sebewa soils and Billett soils, mottled subsoil variant. Also included were small areas that have a sandy loam, loamy sand, silt loam, silty clay loam, or muck surface layer. Some small areas have only a 4- to 10-inch dark-colored surface layer, but other areas have a surface layer more than 24 inches thick. Other inclusions are small areas that have layers of silty clay or clay in the subsoil; other small areas that have bands of loamy sand or sand in the subsoil; and small areas that have a solum that is more than 40 inches thick.

This Marshan soil is poorly drained and is subject to ponding during wet periods and after heavy rain unless drained. Open-ditch or surface drainage is needed for dependable crop production. Tile drainage can be used if measures are taken to prevent the underlying sand from filling the tiles. If the water table is lowered excessively, this soil loses the beneficial effects of free water in the lower part of the soil.

Where this soil is drained, most of the acreage is used for crops. If properly managed, this soil is suited to all of the farm and most of the vegetable crops commonly grown in the county. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IIw-5; woodland group 4w1; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Maumee Series

The Maumee series consists of poorly drained, nearly level, sandy soils that are deep and are underlain by sand and gravel. These soils are on sandy outwash plains and terraces. Ground water is at or near the surface throughout the year unless this soil is drained.

In a representative profile, the surface layer is black loamy sand about 15 inches thick. There are gray mottles in the lower part of this layer. The substratum is at a depth of 15 inches. It is light brownish-gray medium sand in the upper part; pale-brown medium sand in the middle part; and brown and yellowish-brown sand and gravel in the lower part. The depth to sand and gravel is about 50 inches.

These soils can hold about 3 inches of water available to plants between the surface and a depth of 5 feet. Permeability is rapid. Depth of the root zone is limited by the high water table or, in drained areas, generally by the underlying sand. Natural fertility is low.

Where these soils are drained, most areas are used for corn, soybeans, small grains, and legumes. Undrained areas are used for unimproved pasture and wildlife habitat.

Representative profile of Maumee loamy sand in a cultivated field, 90 feet west of Nelson Road and 670 feet south of a drainage ditch, SE¼NW¼SW¼ sec. 34, T. 1 N., R. 10 E.:

Ap—0 to 10 inches, black (N 2/0) loamy sand; moderate, medium, granular structure; very friable; high organic-matter content; mildly alkaline; abrupt, smooth boundary.

A12—10 to 15 inches, black (10YR 2/1) loamy sand; common, fine, distinct, gray (10YR 5/1) mottles; moderate, fine, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

C1g—15 to 23 inches, light brownish-gray (2.5Y 6/2) medium sand; single grain; loose; slightly acid; clear, smooth boundary.

C2—23 to 36 inches, pale-brown (10YR 6/3) medium sand; single grain; loose; moderately alkaline; clear, smooth boundary.

C3—36 to 50 inches, brown (7.5YR 4/4) sand and gravel; single grain; loose; neutral; gradual, smooth boundary.

C4—50 to 60 inches, yellowish-brown (10YR 5/6) sand and gravel; single grain; loose; moderately alkaline.

Depth to underlying sand ranges from 14 to 24 inches. The Ap horizon ranges from 7 to 11 inches in thickness. The A12 horizon ranges from 4 to 14 inches in thickness. It has matrix colors of black or very dark gray. The C1g horizon has matrix colors of gray, dark grayish brown, grayish grown, or light brownish gray. The C2 horizon has matrix colors of gray, light brownish gray, or pale brown. The C3 and C4 horizons, where present, are sand or sand and gravel and have matrix colors of yellowish brown or brown.

Maumee soils are associated with Marshan and Sebewa soils. Maumee soils have more sand and less clay in their solum than do Marshan and Sebewa soils.

Maumee loamy sand (0 to 2 percent slopes) (Me).—This nearly level soil is on outwash plains and terraces. Most areas are from 10 to 100 acres in size and are elongated in shape.

Included with this soil in mapping were small areas of Hayfield, Kane, Marshan, Sebewa, and Watseka soils and soils of the Billett series, mottled subsoil variant. Other inclusions are small areas that have a sandy loam or muck surface layer and small areas that have thin strata of clayey material in the substratum. Also included were small areas where the dark-colored surface layer is less than 14 inches thick and other small areas where it is more than 24 inches thick.

This Maumee soil is poorly drained and, unless drained, is subject to ponding during wet periods and after heavy rain. Open-ditch or surface drainage is needed for best crop production. If drained, this soil is subject to soil blowing, and if the water table is lowered excessively, it loses the beneficial effect of free water in the lower part of the soil.

Where this soil is drained, most of the acreage is used for crops. If properly managed, this soil is suited to corn, soybeans, small grains, pasture, and legumes. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IVw-5; woodland group 3w2; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Millington Series

The Millington series consists of deep, poorly drained, calcareous, loamy alluvial soils. These nearly level soils are on flood plains. Ground water is at or near the surface throughout the year unless this soil is drained.

In a representative profile, the surface layer is about 33 inches thick. It is black silt loam in the upper part and very dark gray silt loam in the lower part. The subsoil is very dark gray, very friable silt loam about 9 inches thick. Brown mottles are in the surface layer and subsoil. The substratum is at a depth of about 42 inches. The upper part of the substratum is calcareous, dark-gray loam about 16 inches thick. The middle part is calcareous, dark-gray sandy loam about 7 inches thick. The lower part of the substratum is calcareous, dark-gray gravelly sandy loam more than 5 inches thick. Yellowish-brown and olive-brown mottles are in the substratum. White snail shells and shell fragments are throughout the soil.

These soils can hold about 12 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. Depth of the root zone is limited by the water table. Natural fertility is moderate.

Where they are drained and protected from flooding, these soils are used for corn and pasture. Undrained areas and areas not protected from flooding are used for unimproved pasture and wildlife habitat.

Representative profile of Millington silt loam in a cultivated field, 30 feet west of lane leading to Turtle Creek and

100 feet north of creek, SE¼NW¼NW¼ sec. 31, T. 2 N., R. 14 E.:

Ap—0 to 8 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; very friable; few, small, white (10YR 8/2) shell fragments; strongly calcareous; abrupt, smooth boundary.

A12—8 to 20 inches, black (N 2/0) silt loam; moderate, medium, granular structure; very friable; few, small, white (10YR 8/2) shell fragments; strongly calcareous; abrupt, smooth boundary.

A13g—20 to 33 inches, very dark gray (10YR 3/1) silt loam; few, fine, distinct, brown (7.5YR 4/4) mottles; moderate, medium, granular structure; very friable; many white (10YR 8/2) shells and shell fragments, especially in the lower part; few pebbles; strongly calcareous; clear, smooth boundary.

Bg—33 to 42 inches, very dark gray (10YR 3/1) silt loam; common, fine, distinct, brown (7.5YR 4/4) mottles; weak, medium, subangular blocky structure; very friable; few white (10YR 8/2) shell fragments; strongly calcareous; clear, smooth boundary.

IIC1g—42 to 58 inches, dark-gray (10YR 4/1) loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; friable; few white (10YR 8/2) shell fragments; strongly calcareous; gradual, smooth boundary.

IIC2g—58 to 65 inches, dark-gray (10YR 4/1) sandy loam; common, medium, distinct, olive-brown (2.5Y 4/4) mottles; massive; friable; few white (10YR 8/2) shell fragments and pebbles; strongly calcareous; gradual, smooth boundary.

IIC3g—65 to 70 inches, dark-gray (10YR 4/1) gravelly sandy loam; common, medium, distinct, olive-brown (2.5Y 4/4) mottles; massive; friable; numerous white (10YR 8/2) shell fragments; strongly calcareous.

Thickness of the solum ranges from 36 to 48 inches. The dark-colored surface layer is more than 24 inches thick. The silty mantle ranges from 33 to 45 inches in thickness and contains about 20 percent sand. The A11, or the Ap, horizon ranges from 7 to 10 inches in thickness. The A12 horizon ranges from 10 to 18 inches in thickness. The A13g horizon ranges from 8 to 15 inches in thickness. The A14g horizon is 7 to 12 inches thick. Where present, it is silt loam and is very dark gray. The Bg horizon is silt loam or loam and ranges from 7 to 20 inches in thickness. It has matrix colors of dark gray or very dark gray. The IICg horizons are at depths below 36 inches and are loam, sandy loam, gravelly sandy loam, or sand and gravel. They have matrix colors of dark gray and dark grayish brown.

Millington soils are associated with Otter, Troxel, and Worthen soils. Millington soils have carbonates throughout the solum, but Otter, Troxel, and Worthen soils do not. Millington soils also have more gray colors than the Troxel and Worthen soils.

Millington silt loam (0 to 2 percent slopes) (Mf).—This nearly level soil occurs in elongated tracts, generally 10 to 50 acres in size, on flood plains.

Included with this soil in mapping were small areas of Otter soils. Also included were small areas of organic soils, areas that have a muck surface layer, areas that have less than a 33-inch silt mantle, and areas that are somewhat poorly drained, moderately well drained, or well drained.

This Millington soil is poorly drained and is subject to flooding and ponding during wet periods and after heavy rain. Surface and tile drainage are used to remove excess water rapidly. This soil is naturally high in lime, and applications of agricultural lime are not necessary.

Where drained and protected from flooding, this soil is used for corn and pasture. Undrained areas are suitable for unimproved pasture and for wildlife habitat. (Capability unit IIw-1; woodland group 4w1; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Navan Series

The Navan series consists of deep, poorly drained, nearly level soils in glacial lakebeds and drainage basins. These are loamy soils over stratified lacustrine deposits of calcareous silty clay loam. Ground water is at or near the surface throughout the year unless this soil is drained.

In a representative profile, the surface layer is about 12 inches thick. It is black silt loam in the upper part and black clay loam in the lower part. The subsoil is about 25 inches thick. It is dark grayish-brown, firm clay loam in the upper part; olive-gray, firm clay loam in the middle part; and light olive-gray, firm silty clay loam in the lower part. There are dark-gray and yellowish-brown mottles in the subsoil. The substratum is mixed yellowish-brown, gray, and greenish-gray, calcareous silty clay loam.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately slow. Depth of the root zone is limited by the water table. Natural fertility is moderate.

Navan soils, where drained, are used for general farm crops. Undrained areas are used for unimproved pasture and wildlife habitat.

Representative profile of Navan silt loam, 130 feet east of State Route 104 and 700 feet south of Norwegian Creek, SW¼NW¼NW¼ sec. 6, T. 2 N., R. 10 E.:

Ap—0 to 10 inches, black (N 2/0) silt loam; weak, fine, subangular blocky structure; very friable; high organic-matter content; mildly alkaline; abrupt, smooth boundary.

A12g—10 to 12 inches, black (10YR 2/1) clay loam; few, fine, distinct, dark grayish-brown (2.5Y 4/2) mottles; weak, fine, subangular blocky structure; firm; mildly alkaline; abrupt, smooth boundary.

B21tg—12 to 17 inches, dark grayish-brown (2.5Y 4/2) clay loam; many, fine, distinct, light olive-brown (2.5Y 5/4) mottles and common, medium, distinct, dark-gray (10YR 4/1) mottles; moderate, fine and very fine, subangular blocky structure; firm; thin patchy clay films on some ped faces and in pores and channels; some channels filled with black (10YR 2/1) material from A12g horizon; mildly alkaline; clear, wavy boundary.

B22tg—17 to 29 inches, olive-gray (5Y 5/2) clay loam; common, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; thin patchy clay films on some ped faces and in pores and channels; mildly alkaline; clear, smooth boundary.

IIB3g—29 to 37 inches, light olive-gray (5Y 6/2) silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium and fine, prismatic structure; firm; calcareous; gradual, wavy boundary.

IICg—37 to 60 inches, mixed yellowish-brown (10YR 5/6), gray (5Y 6/1), and greenish-gray (5GY 6/1) silty clay loam; massive; firm; weakly stratified with layers of silt loam and silty clay; calcareous.

Depth to underlying, calcareous, stratified silty clay loam ranges from 24 to 40 inches. The A horizon ranges from 10 to 18 inches in thickness. It is black, very dark grayish brown, or very dark gray. The B2tg horizon is clay loam or sandy clay loam and ranges from 12 to 23 inches in thickness. It has matrix colors of dark gray, dark grayish brown, or olive gray. The IIBg horizon is silty clay loam or silty clay and ranges from 2 to 10 inches in thickness. It has matrix colors of light olive gray, light yellowish brown, or brown. The IICg horizon is silty clay loam that has strata of silt loam, silty clay, clay, or is stratified silt and clay. It has matrix colors of yellowish brown, gray, greenish gray, pinkish gray, and grayish brown and in some profiles it is a mixture of two or more of these colors.

Navan soils are associated with Aztalan, Colwood, Hebron, and Mahalasville soils. Navan soils are more poorly drained than Aztalan and Hebron soils. They are finer textured in the lower part of the subsoil and substratum than Colwood soils. Navan soils have more sand in the upper part of the subsoil and are finer textured in the lower part of the subsoil and substratum than Mahalasville soils. They are also more stratified in the lower part of the subsoil and substratum than Mahalasville soils.

Navan silt loam (0 to 2 percent slopes) (Na).—This nearly level soil is in glacial lakebeds and drainage basins in irregularly shaped areas. Many areas are more than 40 acres in size.

Included with this soil in mapping were small areas of Aztalan, Colwood, Mahalasville, and Sebewa soils. In drainageways and depressions the surface layer is thicker

than the one in this soil. Also included were areas that have a loam, sandy loam, or silty clay loam surface layer. In some areas the substratum has lenses of clay loam or sand in the silty clay loam.

This Navan soil is poorly drained. It receives runoff from adjoining areas and is subject to ponding during wet periods and after heavy rain. Drainage is needed for crop production.

If drained, Navan soils are suited to all the farm and vegetable crops commonly grown in the county. Undrained areas are used for pasture and wildlife habitat. (Capability unit IIw-1; woodland group 4w1; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Ogle Series

The Ogle series consists of well-drained, nearly level and gently sloping, silty soils that are deep and are underlain by gravelly sandy loam glacial till. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is about 17 inches thick. It is very dark brown silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The subsoil is at least 79 inches thick. It is brown, friable heavy silt loam in the upper part; yellowish-brown, firm silty clay loam in the middle part; and yellowish-red and strong-brown, firm clay loam and sandy clay loam in the lower part.

These soils can hold about 12 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Ogle silt loam, 0 to 2 percent slopes, in a cultivated field, 100 feet east of State Route 184 and one-fourth mile north of the junction of State Route 184 and County Road A, NW¼SW¼SW¼ sec. 19, T. 3 N., R. 12 E.:

Ap—0 to 9 inches, very dark brown (10YR 2/2) silt loam; weak, medium, granular structure; very friable; neutral; abrupt, smooth boundary.

A12—9 to 14 inches, very dark brown (10YR 2/2) silt loam; weak, thick, platy structure; very friable; neutral; clear, smooth boundary.

A3—14 to 17 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, subangular blocky structure; very friable; neutral; clear, smooth boundary.

B1—17 to 23 inches, brown (10YR 4/3) heavy silt loam; moderate, fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—23 to 48 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; firm; thick continuous clay films on ped faces; strongly acid; gradual, smooth boundary.

IIB22t—48 to 62 inches, yellowish-red (5YR 5/6) clay loam; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure-; firm; thin patchy clay films on ped faces; clay flows in channels; slightly acid; clear, smooth boundary.

IIB3—62 to 96 inches, strong-brown (7.5YR 5/6) sandy clay loam; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium, subangular blocky structure; firm; slightly acid.

Depth to calcareous gravelly sandy loam till ranges from 5 to 9 feet. The silty mantle ranges from 30 to 50 inches in thickness. The A horizon ranges from 10 to 20 inches in thickness. It is very dark brown, very dark grayish brown, or dark brown. The B1 horizon ranges from 4 to 20 inches in thickness and is brown or dark yellowish brown. The B21t horizon ranges from 10 to 36 inches in thickness and is brown or yellowish brown. The IIB2t horizon is clay loam or sandy clay loam and ranges from 15 to 30 inches in thickness. It is brown, reddish brown, yellowish red, or strong brown. The IIB3 horizon is sandy clay loam, loam, or sandy loam and ranges from 5 to 40 inches in thickness. It is brown, strong brown, or dark yellowish brown. Profiles that lack base colors of a hue of 5YR in the IIB horizon have clay films of that hue. The IIC horizon is yellowish brown or light yellowish brown.

Ogle soils are associated with Durand, Flagg, and Plano soils. Ogle soils have redder colors in the lower part of the B horizon and are more deeply weathered into the till than Plano soils. They have a thicker silty mantle than Durand soils. They have a darker colored or thicker, dark-colored surface layer than Flagg soils.

Ogle silt loam, 0 to 2 percent slopes (OgA).—This nearly level soil is on till plains and on broad, till-covered ridgetops and valley floors in areas where the bedrock is relatively shallow. The areas are generally less than 100 acres in size and irregular in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Elburn, Flagg, Plano, and Rockton soils. In drainageways and depressions the surface layer is thicker than the one in this soil, and in some areas the subsoil in mottled. Some areas of this soil have a silty mantle that is more than 50 inches thick. Also included were areas where the lower part of the subsoil is more sandy than the one in this soil, and areas where the subsoil is less red. In some areas this soil is underlain by stratified silt and sand, sand, sand and gravel, or dolomite bedrock, rather than glacial till. Also included were some small areas of gently sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam.

This Ogle soil has few limitations and can be cultivated intensively if organic matter is returned regularly and if the soil is kept in good tilth.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-3; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Ogle silt loam, 2 to 6 percent slopes (OgB).—This gently sloping soil is on till plains and on broad, till-covered ridgetops, side slopes, and valley floors in areas where the bedrock is relatively shallow. The areas are irregular in shape and range from 20 to more than 100 acres in size. The profile of this soil is about 10 inches thinner than the profile described as representative for the series. In addition, the surface layer is about 4 inches thinner.

Included with this soil in mapping were small areas of Durand, Elburn, Flagg, Plano, and Rockton soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Some areas of this soil have a silty mantle that is more than 50 inches thick. Also included were areas where the lower part of the subsoil is more sandy than that in the profile described as representative for the series and areas where the subsoil is less red. In some areas this soil is underlain by stratified silt and sand, sand, sand and gravel, or dolomite bedrock, rather than glacial till. Also included were some small areas of nearly level and sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This Ogle soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Oshtemo Series

The Oshtemo series consists of well-drained, nearly level to steep, loamy soils that are deep and are underlain by stratified sand and gravel at a depth of 40 to 60 inches. These soils are on outwash plains and terraces. They are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is brown light sandy loam about 8 inches thick. The subsoil is about 40 inches thick. It is dark-brown, friable sandy loam in the upper part; brown, firm sandy loam and heavy sandy loam in the middle part; and dark yellowish-brown, friable light sandy loam in the lower part. The substratum is pale-brown, calcareous, stratified sand and gravel and is at a depth of about 48 inches.

These soils can hold about 5 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid. The root zone is deep. Natural fertility is moderate.

Most areas of nearly level to sloping Oshtemo soils are used for corn, small grains, legumes, and other crops commonly grown in the county. In most places the steeper soils are used for pasture or woods.

Representative profile of Oshtemo sandy loam, 2 to 6 percent slopes, in a cultivated field, 660 feet north of Cleophas Road and 270 feet west of long driveway, NW¼SW¼SE¼ sec. 8, T. 1 N., R. 11 E.:

Ap—0 to 8 inches, brown (10YR 4/3) light sandy loam; weak, coarse, granular structure; very friable; slightly acid; clear, smooth boundary.

B1—8 to 15 inches, dark-brown (7.5YR 4/4) sandy loam; weak, coarse, subangular blocky structure; friable; neutral; few worm and root channels filled with Ap material; neutral; clear, smooth boundary.

B21t—15 to 23 inches, brown (7.5YR 4/4) sandy loam; weak, coarse, subangular blocky structure; firm; few, thin, discontinuous clay films and clay flows in some pores; some clay bridging between sand grains; neutral; clear, smooth boundary.

B22t—23 to 37 inches, brown (7.5YR 4/4) heavy sandy loam; weak, coarse, subangular blocky structure; firm; few, thin, discontinuous clay films; clay flows in some pores; some clay bridging between sand grains; neutral; clear, smooth boundary.

B3—37 to 48 inches, dark yellowish-brown (10YR 4/4) light sandy loam; weak, medium, subangular blocky structure; friable; clay bridging between sand grains; about 10 percent gravel, by volume; neutral; abrupt, smooth boundary.

IIC—48 to 60 inches, pale-brown (10YR 6/3), stratified medium sand and fine gravel; single grain; loose; calcareous.

Depth to underlying sand and gravel ranges from 40 to 60 inches. The A horizon ranges from 7 to 12 inches in thickness. Where the soil has not been cultivated, it has a very dark brown or very dark grayish-brown sandy loam A1 horizon 1 to 4 inches thick and a brown sandy loam A2 horizon 6 to 8 inches thick. The Ap horizon is dark grayish brown or brown. The B1 horizon ranges from 5 to 9 inches in thickness. The B2t horizon is sandy loam or sandy clay loam and ranges from 20 to 35 inches in thickness. It is brown or dark yellowish brown. In the lower part of the solum in some areas, the Bt horizon is in layers 1 to 4 inches thick separated by B3 horizon material. The B3 horizon is dark yellowish brown or yellowish brown and ranges from 2 to 15 inches in thickness. It is sandy loam or loamy sand and contains 5 to 25 percent gravel.

Oshtemo soils are associated with Casco and Dresden soils and Oshtemo soils, dark variant. Oshtemo soils have a lighter colored or thinner, dark-colored surface layer than Oshtemo soils, dark variant. Oshtemo soils are coarser textured and have a deeper solum than Dresden and Casco soils.

Oshtemo sandy loam, 0 to 2 percent slopes (OoA).—This nearly level soil is on outwash plains and terraces. The areas are generally 5 to 75 acres in size and irregular in shape. The profile of this soil is about 8 inches thicker than the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett, Dresden, and Gotham soils and Oshtemo soils, dark variant. In some areas the surface layer is darker colored than the one in the soil having the profile described as representative for the series. In drainageways and depressions the surface layer is thicker and darker colored than in that soil, and in some areas the lower part of the subsoil is mottled. Also included were small areas of gently sloping soils and areas where the solum is less than 40 inches thick. Also included were small areas that have a loamy sand surface layer and areas where the sand and gravel outwash is underlain by glacial till or lacustrine silt and fine sand.

This Oshtemo soil is subject to soil blowing. Crop growth during most seasons is limited by low available water capacity. This soil is well suited to irrigation. Management practices are needed that regularly add organic matter to the soil, increase infiltration, and control soil blowing.

Most of the acreage is used for crops. This soil is suited to all the farm crops commonly grown in the county. By using supplemental irrigation, fertilization, and protection from soil blowing, this soil is suitable for intensive production of vegetable crops. (Capability unit IIIs-4; woodland group 3s2; wildlife group 1; shrub and vine group 2; recreation group 3)

Oshtemo sandy loam, 2 to 6 percent slopes (OoB).—This gently sloping soil is on low ridges and knobs on outwash plains and terraces. The areas are generally 10 to 40 acres in size and elongated in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett, Dresden, and Gotham soils and Oshtemo soils, dark variant. In some areas the surface layer is darker colored than the one in this soil; in drainageways and depressions the surface layer is thicker and darker colored; and in some areas the lower part of the subsoil is mottled. Also included were small areas of nearly level and sloping soils and moderately eroded areas where the surface layer is lighter colored than the one in this soil. In some places there is dark-brown subsoil material mixed with the surface layer. In some areas the solum is less than 40 inches thick. Also included were small areas that have a loamy sand surface layer and areas where the sand and gravel outwash is underlain by glacial till or lacustrine silt and fine sand.

This Oshtemo soil is slightly susceptible to erosion and is subject to soil blowing. Crop growth during most seasons is limited by low available water capacity. Management practices are needed that regularly add organic matter to the soil, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. This soil is suited to all of the farm crops commonly grown in the county. It is suited to irrigation, especially in the less sloping areas. If irrigated, fertilized, and protected from soil blowing, this soil is suitable for intensive production of vegetable crops. (Capability unit IIIs-4; woodland group 3s2; wildlife group 1; shrub and vine group 2; recreation group 3)

Oshtemo sandy loam, 6 to 12 percent slopes, eroded (Oo C2).—This sloping soil is on low ridges and knobs on outwash plains and on terraces adjacent to steeper soils on uplands. The areas are generally 5 to 40 acres in size and

elongated. The profile of this soil is about 5 inches thinner than the profile described as representative for the series. In addition, the present surface layer is lighter colored and in some places has dark-brown subsoil material mixed with the original surface layer by plowing.

Included with this soil in mapping were small areas of Billett, Dresden, and Gotham soils and Oshtemo soils, dark variant. In some areas the surface layer is darker colored than the one in the soil having the profile described as representative for the series. Also, in drainageways and depressions the surface layer is thicker and darker colored than the one in that soil, and in some areas the lower part of the subsoil is mottled. Also included were small areas of gently sloping and moderately steep soils and uneroded areas. Small severely eroded areas where nearly all of the original surface layer has been removed by erosion and areas that have gravel in the surface layer also were included. In some areas the solum in less than 40 inches thick. Also included were small areas that have a loamy sand surface layer and areas where the sand and gravel outwash is underlain by glacial till or lacustrine silt and fine sand. A few small areas are underlain by bedrock at depths below 5 feet.

This Oshtemo soil is moderately susceptible to erosion and is subject to soil blowing. Crop growth during most seasons is limited by low available water capacity. Management practices are needed that supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops, but some areas are wooded. If properly managed, this soil is suited to all of the farm crops commonly grown in the county. (Capability unit IIIe-7; woodland group 3s2; wildlife group 1; shrub and vine group 2; recreation group 3)

Oshtemo sandy loam, 12 to 25 percent slopes, eroded (OoD2).— This moderately steep and steep soil is on side slopes along narrow drainageways and the edge of outwash plains and terraces. The areas are generally 5 to 20 acres in size and elongated in shape. The profile of this soil is about 8 inches thinner than the profile described as representative for the series. In addition, the surface layer is lighter colored and in some places has dark-brown subsoil material mixed with the original surface layer by plowing.

Included with this soil in mapping were small areas of Billett, Dresden, and Gotham soils and Oshtemo soils, dark variant. In some areas the surface layer is darker colored than the one in the soil having the profile described as representative for the series. Also, in drainageways and depressions the surface layer is thicker and darker colored than in that soil. Also included were small areas of sloping and steep soils and uneroded areas, most of which are wooded. Also included were small severely eroded areas where nearly all of the original surface layer has been removed by erosion and areas that have considerable gravel in the surface layer. In some areas the solum is less than 40 inches thick. Small areas that have a loamy sand surface layer and areas where the sand and gravel outwash is underlain by glacial till or lacustrine silt and fine sand also were included. A few small areas are underlain by bedrock at depths below 5 feet.

This Osthemo soil has very rapid runoff and is severely susceptible to erosion. Crop growth during most seasons is limited by low available water capacity. Management practices are needed that regularly return organic matter to the soil, conserve moisture, reduce runoff, and control erosion.

Most of the acreage is in hay, pasture, or woods. Row crops are grown in some of the less sloping areas. Many areas that were cultivated in the past are now in pasture or woods. This soil is not suited to row crops unless erosion is controlled. It is better suited to close-growing crops and trees. (Capability unit IVe-7; woodland group 3r2; wildlife group 1; shrub and vine group 2; recreation group 3)

Oshtemo Series, Dark Variant

The Oshtemo series, dark variant, consists of well-drained, nearly level to sloping, loamy soils. These soils are underlain by stratified sand and gravel at depths ranging from 40 to 60 inches. They are on outwash plains and terraces. These soils are not saturated for periods long enough to affect crop growth.

In a representative profile, the surface layer is about 16 inches thick. It is very dark brown sandy loam in the upper part and very dark grayish-brown sandy loam in the lower part. The subsoil is about 29 inches thick. It is dark yellowish-brown, friable heavy sandy loam in the upper part and brown, very friable and loose loamy sand in the lower part. The substratum is light yellowish-brown, calcareous, stratified sand and gravel and is at a depth of about 45 inches.

These soils can hold about 3 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid. The root zone is deep. Natural fertility is moderate.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Oshtemo sandy loam, dark variant, 2 to 6 percent slopes, in a cultivated field, 400 feet south of U. S. Highway No. 14 and 50 feet west of line fence, NE¼NW¼NE¼ sec. 17, T. 3 N., R. 12 E.:

Ap—0 to 9 inches, very dark brown (10YR 2/2) sandy loam; weak, fine, granular structure; very friable; neutral; clear, smooth boundary.

A12—9 to 16 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, granular structure; very friable; neutral; clear, smooth boundary.

B2t—16 to 23 inches, dark yellowish-brown (10YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; thin patchy clay films on ped faces; slightly acid; clear, smooth boundary.

B31—23 to 29 inches, brown (7.5YR 4/4) loamy sand; weak, fine, subangular blocky structure; very friable; medium acid; clear, smoothy boundary.

B32—29 to 34 inches, brown (7.5YR 5/4) loamy sand; weak, fine, subangular blocky structure, breaking to single grain; very friable; medium acid; clear, smooth boundary.

B33—34 to 45 inches, brown (7.5YR 5/4) loamy sand; single grain; loose; dolomite pebbles; neutral; clear, smooth boundary.

C—45 to 60 inches, light yellowish-brown (10YR 6/4), stratified sand and gravel; single grain; loose; calcareous.

Depth to underlying sand and gravel ranges from 40 to 60 inches. The A horizon ranges from 11 to 18 inches in thickness. It is very dark brown, very dark grayish brown, or dark brown. The B1 horizon is 0 to 10 inches thick. Where present, it is brown or dark yellowish brown. The B2t horizon is sandy loam or light sandy clay loam and ranges from 5 to 20 inches in thickness. It is dark yellowish brown or brown. In the lower part of the solum in some areas, the Bt horizon is in layers that are 1 to 4 inches thick and are separated by B3 horizon material. The B3 horizon is dark yellowish brown, yellowish brown, or brown and ranges from 4 to 20 inches in thickness. It is sandy loam or loamy sand and contains 5 to 30 percent gravel. The C horizon is pale brown or light yellowish brown.

Oshtemo soils, dark variant, are associated with Lorenzo, Oshtemo, and Warsaw soils. They have a thicker, darker colored surface layer than normal Oshtemo soils. Oshtemo soils, dark variant, are coarser textured and have a deeper solum than Warsaw and Lorenzo soils.

Oshtemo sandy loam, dark variant, 0 to 2 percent slopes (OsA).—This nearly level soil is on outwash plains and terraces. The areas are generally 5 to 75 acres in size and irregular in shape. The profile of this soil is about 10 inches thicker than the one in the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett, Dickman, Oshtemo, and Warsaw soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the lower part of the subsoil is mottled. Also included were small areas of gently sloping soils and areas where the solum is less than 40 inches thick. Small areas that have a loamy sand surface layer and areas where the sand and gravel outwash is underlain by glacial till or lacustrine silt and fine sand also were included.

This Oshtemo soil is subject to soil blowing. Crop growth during most seasons is limited by low available water capacity. This soil is well suited to irrigation.

Most of the acreage is used for crops. This soil is suited to all the farm crops commonly grown in the county. By using supplemental irrigation, fertilization, and protection from soil blowing, this soil is suitable for intensive production of vegetable crops. (Capability unit IIIs-4; woodland group 4o1; wildlife group 4; shrub and vine group 2; recreation group 3)

Oshtemo sandy loam, dark variant, 2 to 6 percent slopes (OsB).—This gently sloping soil is on low ridges and knobs on outwash plains and terraces. The areas are generally 20 to 200 acres in size and elongated in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Billett, Dickman, Oshtemo, and Warsaw soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil, and in some areas the lower part of the subsoil is mottled. Also included were small areas of nearly level and sloping soils and moderately eroded areas where the dark-colored surface layer is thinner than the one in this soil. In some areas the solum is less than 40 inches thick. Small areas that have a loamy sand surface layer and areas were the sand and gravel outwash is underlain by glacial till or lacustrine silt and fine sand also were included.

This Oshtemo soil is slightly susceptible to erosion and is subject to soil blowing. Crop growth during most seasons is limited by low available water capacity. Management practices are needed that improve tilth, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. This soil is suited to all the farm crops commonly grown in the county. It is suited to irrigation, especially in less sloping areas. If irrigated, fertilized, and protected from soil blowing, this soil is suitable for intensive production of vegetable crops. (Capability unit IIIs-4; woodland group 4o1; wildlife group 4; shrub and vine group 2; recreation group 3)

Oshtemo sandy loam, dark variant, 6 to 12 percent slopes, eroded (OsC2).—This sloping soil is on low ridges and knobs on outwash plains and on terraces adjacent to the steeper uplands. The areas are generally 5 to 40 acres in size and elongated in shape. This soil is about 5 inches thinner than the soil having the profile described as representative for the series. In addition, the dark-colored surface layer is not so thick as the one in that soil.

Included with the soil in mapping were small areas of Billett, Dickman, Oshtemo, and Warsaw soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the lower part of the subsoil is mottled. Also included were small areas of gently sloping and moderately steep soils and uneroded areas. Small severely eroded areas where nearly all of the original surface layer has been removed by erosion and areas that have considerable gravel in the surface layer also were included. In some areas the solum is less than 40 inches thick. Small areas that have a loamy sand surface layer and areas where the sand and gravel outwash is underlain by glacial till or lacustrine silt and fine sand also were included. A few small areas are underlain by bedrock at depths below 5 feet.

This Oshtemo soil is moderately susceptible to erosion and is subject to soil blowing. Crop growth during most seasons is limited by low available water capacity. Management practices are needed to improve tilth, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops, but some areas are wooded. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-7; woodland group 4o1; wildlife group 4; shrub and vine group 2; recreation group 3)

Otter Series

The Otter series consists of deep, poorly drained, nearly level, silty soils that formed in alluvium on flood plains. Ground water is at or near the surface throughout the year unless this soil is drained.

In a representative profile, the surface layer is black silt loam about 34 inches thick. The substratum is black, stratified sandy loam and loam and is at a depth of about 34 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. Depth of the root zone is limited by the water table. Natural fertility is moderate.

Where these soils are drained and protected from flooding, they are used for corn and pasture. Undrained areas and areas not protected from flooding are used for unimproved pasture and wildlife habitat.

Representative profile of Otter silt loam in a pasture, 100 feet southeast of where the east fork of Raccoon Creek crosses Paddock Road, SW¼NW¼SW¼ sec. 29, T. 1 N., R. 12 E.:

A11—0 to 8 inches, black (10YR 2/1) silt loam; few, fine, faint, brown (7.5YR 4/4) mottles; moderate, medium, granular structure and weak, fine, subangular blocky structure; very friable; moderately alkaline; clear, wavy boundary.

A12—8 to 26 inches, black (N 2/0) silt loam; many, medium, distinct, yellowish-red (5YR 5/8) mottles; weak, medium, subangular blocky structure; very friable; mildly alkaline; abrupt, smooth boundary.

A13—26 to 34 inches, black (N 2/0) silt loam; few, fine, faint, brown (7.5YR 4/4) mottles; weak, medium, subangular blocky structure; very friable; moderately alkaline; gradual, wavy boundary.

IICg—34 to 60 inches, black (10YR 2/1), stratified sandy loam and loam; massive; very friable; 1/4- to 1/2-inch bands of light brownish-gray (2.5Y 6/2) sand; organic bands 1 to 3 inches thick; moderately alkaline.

The thickness of the A horizon and the solum ranges from 24 to 40 inches. The surface layer is black, very dark brown, or very dark gray.

Otter soils are associated with Mahalasville and Millington soils. Otter soils lack the well-defined subsoil of the Mahalasville soils. They are not calcareous as are the Millington soils.

Otter silt loam (0 to 2 percent slopes) (Ot).—This nearly level soil occurs in elongated tracts, generally more than 20 acres in size, along stream flood plains.

Included with this soil in mapping were small areas of Elburn, Mahalasville, and Millington soils. Also included were small areas that have an organic surface layer, areas in which the solum is dominantly silty clay loam, areas that are well drained, and areas that have sandy layers in the alluvial material.

This Otter soil is poorly drained and is subject to flooding and ponding during wet periods and after heavy rain. Surface and tile drainage are used to remove excess water rapidly.

Where drained and protected from flooding, this soil is used for corn and pasture. Undrained areas are suitable for unimproved pasture and for wildlife habitat. (Capability unit IIw-1; woodland group 4w2; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Palms Series

The Palms series consists of very poorly drained muck soils underlain by a loamy material at depths of 16 to 45 inches. These nearly level soils are on flood plains, on low terraces, and in slight depressional areas. Ground water is at or near the surface throughout the year unless this soil is drained.

In a representative profile, the organic layer is black muck about 24 inches thick. The upper part of the underlying material is dark-gray and gray, firm silt loam and loam. The middle part is gray, friable sandy clay loam. The lower part is gray, very friable loamy sand and extends to a depth of at least 60 inches. The underlying material is moderately alkaline throughout.

These soils can hold about 13 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid in the muck and moderate in the substratum. Depth of the root zone is limited by the water table. Natural fertility is low.

Drained areas of these soils are used for corn and pasture. Undrained areas are too wet to be farmed and are used for unimproved pasture and wildlife habitat.

Representative profile of Palms muck, 525 feet west of State Route 213, NE¼NE¼SW¼ sec. 34, T. 4 N., R. 10 E.:

Oa1—0 to 8 inches, black (N 2/0) sapric material; trace of herbaceous fibers where not rubbed; weak, medium, granular structure and weak, medium, subangular blocky structure; nonsticky; few rounded quartz grains; neutral; clear, smooth boundary.

Oa2—8 to 15 inches, black (N 2/0) sapric material; trace of herbaceous fibers where not rubbed; massive; nonsticky; few rounded quartz grains; neutral; clear, smooth boundary.

Oa3—15 to 19 inches, black (N 2/0) sapric material; about 5 percent herbaceous fibers where not rubbed; massive; nonsticky; few rounded quartz grains; neutral; abrupt, smooth boundary.

Oa4—19 to 24 inches, black (10YR 2/1) sapric material; about 15 percent herbaceous fibers where not rubbed; massive; nonsticky; neutral; abrupt, smooth boundary.

IIC1g—24 to 30 inches, dark-gray (10YR 4/1) silt loam; massive; firm; few roots and pebbles; moderately alkaline; clear, smooth boundary.

IIC2g—30 to 45 inches, gray (5Y 5/1) loam; massive; firm; few roots and pebbles; moderately alkaline; gradual, wavy boundary.

IIC3g—45 to 50 inches, gray (5Y 5/1) sandy clay loam; few, medium, distinct, yellowish-brown (10YR 5/4) mottles and few, fine, prominent, light-gray (10YR 7/1) mottles; massive; friable; few pebbles; moderately alkaline; calcareous; clear, wavy boundary.

IIIC4g—50 to 60 inches, gray (5Y 6/1) loamy sand; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; massive; very friable; few pebbles; moderately alkaline; calcareous.

The organic layer ranges from 16 to 45 inches in thickness. Immediately above its contact with the loamy mineral, the organic layer normally has a comparatively high mineral content that can amount to as much as 50 percent of the volume.

Palms soils are associated with Adrian, Houghton, and Rollin soils. Palms soils have a finer textured substratum than do Adrian soils. Palms soil lack the marl substratum of Rollin soils. The organic layer in Palms soils is thinner than that in Houghton soils.

Palms muck(0 to 2 percent slopes)(Pa).—This nearly level soil occurs in elongated tracts along the smaller flood plains and in irregular areas on larger flood plains and in old lake basins. It is commonly between areas of Houghton soils and surrounding mineral soils derived from till.

Included with this soil in mapping were small areas of Adrian, Brookston, Houghton, Mahalasville, and Otter soils. Also included were areas that have only 12 to 16 inches of muck over loamy material, areas that have loamy and clayey mineral strata in the muck layer, areas that have slopes of as much as 4 percent, and areas that have silty overwash. Areas that have 16 to 40 inches of silty overwash are indicated on the soil map by the symbol for silty overwash.

Palms muck is generally ponded during wet periods and after heavy rain. Surface drainage is used to dispose of excess water rapidly. This soil is also suitable for tile drainage. Cultivated areas are subject to soil blowing and burning. If the water table is lowered excessively, organic matter decomposes very rapidly in cultivated areas and subsidence becomes a problem.

Where drained, this soil is used for pasture and corn and is suited to certain vegetable crops, such as beets and carrots. (Capability unit IIw-8; woodland group 5w3; wildlife group 6; not placed in a shrub and vine group; recreation group 8)

Pecatonica Series

The Pecatonica series consists of well drained and moderately well drained, nearly level to sloping, loamy soils that are deep and are underlain by gravelly sandy loam glacial till. In some places these soils are saturated with water at depths of 3 to 5 feet in wet periods.

In a representative profile, the surface layer is dark grayish-brown silt loam about 10 inches thick. The subsoil is about 56 inches thick. It is dark-brown and dark yellowish-brown, firm silty clay loam in the upper part; dark-brown, very firm and firm clay loam in the middle part; and dark-brown, firm light sandy clay loam in the lower part. The substratum is yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 66 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Pecatonica silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 30 feet east of street and 250 feet south of fence line on the southeast edge of Shopiere, SE¼NE¼SE¼ sec. 3, T. 1 N., R. 13 E.:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; neutral; abrupt, smooth boundary.

B21t—10 to 18 inches, dark-brown (10YR 4/3) silty clay loam; weak, fine, subangular blocky structure; firm; thin patchy clay films on ped faces; neutral; clear, smooth boundary.

B22t—18 to 28 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; firm; thin patchy clay films on ped faces; neutral; clear, smooth boundary.

IIB23t—28 to 36 inches, dark-brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; very firm; thin, continuous, dark reddish-brown (5YR 2/2) clay films on ped faces; medium acid; clear, smooth boundary.

IIB24t—36 to 43 inches, dark-brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; reddish-brown (5YR 4/3) clay films on ped faces; slightly acid; clear, smooth boundary.

IIB3—43 to 66 inches, dark-brown (7.5YR 4/4) light sandy clay loam; weak, medium, subangular blocky structure; firm; clay bridging between sand grains; slightly acid; clear, smooth boundary.

IIC—66 to 80 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; very friable; calcareous.

Depth to the underlying calcareous gravelly sandy loam till ranges from 48 to 80 inches. The silty mantle ranges from 15 to 25 inches in thickness. The Ap horizon ranges from 6 to 10 inches in thickness and is dark gray, dark grayish brown, or dark brown. Where these soils have not been cultivated, the A1 horizon is silt loan and is black, very dark gray, very dark grayish brown, or dark brown. It ranges from 3 to 5 inches in thickness. In uncultivated areas the A2 horizon is silt loam, ranges from 4 to 9 inches in thickness, and is brown or grayish brown. The B2t horizons are silty clay loam or heavy silt loam and range from 5 to 28 inches in thickness. They are brown, dark brown, dark yellowish brown, or yellowish brown. The IIB2t horizons are clay loam or sandy clay loam and range from 13 to 40 inches in thickness. They are dark brown, dark yellowish brown, reddish brown, or yellowish red. The IIB3 horizon is sandy clay loam or sandy loam and ranges from 4 to 33 inches in thickness. It is brown, dark brown, or dark yellowish brown. Profiles that lack base colors having a hue of 5YR in some part of the B horizon have clay films of that hue. Mottles occur in the lower subsoil in some profiles.

Pecatonica soils are associated with Durand, Flagg, and Westville soils. Pecatonica soils have a lighter colored or thinner, dark-colored surface layer than Durand soils. They have less sand in the upper part of the subsoil than Westville soils. They have a thinner silty mantle than Flagg soils.

Pecatonica silt loam, 0 to 2 percent slopes (PeA).—This nearly level soil is on till plains and on broad, till-covered ridgetops and valley floors in areas where bedrock is relatively shallow. The areas are generally less than 50 acres in size and irregular in shape. The profile of this soil is about 3 inches thicker than the profile described as representative for the series. In addition, the surface layer is thicker.

Included with this soil in mapping were small areas of Durand, Flagg, Kidder, and Westville soils. In some areas the surface layer is darker colored than the one in the soil having the profile described as representative for the series, and in drainageways and depressions the surface layer is thicker and darker colored than in that soil. In some areas the subsoil is mottled. In some included areas the soil has a silty mantle up to 36 inches thick. Also included were areas where the subsoil is more sandy than the one in the soil having the representative profile and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by stratified silt and sand, sand, sand and gravel, or dolomite bedrock, rather than glacial till. Also included were some small areas of gently sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam.

This Pecatonica soil has few limitations and can be cultivated intensively if management practices are used to supply regular additions of organic matter and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Pecatonica silt loam, 2 to 6 percent slopes, eroded (PeB2).—This gently sloping soil is on till plains and on broad, till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The areas are irregular in shape and range from 20 to more than 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Flagg, Kidder, Westville, and Whalan soils. In some areas the surface layer is darker colored than the one in this soil, and in drainageways and depressions the surface layer is thicker and darker colored than in this soil. In some areas the subsoil is mottled. Substantial areas have a silty mantle up to 36 inches thick. Also included were areas where the subsoil is more sandy than the one in this soil, and areas where the subsoil is less red than in this soil. In some areas this soil is underlain by stratified silt and sand, sand, sand and gravel, or dolomite bedrock, rather than glacial till. Also included were some small areas of nearly level and sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This Pecatonica soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Pecatonica silt loam, 6 to 12 percent slopes, eroded (PeC2).—This sloping soil is on till plains and on till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The profile of the areas generally are less than 30 acres in size and are irregular in shape. This soil is about 10 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Flagg, Kidder, Westville, and Whalan soils. In some areas the surface layer is darker colored than the one in the soil having the profile described as representative for the series. In addition, in drainageways and depressions the surface layer is thicker and darker colored than in that soil, and in some of these areas the subsoil is mottled. Substantial areas have a silty mantle up to 36 inches thick. Also included were areas where the subsoil is more sandy than the one in the soil having the representative profile, and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than glacial till. Also included were some small areas of gently sloping and moderately steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This Pecatonica soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Plano Series

The Plano series consists of well drained and moderately well drained, nearly level to sloping, silty soils that are deep and are underlain by calcareous gravelly sandy loam glacial till or stratified sand and gravel. Some of these soils are saturated with water at depths of 3 to 5 feet during wet periods.

In a representative profile, the surface layer is about 14 inches thick (fig. 23). It is black silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The subsoil is about 46 inches thick. It is dark-brown, friable and firm silt loam in the upper part; dark yellowish-brown, firm sandy clay loam in the middle part; and yellowish-brown, friable sandy clay loam in the lower part. The substratum is brown, calcareous gravelly sandy loam and is at a depth of about 60 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

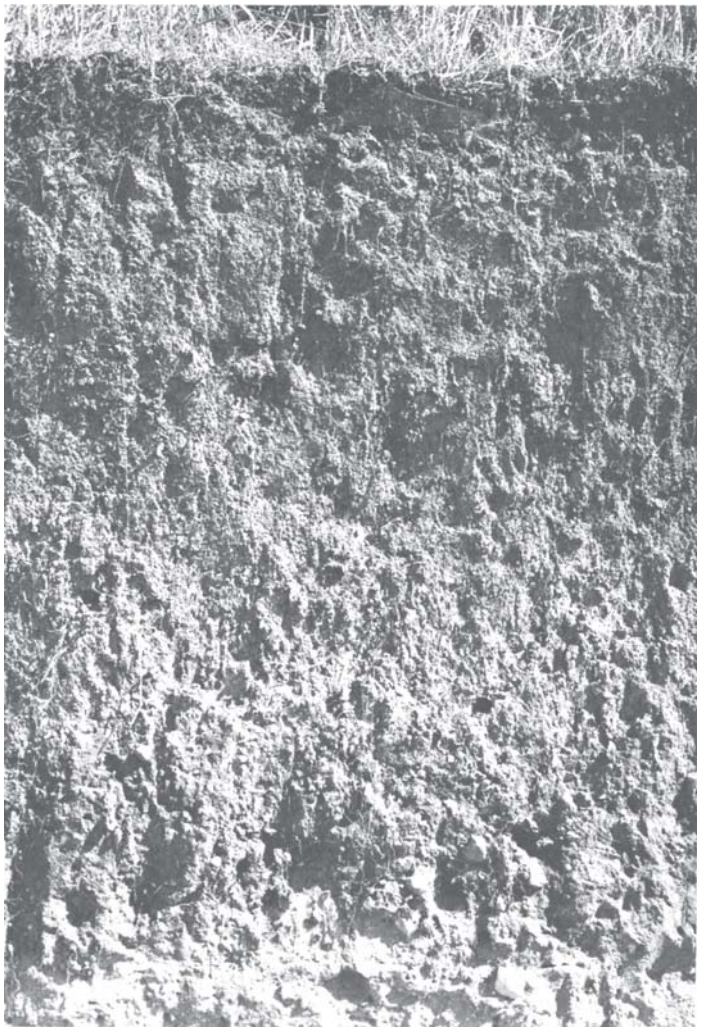

Figure 23.—Profile of a Plano soil that is underlain by gravelly sandy loam glacial till at a depth of about 60 inches.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Plano silt loam, 2 to 6 percent slopes, in a cultivated field, 45 feet north of Townhall Road and 330 feet west of railroad intersection with Townhall Road, SW¼SE¼SW¼ sec. 16, T. 2 N., R. 14 E.:

Ap—0 to 10 inches, black (10YR 2/1) silt loam; moderate, medium, subangular blocky structure; friable; mildly alkaline; abrupt, smooth boundary.

A3—10 to 14 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B1—14 to 20 inches, dark-brown (10YR 3/3) silt loam; moderate, fine and very fine, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B21t—20 to 44 inches, dark-brown (10YR 4/3) heavy silt loam; medium, fine and very fine, subangular blocky structure; firm; clay films on some ped faces; clay flows in pores and channels; neutral; clear, smooth boundary.

IIB22t—44 to 50 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; weak, medium, subangular blocky structure; firm; black (10YR 2/1) clay films on some ped faces; clay flows in pores and channels; neutral; clear, smooth boundary.

IIB3t—50 to 60 inches, yellowish-brown (10YR 5/4) light sandy clay loam; weak, medium, subangular blocky structure; friable; black (10YR 2/1) and dark yellowish-brown (10YR 4/4) clay films on some ped faces; clay flows in pores and channels; moderately alkaline; gradual, smooth boundary.

IIC—60 to 75 inches, brown (10YR 5/3) gravelly sandy loam; massive; very friable; calcareous.

Depth to calcareous gravelly sandy loam till or stratified sand and gravel ranges from 48 to 65 inches. The silty mantle ranges from 40 to 60 inches in thickness, and the dark-colored surface layer and subsoil range from 10 to 24 inches in thickness. The A horizon ranges from 10 to 20 inches in thickness. It is very dark grayish brown, black, very dark brown, or very dark gray. The B1 horizon ranges from 5 to 12 inches in thickness. The B2t horizon is silty clay loam or heavy silt loam and ranges from 20 to 35 inches in thickness. It is dark brown or dark yellowish brown. The IIBt horizon is sandy clay loam, sandy loam, clay loam, or loam and ranges from 5 to 18 inches in thickness. It is brown, yellowish brown, or dark yellowish brown. The IIC horizon is brown or yellowish brown. Mottles occur in the lower part of the subsoil and the substratum in some profiles.

Plano soils are associated with Elburn, Ogle, and Ringwood soils and Plano soils, loamy variant. Plano soils have a thicker silty mantle than Ringwood soils. They are not so red in the lower part of the B horizon and are not so deeply weathered into the till as the Ogle soils. Plano soils are better drained than Elburn soils. Plano soils are less sandy in the surface layer and upper part of the subsoil than Plano soils, loamy variant.

Plano silt loam, 0 to 2 percent slopes (PlA).—This nearly level soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 10 to more than 100 acres in size. This soil has a silty mantle that is about 10 inches thicker than the soil having the profile described as representative for the series.

Included with this soil in mapping were small areas of Elburn, Ogle, Ringwood, and St. Charles soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Some areas have a silty mantle more than 60 inches thick. In some areas this soil is underlain by dolomite bedrock or sand and gravel outwash. Also included were some small areas of gently sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam.

This Plano soil has few limitations and can be cultivated intensively if management practices are used to supply regular additions of organic matter and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-3; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Plano silt loam, 2 to 6 percent slopes (PlB).—This gently sloping soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 10 to more than 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Elburn, Ogle, Ringwood, Rockton, and St. Charles soils. In drainageways and depressions the surface layer is thicker than in the one in this soil, and in some areas the subsoil is mottled. Some areas have a silty mantle that is more than 60 inches thick, and in some areas this soil is underlain by dolomite bedrock or sand and gravel outwash. Also included were moderately eroded areas and small areas of sloping and nearly level soils. In some small areas the underlying till has a texture of silt loam, loam, or clay loam.

This Plano soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Plano silt loam, 6 to 12 percent slopes, eroded (PlC2).—This sloping soil is on till plains and on lower side slopes in areas where bedrock is relatively shallow. The areas are generally elongated in shape and range from 5 to 40 acres in size. In a profile of this soil, the surface layer is about 4 inches thinner and the solum is about 8 inches thinner than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Ogle, Ringwood, Rockton, and St. Charles soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. In some areas this soil is underlain by dolomite bedrock. Also included were some small areas of gently sloping and moderately steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This Plano soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Plano silt loam, gravelly substratum, 0 to 2 percent slopes (PmA).—This nearly level soil is on outwash plains. The areas are generally large and range up to several thousand acres in size and are irregular in shape. This soil differs from the soil that has the profile described as representative for the series in having a substratum consisting of rapidly permeable sand and gravel at a depth of 48 to 65 inches (fig. 24).

Included with this soil in mapping were small areas of Plano, St. Charles, Warsaw, and Plano, loamy variant, soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. In some areas the silty mantle ranges from 20 to 36 inches in thickness, and in other areas it is more than 65 inches thick. Also included were areas where the lower part of the subsoil is sandy and lacks an appreciable content of gravel. Small areas that are underlain by stratified silt and fine sand at a depth of less than 40 inches, or bedrock below a depth of 5 feet, and areas of gently sloping soils also were included. Some areas have only an 8- to 10-inch, dark-colored surface layer.

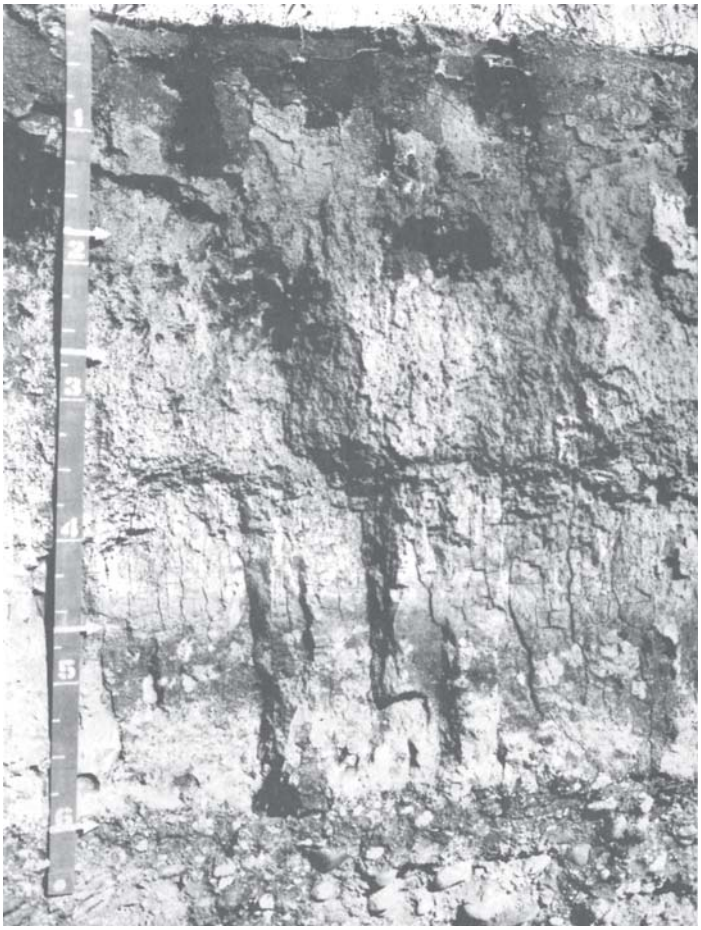

Figure 24.—Profile of a Plano soil that has a gravelly substratum. This soil is underlain by sand and gravel at some depth between 48 and 65 inches.

This Plano soil has few limitations and can be cultivated intensively if management practices are used to supply regular additions of organic matter and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-3; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Plano silt loam, gravelly substratum, 2 to 6 percent slopes (PmB).—This gently sloping soil is on low ridges and knobs and along natural drainageways an outwash plains and terraces. The areas are generally 10 to 40 acres in size and elongated in shape. This soil differs from the soil that has the profile described as representative for the series in having a substratum consisting of rapidly permeable sand and gravel at a depth of 48 to 65 inches.

Included with this soil in mapping were small areas of Plano, St. Charles, and Warsaw soils and Plano soils, loamy variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. In some areas the silty mantle ranges from 20 to 36 inches in thickness, and in other areas it is more than 65 inches thick. Also included were areas where the lower part of the subsoil is sandy and lacks appreciable gravel content. Small included areas are underlain by stratified silt and fine sand at a depth of less than 40 inches, or have bedrock below a depth of 5 feet. Also included were areas of nearly level and sloping soils. Some areas have a dark-colored surface layer only 8 to 10 inches thick.

This Plano soil is slightly susceptible to erosion. Management practices are needed that reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Plano Series, Loamy Variant

The Plano series, loamy variant, consists of deep, well drained and moderately well drained, nearly level and gently sloping soils. These soils are loamy and are underlain by stratified sand and gravel at depths ranging from 40 to 76 inches. They are on outwash plains and terraces. In some areas these soils are saturated with water at depths of 3 to 5 feet in wet periods.

In a representative profile, the surface layer is about 16 inches thick. It is black loam in the upper part and very dark gray and very dark grayish-brown loam in the lower part. The subsoil is about 50 inches thick. It is dark yellowish-brown, friable loam and firm heavy loam in the upper part; yellowish-brown, friable silt loam in the middle part; and brown, friable sandy clay loam in the lower part. The substratum is light yellowish-brown, calcareous sand and gravel and is at a depth of about 66 inches.

These soils can hold about 12 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate in the subsoil and rapid in the substratum. The root zone is deep. Natural fertility is high.

Most areas of these soils are used for corn, soybeans, small grains, and other crops commonly grown in the county.

Representative profile of Plano loam, loamy variant, 2 to 6 percent slopes, in a cultivated field, 225 feet west of barn, NW¼NW¼SE¼ sec. 35, T. 2 N., R. 13 E.:

Ap—0 to 8 inches, black (10YR 2/1) loam; weak, fine, subangular blocky structure; very friable; mildly alkaline; abrupt, smooth boundary.

A12—8 to 11 inches, very dark gray (10YR 3/1) loam; weak, fine, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

A13—11 to 16 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B1—16 to 25 inches, dark yellowish-brown (10YR 4/4) loam; weak, medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—25 to 31 inches, dark yellowish-brown (10YR 4/4) heavy loam; moderate, medium, subangular blocky structure; firm; discontinuous clay films on ped faces and in pores; slightly acid; clear, smooth boundary.

IIB22t—31 to 45 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; discontinuous clay films on ped faces and in some pores; friable; slightly acid; clear, smooth boundary.

IIB23t—45 to 59 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, faint, brownish-yellow (10YR 6/6) mottles; moderate, medium, subangular blocky structure; discontinuous clay films on ped faces and in some pores; friable; slightly acid; clear, smooth boundary.

IIIB3t—59 to 66 inches, brown (10YR 4/3) sandy clay loam; common, medium, faint, very dark grayish-brown (10YR 3/2) mottles; weak, medium, subangular blocky structure; clay bridges between sand grains; friable; moderately alkaline; abrupt, smooth boundary.

IVC—66 to 72 inches, light yellowish-brown (10YR 6/4) sand and gravel; single grain; loose; calcareous.

Depth to underlying sand and gravel ranges from 40 to 76 inches. The A horizon ranges from 10 to 16 inches in thickness. It is very dark grayish brown, black, very dark brown, or very dark gray. The B1 horizon is sandy loam, loam, or clay loam and ranges from 4 to 10 inches in thickness. It is brown or dark yellowish brown. The B2t horizon is heavy loam, clay loam, or sandy clay loam and ranges from 4 to 24 inches in thickness. It is dark yellowish brown or brown. The IIBt horizon is silt loam or silty clay loam and ranges from 15 to 40 inches in thickness. It is yellowish brown, pale brown, or light yellowish brown. The IIIB horizon is sandy clay loam or clay loam and ranges from 4 to 9 inches in thickness. It is brown or dark brown. The IVC horizon is light yellowish brown, yellowish brown, or very pale brown.

Plano soils, loamy variant, are associated with Jasper and normal Plano soils. These loamy variants are more sandy in the surface layer and upper part of the subsoil than normal Plano soils.They are underlain by stratified sand and gravel, but Jasper soils are underlain by stratified silt and fine sand.

Plano loam, loamy variant, 0 to 2 percent slopes (PnA).—This nearly level soil is on outwash plains and terraces. The areas are generally 10 to 80 acres in size and irregular in shape. The profile of this soil is about 5 inches thicker than the profile described as representative for the series.

Included with this soil in mapping were small areas of Jasper, Plano, and Warsaw soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Also included were small areas that have a silt loam or sandy loam surface layer and areas that are more sandy throughout the upper part of the subsoil than the soil in the profile described as representative. In some areas the lower part of the subsoil is silt. Other inclusions are small areas of gently sloping soils, areas where the dark-colored surface layer is only 6 to 10 inches thick, and areas underlain by glacial till or stratified silt and fine sand below a depth of 42 inches.

This Plano soil has few limitations and can be cropped intensively if management practices are used to return organic matter to the soil and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 2)

Plano loam, loamy variant, 2 to 6 percent slopes (PnB).—This gently sloping soil is on low ridges and knobs and along natural drainageways on outwash plains and terraces. The areas are generally 10 to 40 acres in size and irregular in shape. Areas along natural drainageways are elongated in shape. This soil has the profile described as representative for the Plano series, loamy variant.

Included with this soil in mapping were small areas of Jasper, Plano, and Warsaw soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil, and in some areas the subsoil is mottled. Also included were small areas that have a silt loam or sandy loam surface layer and areas that are more sandy throughout the upper part of the subsoil than this soil.

The lower part of the subsoil in some areas is silt. Other inclusions are small areas of nearly level and sloping soils, moderately eroded areas, and areas where the dark-colored surface layer is only 6 to 10 inches thick. Some areas are underlain by glacial till or stratified silt and fine sand below a depth of 42 inches.

This Plano soil is slightly susceptible to erosion. Management practices are needed that reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 2)

Ringwood Series

The Ringwood series consists of well-drained, gently sloping and sloping, loamy soils that are deep and are underlain by calcareous gravelly sandy loam glacial till. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is about 14 inches thick. It is very dark brown silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The subsoil is about 18 inches thick. It is dark-brown, friable light silty clay loam in the upper part; brown, firm silty clay loam in the middle part; and dark yellowish-brown, firm clay loam in the lower part. The substratum is yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 32 inches.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is moderate.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Ringwood silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 300 feet west of Carvers Rock Road and about 450 feet south of fence line, NE¼SE¼SE¼ sec. 4, T. 1 N., R. 14 E.:

Ap—0 to 10 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; friable; moderately alkaline; abrupt, smooth boundary.

A3—10 to 14 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; neutral; clear, wavy boundary.

B1—14 to 21 inches, dark-brown (10YR 3/3) light silty clay loam; weak, medium, subangular blocky structure; friable; slightly acid; clear, wavy boundary.

B21t—21 to 27 inches, brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; firm; thin discontinuous clay films on ped faces; slightly acid; clear, wavy boundary.

IIB22t—27 to 32 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; thin discontinuous clay films on most ped faces and in pores; neutral; clear, wavy boundary.

IIC—32 to 60 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; friable; calcareous.

Depth to calcareous gravelly sandy loam till ranges from 24 to 40 inches. The silty mantle ranges from 20 to 36 inches in thickness, and the dark-colored surface layer and subsoil range from 10 to 24 inches in thickness. The A horizon is 10 to 16 inches thick and is black, very dark brown, or very dark grayish brown. The B1 horizon is silt loam or silty clay loam and ranges from 3 to 18 inches in thickness. It is very dark grayish brown, dark brown, or dark yellowish brown. The B21t horizon ranges from 5 to 20 inches in thickness and is brown or dark yellowish brown. The IIB22t horizon is clay loam or sandy clay loam and ranges from 3 to 16 inches in thickness. It is brown or dark yellowish brown. The IIB3 horizon is 0 to 8 inches thick. Where present, it is brown sandy clay loam or sandy loam. The IIC horizon contains from 10 to 30 percent gravel, by volume. It is brown, yellowish brown, or brownish yellow.

Ringwood soils are associated with Griswold and Plano soils. Ringwood soils have a thinner silty mantle than Plano soils and a thicker silty mantle than Griswold soils.

Ringwood silt loam, 2 to 6 percent slopes, eroded (RnB2).—This gently sloping soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 10 to more than 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Griswold, Kidder, and Plano soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some areas the subsoil is mottled. In some areas this soil is underlain by stratified silt and fine sand, sand and gravel, or dolomite bedrock. Also included were some small areas of nearly level and sloping soils and some small areas where the texture of the underlying till is silt loam, loam, or clay loam. Other inclusions were eroded areas where most of the original surface layer has been removed by erosion.

This Ringwood soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

This soil is used mainly for crops. It is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Ringwood silt loam, 6 to 12 percent slopes, eroded (RnC2).—This sloping soil is on till plains and on the lower side slopes in areas where bedrock is relatively shallow. The areas are generally elongated in shape and range from 5 to 40 acres in size. The profile of this soil has a surface layer that is about 3 inches thinner and a solum that is about 4 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Griswold, Kidder, and Plano soils. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. In some small areas this soil is underlain by dolomite bedrock, stratified silt and fine sand, or sand and gravel. Also included were some small areas of gently sloping and moderately steep soils and some small areas where the texture of the underlying till is silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This Ringwood soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage of this soil is used for crops. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Rock Land

Rock land (6 to 45 percent slopes) (Ro) consists of sloping to very steep, well-drained to excessively drained areas that are shallow over bedrock (fig. 25). The areas generally contain many bedrock outcrops. They are generally underlain by dolomite bedrock on the upper one-third of the slope and by sandstone bedrock on the lower part. These areas are

Figure 25.—Area of Rock land that has fragments of rock on the surface and scattered throughout the soil material. In some places bedrock crops out at the surface.

long, narrow breaks in the deeply dissected bedrock uplands. Rock land ranges from silt loam to sand and has fragments of sandstone and dolomite on the surface and throughout the profile.

Included with this land type in mapping were areas of Edmund, Eleva, Rockton, Sogn, and Whalan soils. Also included were deep, sandy deposits on the lower part of the slopes in many places.

These areas are not suitable for cultivation, because of stoniness and very steep slopes. Runoff is very rapid, and this land type is severely susceptible to erosion. Some areas are grazed, although Rock land is not suited to that purpose. The areas are subject to gullying if runoff is allowed to concentrate in trails made by cattle. Because of these hazards, most areas are wooded. They are suitable for wildlife habitat and recreation. (Capability unit VIIs-5; woodland group 4f1 and 4r1; wildlife group 8; shrub and vine group 2; recreation group 11)

Rockton Series

The Rockton series consists of well-drained, gently sloping to moderately steep, loamy soils that are underlain by dolomite bedrock at depths ranging from 20 to 40 inches. The subsoil formed mainly in weathered glacial till, but in some areas the lower part of the subsoil formed in clayey residuum from weathered dolomite. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark brown loam about 10 inches thick (fig. 26). The subsoil is about 17 inches thick. It is dark-brown, friable heavy loam in the upper part and dark yellowish-brown, firm clay loam in the lower part. The underlying dolomite is pale yellow, calcareous, fragmentary, and creviced and is at a depth of about 27 inches.

These soils can hold about 5 inches of water available to plants between the surface and the depth to bedrock. Permeability is moderate. The depth of the root zone is generally limited by the dolomite, but some roots extend into crevices that are filled with subsoil material. Natural fertility is moderate.

Most areas of gently sloping and sloping Rockton soils are used for corn, small grains, legumes, and other crops commonly grown in the county. In most places the steeper soils are in pasture or woods.

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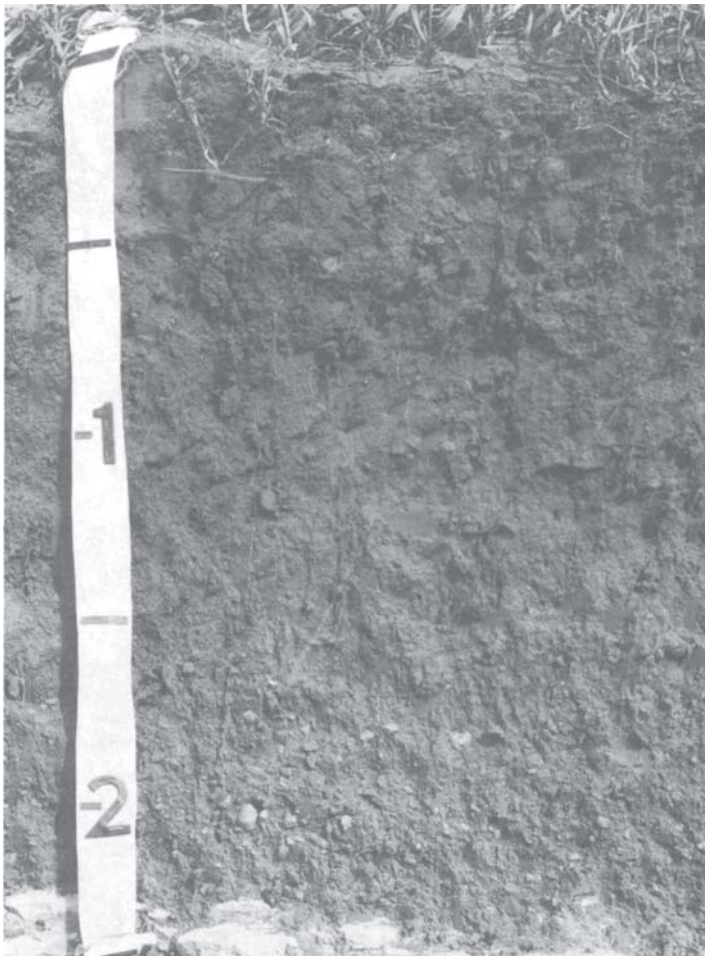

Figure 26.—Profile of a Rockton soil that is underlain by dolomite bedrock at a depth of about 27 inches.

Representative profile of Rockton loam, 2 to 6 percent slopes, 30 feet from edge of quarry about 200 feet east of Johnson Road, NW¼SW¼SW¼ sec. 6, T. 1 N., R. 12 E.:

Ap—0 to 10 inches, very dark brown (10YR 2/2) loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B21t—10 to 18 inches, dark-brown (10YR 3/3) heavy loam; moderate, fine, subangular blocky structure; friable; thin patchy clay films on ped faces; slightly acid; clear, smooth boundary.

I&IIB22t—18 to 27 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, fine, subangular blocky structure; firm; continuous clay films on ped faces; 10 percent gravel and chert fragments; slightly acid; abrupt, wavy boundary.

IIR—27 inches +, pale-yellow (2.5Y 8/4), fragmentary and creviced dolomite bedrock.

Depth to dolomite ranges from 20 to 40 inches. The Ap, or the A1, horizon is loam or silt loam and ranges from 7 to 10 inches in thickness. It is black or very dark brown. The A12 horizon is 0 to 8 inches thick. Where present, it is loam or silt loam and is very dark brown or very dark grayish brown. The B1 horizon is 0 to 6 inches thick. Where present, it is very dark grayish brown, dark brown, or dark yellowish brown. The B2t horizon is heavy loam or clay loam in the upper part and clay loam, silty clay, or clay in the lower part. It ranges from 12 to 22 inches in thickness and is dark yellowish brown, dark brown, or reddish brown. The content of coarse fragments ranges from 1 to 20 percent in the B2t horizon.

Rockton soils are associated with Edmund, Eleva, Sogn, and Whalan soils. Rockton soils have a thicker solum and are deeper to dolomite than the Sogn and Edmund soils. Rockton soils have a darker colored or thicker, dark-colored surface layer than do Whalan soils. Rockton soils are underlain by dolomite, but Eleva soils are underlain by sandstone.

Rockton loam, 2 to 6 percent slopes (RpB).—This gently sloping soil is on broad ridgetops and upper side slopes. The areas are generally 20 to 160 acres in size and are elongated in shape. In approximately 60 percent of the acreage, the surface layer is loam, and in 40 percent it is silt loam. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Edmund, Griswold, Sogn, and Whalan soils. Other inclusions are moderately eroded areas where the surface layer is lighter colored and more clayey than it is in uneroded areas. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil, and in some areas the subsoil is mottled. Also included were small areas that have a sandy loam surface layer and some areas where the silty mantle is more than 20 inches thick. In some areas the depth to dolomite ranges from 40 to 60 inches. Some small areas of slightly steeper soils also were included.

This Rockton soil has moderate permeability. It is slightly susceptible to erosion. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-2; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 10)

Rockton loam, 6 to 12 percent slopes, eroded (RpC2).—This sloping soil is on narrow ridgetops and side slopes. The areas are generally 15 to 100 acres in size and are elongated in shape. In approximately 60 percent of the acreage, the surface layer is loam, and in 40 percent it is silt loam. The profile of this soil is about 4 inches thinner than the profile described as representative for the series. In addition, the dark-colored surface layer is thinner and more clayey.

Included with this soil in mapping were small areas of Durand, Edmund, Griswold, Sogn, and Warsaw soils. Other inclusions are uneroded areas and some small severely eroded areas where almost all of the original surface layer has been removed by erosion. Other inclusions are small areas of gently sloping and moderately steep soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Also included were small areas that have a sandy loam surface layer and some areas where the silty mantle is more than 20 inches thick. Small areas that have bedrock at or near the surface are indicated on the soil map by the symbol for rock outcrop. In some areas the depth to dolomite ranges from 40 to 60 inches.

This Rockton soil has moderate permeability. It is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm crops commonly grown in the county. In the more sloping areas that have been damaged by past erosion, surface crusting commonly reduces the emergence of small-seeded crops, such as alfalfa. (Capability unit IIIe-2; wood-

land group 4o1; wildlife group 4; shrub and vine group 1; recreation group 10)

Rockton loam, 12 to 20 percent slopes, eroded (RpD2).—This moderately steep soil is on side slopes in bedrock areas that have been deeply incised by natural drainageways. Areas of this soil are generally 10 to 30 acres in size and are elongated in shape. In approximately 65 percent of the acreage, the surface layer is loam, and in 35 percent it is silt loam. The profile of this soil is about 6 inches thinner than the profile described as representative for the series, and the dark-colored surface layer is thinner and more clayey.

Included with this soil in mapping were small areas of Edmund, Griswold, Sogn, Whalan, and Warsaw soils. Other inclusions are uneroded areas that have never been cleared of trees and small, severely eroded areas where almost all of the original surface layer has been removed by erosion. Other inclusions are small areas of sloping and steep soils. Small areas that have bedrock at or near the surface are indicated on the soil map by the symbol for rock outcrop. In some areas the depth to dolomite ranges from 40 to 60 inches. In drainageways the surface layer is thicker and darker than the one in the soil having the representative profile.

This Rockton soil has very rapid runoff and is highly susceptible to erosion. Most of the acreage is in hay, pasture, or woods. Row crops are grown in some of the less sloping areas. Many areas that were cultivated in the past are now in pasture or are wooded.

This Rockton soil is better suited to close-growing crops or to woods than to row crops. It is not suited to row crops unless erosion is controlled. (Capability unit IVe-2; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 10)

Rodman Series

The Rodman series consists of excessively drained, sloping to very steep, loamy soils that are underlain by stratified sand and gravel at depths of 8 to 14 inches. These soils are on outwash plains and terraces. They are not saturated with water for periods long enough to affect crop growth. In Rock County these soils were mapped only with Lorenzo soils.

In a representative profile, the surface layer is very dark gray gravelly sandy loam about 5 inches thick. The subsoil is dark-brown, very friable gravelly sandy loam about 5 inches thick. The substratum is yellowish-brown, calcareous sand and gravel and is at a depth of about 10 inches.

These soils can hold about 3 inches of water available to plants between the surface and a depth of 5 feet. Permeability is rapid. The depth of the root zone is limited by sand and gravel. Natural fertility is low.

Many areas of these sloping soils are cultivated or have been cultivated in the past. Most areas that are moderately steep, steep, and very steep are in perennial pasture or woods or are used as wildlife habitat.

Representative profile of a Rodman gravelly sandy loam having slopes of 20 to 30 percent, in a wooded area 20 feet east of Britt Road and 30 feet south of driveway, NW¼NE¼SW¼ sec. 20, T. 3 N., R. 12 E.:

A1—0 to 5 inches, very dark gray (10YR 3/1) gravelly sandy loam; weak, medium, subangular blocky structure; very friable; mildly alkaline; abrupt, smooth boundary.

B—5 to 10 inches, dark-brown (10YR 4/3) gravelly sandy loam; weak, fine, subangular blocky structure; very friable; moderately alkaline; abrupt, smooth boundary.

C—10 to 60 inches, yellowish-brown (10YR 5/4) sand and gravel; single grain; loose; calcareous.

Depth to underlying sand and gravel ranges from 8 to 14 inches. The A horizon ranges from 4 to 6 inches in thickness and is very dark brown, very dark gray, or very dark grayish brown. The B horizon is gravelly or very gravelly loam or sandy loam and ranges from 4 to 8 inches in thickness. It is very dark grayish brown or dark brown. The C horizon is yellowish brown or light yellowish brown.

Rodman soils are associated with Casco and Lorenzo soils and Rotamer soils, thin variant. Rodman soils are shallower over sand and gravel than Casco or Lorenzo soils and lack the clayey subsoil of these soils. Rodman soils are underlain by stratified sand and gravel, but Rotamer soils, thin variant, are underlain by gravelly sandy loam till.

Rodman-Lorenzo complex, 6 to 12 percent slopes, eroded (RrC2).—The sloping soils in this complex are on low ridges and knobs and along natural drainageways on outwash plains and terraces. The areas are generally 5 to 20 acres in size and are long and narrow. About 55 percent of the acreage consists of Rodman gravelly sandy loam, and nearly 45 percent of Lorenzo loam.

The Rodman soils in this complex are about 2 inches thinner than the soil having the profile described as representative for the Rodman series. In addition, the surface layer is thinner, lighter colored, and more gravelly than the one in that soil. The Lorenzo soils in this complex have a surface layer about 7 inches thick. This layer is black loam in the upper part and very dark gray loam in the lower part. The underlying stratified sand and gravel is at a depth of 15 inches.

Included with this complex in mapping were small areas of Casco, Dresden, and Rotamer soils and Rotamer soils, thin variant. Also included were small areas of gently sloping and moderately steep soils and uneroded areas. In some areas the surface layer is gravelly loam. A few, small, severely eroded areas have underlying sand and gravel exposed on the surface. The symbol for gravel has been used to indicate most of these areas on the soil map. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile. Areas that are more sandy and contain less gravel in the upper part of the substratum also were included.

The soils in this complex are moderately susceptible to erosion. Natural fertility is low in the Rodman soils and moderate in the Lorenzo soils. Crop growth generally is limited by the very low or low available water capacity.

Most of the acreage is used for pasture and crops that are commonly grown in the county. The soils are not suitable for cultivation. Good management practices, such as fertilization and controlled grazing in areas used for pasture, help to protect the sod and prevent gullying. (Capability unit VIs-5; woodland group 4f1; wildlife group 3; shrub and vine group 2; recreation group 4)

Rodman-Lorenzo complex, 20 to 30 percent slopes (RrE).—The steep soils in this complex are on side slopes along drainageways and the edge of outwash plains and terraces. They also are on hills and moraines. The areas are generally 10 to 50 acres in size and elongated in shape. About 65 percent of the acreage consists of Rodman gravelly sandy loam, and nearly 35 percent of Lorenzo loam.

The Rodman soil in this complex has the profile described as representative for the series. The Lorenzo soils in this complex have a surface layer about 7 inches thick. This layer is black loam in the upper part and very dark gray loam in the lower part. The underlying stratified sand and gravel is at a depth of 13 inches.

Included with this complex in mapping were small areas of Casco, Dresden, and Rotamer soils and Rotamer soils,

thin variant. Also included were areas of moderately steep soils and a few small areas of very steep soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soils having the representative profiles for their respective series. Other inclusions are moderately eroded areas and some severely eroded areas where most of the original surface layer has been lost by erosion and the present surface layer is quite gravelly. Areas that are more sandy and contain less gravel in the upper substratum also were included.

The soils in this complex are very highly susceptible to erosion. Natural fertility is low in the Rodman soils and moderate in the Lorenzo soils. Most of the acreage is in woods or pasture or is used as wildlife habitat. Some areas are used as a source of sand and gravel. These soils are not suitable for cultivation. Good management practices, such as fertilization and controlled grazing in areas used for pasture, help to protect the sod and prevent gullying. Even with good management, this complex is poorly suited to use as pasture. (Capability unit VIIs-5; woodland group 4r1; wildlife group 3; shrub and vine group 2; recreation group 4)

Rodman-Lorenzo complex, 30 to 45 percent slopes (RrF).—The very steep soils in this complex are on side slopes along drainageways and the edge of outwash plains and terraces. They also are on hills and moraines. The areas are generally 5 to 25 acres in size and elongated in shape. About 70 percent of the acreage consists of Rodman gravelly sandy loam, and nearly 30 percent of Lorenzo loam.

The Rodman soils in this complex are about 2 inches thinner than the soil having the profile described as representative for the Rodman series. In addition, the surface layer is thinner, lighter colored, and more gravelly. The Lorenzo soils in this complex have a surface layer about 6 inches thick. This layer is black loam in the upper part and very dark gray loam in the lower part. The underlying stratified sand and gravel is at a depth of 12 inches.

Included with this complex in mapping were small areas of Casco, Dresden, and Rotamer soils and Rotamer soils, thin variant. Also included were small areas of moderately steep soils and a few eroded areas that have more gravel in the surface layer than the soils having the profiles described as representative for their respective series. In addition, in drainageways and depressions the surface layer is thicker and darker colored than in those soils. Areas that are more sandy and contain less gravel in the upper substratum also were included.

Soils in this complex are very highly susceptible to erosion. Natural fertility is low in the Rodman soils and moderate in the Lorenzo soils. Most of the acreage is in woods or pasture or is used as wildlife habitat. Some areas are used as a source of sand and gravel. This complex is not suitable for cultivation. Good management practices, such as fertilization and controlled grazing in areas used for pasture, help to protect the sod and prevent gullying. Even with good management, this complex is poorly suited to use as pasture. (Capability unit VIIs-5; woodland group 4r1; wildlife group 3; shrub and vine group 2; recreation group 4)

Rollin Series

The Rollin series consists of very poorly drained muck soils that are underlain by marl at depths of 16 to 45 inches. These nearly level soils are in old lake basins. Ground water is at or near the surface throughout the year unless this soil is drained.

In a representative profile, the organic layer is black muck about 25 inches thick. This is underlain by white and light-gray, massive marl that extends to a depth of at least 60 inches.

These soils can hold about 14 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid in the muck and slow in the substratum. The depth of the root zone is limited by the water table. Natural fertility is low.

Where these soils are drained, they are used for corn and pasture. Undrained areas are too wet to be farmed and are used for unimproved pasture and wildlife habitat.

Representative profile of Rollin muck in a cultivated field, 200 feet north of Weary Road, SE¼SE¼SW¼ sec. 31, T. 4 N., R. 11 E.:

Oa1—0 to 9 inches, black (N 2/0) sapric material; trace of herbaceous fibers where not rubbed; weak, medium, granular structure; nonsticky; neutral; clear, smooth boundary.

Oa2—9 to 25 inches, black (N 2/0) sapric material; trace of herbaceous fibers where not rubbed; weak, medium, platy structure; nonsticky; mildly alkaline; abrupt, smooth boundary.

IIC1—25 to 30 inches, white (10YR 8/2) marl; massive; firm; many snail shell fragments; few organic fibers; very highly calcareous; gradual, smooth boundary.

IIC2—30 to 60 inches, light-gray (10YR 7/2) marl; massive; firm; few snail shell fragments; few organic fibers; very highly calcareous.

The organic layer ranges from 16 to 45 inches in thickness. The boundary between the organic layer and the underlying marl is abrupt. The underlying marl is highly calcareous and contains a few organic fibers and snail shell fragments.

Rollin soils have an underlying marl layer that is lacking in the associated Adrian, Houghton, and Palms soils. Rollin soils have a thinner organic layer than do Houghton soils.

Rollin muck (0 to 2 percent slopes) (Rs).—This nearly level soil occurs as irregular tracts in broad, flat, old lake basins. It is of very minor extent in the county.

Included with this soil in mapping were small areas of Houghton soils. Also included were areas that have only 12 to 16 inches of muck over marl and areas where the marl is being plowed up because of subsidence or blowing of the muck.

Rollin muck is ponded in wet periods and after heavy rain. Surface drainage is used to remove excess water rapidly. Tile drainage is not suitable if the tile is in the marl, because of the slow permeability in the marl. Cultivated areas are subject to soil blowing and burning. If the water table is lowered excessively, the organic matter decomposes very rapidly in cultivated areas and subsidence becomes a problem.

Where drained, this soil is used for pasture and corn and is suited to certain vegetable crops, such as beets and carrots. (Capability unit IVw-7; woodland group 5w3; wildlife group 6; not placed in a shrub and vine group; recreation group 8)

Rotamer Series

The Rotamer series consists of well-drained, gently sloping to very steep, loamy soils that are underlain by calcareous gravelly sandy loam glacial till at depths of 12 to 20 inches. Most areas of these soils are on moraines and till plains. Rotamer soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark grayish-brown loam about 8 inches thick. The subsoil is about 11 inches thick. It is dark-brown, firm clay loam in the upper part and dark yellowish-brown, firm gravelly heavy

loam in the lower part. The substratum is light yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 19 inches.

These soils can hold about 8 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is moderately deep. Natural fertility is moderate.

Most areas of gently sloping and sloping Rotamer soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep to very steep Rotamer soils are used for woods, pasture, and wildlife habitat.

Representative profile of Rotamer loam, 12 to 20 percent slopes, in a cultivated field, 600 feet west of Grove Road and 40 feet south of woodlot, NE¼NE¼SW¼ sec. 18, T. 3 N., R. 14 E.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam; dark grayish brown (10YR 4/2) when dry; moderate, fine, subangular blocky structure; friable; few worm casts of yellowish-brown (10YR 5/6) material from B2t horizon; plentiful, fine, fibrous roots; many very fine, fine, and medium, mostly exped, continuous, dendritic pores; neutral; abrupt, smooth boundary.

B2t—8 to 16 inches, dark-brown (7.5YR 4/4) clay loam; strong, medium and fine, subangular blocky structure; firm; plentiful, fine, fibrous roots; common, fine and very fine and few, medium and coarse, continuous, mostly exped, dendritic pores; thin continuous clay films on ped faces and in pores; neutral; clear, wavy boundary.

B3t—16 to 19 inches, dark yellowish-brown (10YR 4/4) gravelly heavy loam; moderate, medium, subangular blocky structure; firm; horizon contains approximately 15 percent, by volume, light yellowish-brown (10YR 6/4) dolomitic sand and partly weathered gravel; common, very fine, mostly obliquely oriented, continuous pores; many thin clay films on ped faces and in pores; calcareous; clear, wavy boundary.

C— 19 to 60 inches, light yelllowish-brown (10YR 6/4) gravelly sandy loam; weak, fine, subangular blocky structure; friable; few, very fine and fine, mostly obliquely oriented, continuous pores; horizon contains about 50 to 60 percent coarse fragments, mostly fine and medium gravel but some cobblestones; calcareous.

Depth to calcareous gravelly sandy loam glacial till ranges from 12 to 24 inches. The A horizon ranges from 6 to 9 inches in thickness and is very dark grayish brown, dark brown, or very dark brown. The A2 horizon is 0 to 2 inches thick. Where present, it is brown loam. The B2t horizon is clay loam or sandy clay loam and ranges from 4 to 12 inches in thickness. It is dark brown or dark yellowish brown. The B3 horizon, where present, is loam, sandy loam, or sandy clay loam, and in some profiles it is gravelly. It ranges from 0 to 6 inches in thickness and is dark yellowish brown, yellowish brown, or brown. The C horizon is light yellowish brown, yellowish brown, or pale brown. The calcium carbonate equivalent of the C horizon ranges from 20 to 30 percent.

Rotamer soils are associated with Kidder soils and Rotamer soils, thin variant. Rotamer soils have a thinner solum than Kidder soils. They have a thicker, more clayey solum than Rotamer soils, thin variant.

Rotamer loam, 2 to 6 percent slopes eroded (RtB2).—This gently sloping soil is on low hills on till plains and moraines. The areas are irregular in shape and range from 5 to 60 acres in size. The profile of this soil is about 1 inch thicker than the profile described as representative for the series. Also, it is more eroded and has some dark-brown subsoil material in the surface layer.

Included with this soil in mapping were small areas of Griswold, Kidder, and Ringwood soils and Rotamer soils, thin variant. Also included were areas that have a silt loam or sandy loam surface layer, small areas of nearly level and sloping soils, and some uneroded areas. Small areas of severely eroded soils have gravel mixed in the surface layer. The symbol for gravel has been used to indicate many of these areas on the soil map. Also included were small areas that are more sandy and less clayey throughout the solum than the soil having the profile described as representative for the series. Some small areas of this soil are underlain by stratified sand and gravel or stratified silt and fine sand, rather than glacial till. Many areas of this soil have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones. In some small areas the underlying till has a texture of silt loam, loam, or clay loam.

This Rotamer soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage of this soil is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 3s2; wildlife group 1; shrub and vine group 1; recreation group 2)

Rotamer loam, 6 to 12 percent slopes, eroded (RtC2).—This sloping soil is on low hills on till plains and moraines. The areas are irregular in shape and range from 5 to 40 acres in size. The profile of this soil is about 1 inch thicker than the profile described as representative for the series. Also, it is more eroded and has some dark-brown subsoil material in the surface layer.

Included with the soil in mapping were small areas of Griswold, Kidder, and Ringwood soils and Rotamer soils, thin variant. Also included were areas that have a silt loam or sandy loam surface layer, small areas of gently sloping and moderately steep soils, and some uneroded areas. Small areas of severely eroded soils have gravel mixed in the surface layer. The symbol for gravel has been used to indicate many of these areas on the soil map. Also included were small areas that are more sandy and less clayey throughout the solum than the soil having the profile described as representative for the series. Some small areas of this soil are underlain by stratified sand and gravel or stratified silt and fine sand, rather than glacial till. Many areas have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones. In some small areas the underlying till has a texture of silt loam, loam, or clay loam.

This Rotamer soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage of this soil is used for crops. This soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 3s2; wildlife group 1; shrub and vine group 1; recreation group 2)

Rotamer loam, 12 to 20 percent slopes (RtD).—This moderately steep soil is on low hills on till plains and moraines. The areas are irregular in shape and range from 5 to 40 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Griswold, Kidder, and Ringwood soils and Rotamer soils, thin variant. Also included were areas that have a silt loam or sandy loam surface layer, small areas of sloping and steep soils, and some uneroded areas. Small areas of severely eroded soils have gravel mixed in the surface layer. The symbol for gravel has been used to indicate many of these areas on the soil map. Also included were small areas that are more sandy and less clayey throughout the solum than this soil. Some small areas of this soil are underlain by

stratified sand and gravel or stratified silt and fine sand, rather than glacial till. Many areas of this soil have cobblestones and boulders on the surface and throughout the soil. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones. In some small areas the underlying till has a texture of silt loam, loam, or clay loam.

The Rotamer soil is highly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is wooded or in pasture. Some of it is used for crops. This soil is better suited to pasture, woods, and close-growing crops than it is to row crops. If the soil is used for row crops, it is very susceptible to erosion. (Capability unit IVe-1; woodland group 3r2; wildlife group 1; shrub and vine group 1; recreation group 2)

Rotamer Series, Thin Variant

The Rotamer series, thin variant, consists of well-drained, steep and very steep, loamy soils that are underlain by calcareous gravelly sandy loam glacial till at depths of 10 to 15 inches. These soils are on moraines and on breaks along natural drainageways on till plains. They are not saturated with water for periods long enough to affect crop growth. In Rock County they are mapped only with normal Rotamer soils.

In a representative profile, the surface layer is very dark brown gravelly sandy loam about 3 inches thick. The subsoil is dark-brown, friable gravelly sandy loam about 9 inches thick. The substratum is yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 12 inches.

These soils can hold about 6 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderately rapid. The root zone is moderately deep. Natural fertility is low.

Most areas of these soils are in woods or pasture or are used as wildlife habitat.

Representative profile of a Rotamer gravelly sandy loam, thin variant, that has slopes of 20 to 30 percent, in a wooded area, 300 feet west of the Edgerton water tower, NE¼NW¼SE¼ sec. 3, T. 4 N., R. 12 E.:

A1—0 to 3 inches, very dark brown (10YR 2/2) gravelly sandy loam; weak, fine, subangular blocky structure; friable; calcareous; clear, smooth boundary.

B—3 to 12 inches, dark-brown (10YR 4/3) gravelly sandy loam; weak, fine, subangular blocky structure; friable; calcareous; clear, smooth boundary.

C—12 to 60 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; friable; calcareous.

Depth to calcareous gravelly sandy loam glacial till ranges from 10 to 15 inches. The A horizon ranges from 2 to 4 inches in thickness and is very dark brown, very dark grayish brown, or dark brown. The B horizon ranges from 3 to 11 inches in thickness. It is dark brown, dark yellowish brown, or yellowish brown. The C horizon is yellowish brown or light yellowish brown.

Rotamer soils, thin variant, are associated with Rodman and Rotamer soils. Rotamer soils, thin variant, have a thinner, less clayey and more sandy solum than normal Rotamer soils. They are underlain by gravelly sandy loam glacial till, whereas the Rodman soils are underlain by stratified sand and gravel.

Rotamer complex, 20 to 30 percent slopes (RuE).—The steep soils in this complex are on moraines and breaks along natural drainageways on till plains. The areas are generally elongated in shape and range from 5 to more than 40 acres in size. This complex is about 50 percent Rotamer soils, thin variant, and nearly 50 percent normal Rotamer soils. The thin variant soil has the profile described as representative for the series. Rotamer soils in this complex have a subsoil that is about 7 inches thick. The substratum is at a depth of 15 inches.

Included with this complex in mapping were small areas of Griswold, Kidder, and Ringwood soils. Also included were areas of moderately steep soils and small areas of very steep soils. Some areas of these soils have been eroded. In some small areas these soils are underlain by stratified silt and fine sand or sand and gravel rather than by glacial till. Many areas of these soils have cobblestones and boulders on the surface and throughout the solum. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones. In some small areas the underlying till has a texture of silt loam or loam.

Soils of this complex are very highly susceptible to erosion and are too steep and commonly too stony for cultivation. Most of the acreage is in woods or pasture or is used as wildlife habitat. These soils are not suited to cultivation. They are better suited to use as woodland and wildlife habitat than to other uses. In areas that are used for pasture, good management practices, such as fertilization and controlled grazing, are needed to protect the sod and prevent gullying. (Capability unit VIIe-4; woodland group 3r2; wildlife group 1; shrub and vine group 2; recreation group 4)

Rotamer complex, 30 to 45 percent slopes (RuF).—The very steep soils in this complex are on moraines and breaks along natural drainageways on till plains. The areas are generally elongated in shape and range from 5 to 25 acres in size. This complex is about 70 percent Rotamer soils, thin variant, and nearly 30 percent normal Rotamer soils.

The Rotamer soils, thin variant, in this complex have a solum that is about 2 inches thinner than the one in the soil having the profile described as representative for the series. Normal Rotamer soils in this complex have a very dark grayish-brown loam surface layer about 6 inches thick. The subsoil is about 6 inches thick. The substratum is at a depth of 15 inches.

Included with this complex in mapping were small areas of Griswold, Kidder, and Ringwood soils. Also included were areas of steep soils. Some areas of these soils have been eroded. In some small areas these soils are underlain by stratified silt and fine sand or sand and gravel, rather than glacial till. Many areas of these soils have cobblestones and boulders on the surface and throughout the solum. Most areas that have boulders on the surface are indicated on the soil map by the symbol for stones. In some small areas the underlying till has a texture of loam or silt loam.

Soils of this complex are very highly susceptible to erosion and are too steep and commonly too stony for cultivation. Most of the acreage is in woods or pasture or is used as wildlife habitat. These soils are not suited to cultivation. They are better suited to use as woodland and wildlife habitat than to other uses. In areas that are used for pasture, good management practices, such as fertilization and controlled grazing, help to protect the sod and prevent gullying. (Capability unit VIIe-4; woodland group 3r2; wildlife group 1; shrub and vine group 2; recreation group 4)

St. Charles Series

The St. Charles series consists of well drained and moderately well drained, nearly level to moderately steep, silty soils that are deep and are underlain by calcareous gravelly sandy loam glacial till or stratified sand and gravel. In some areas these soils are saturated with water at depths of 3 to 5 feet in wet periods.

In a representative profile, the surface layer is dark grayish-brown silt loam about 9 inches thick. The subsoil is about 56 inches thick. It is brown, very friable silt loam in the upper part; brown, friable and firm silty clay loam grading to brown, firm silt loam in the middle part; and brown, friable sandy clay loam in the lower part. The substratum is light yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 65 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas of nearly level to sloping St. Charles soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of the moderately steep soils are used for pasture and woods.

Representative profile of St. Charles silt loam, 2 to 6 percent slopes, in a cultivated field, 120 feet north of Elmer Road and 400 feet west of U.S. Highway No. 14, SE¼NE¼NW¼ sec. 22, T. 4 N., R. 10 E.:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B1—9 to 12 inches, brown (10YR 4/3) silt loam; moderate, fine, subangular blocky structure; very friable; mildly alkaline; clear, smooth boundary.

B21t—12 to 22 inches, brown (10YR 4/3) silty clay loam; moderate, fine and very fine, subangular blocky structure; friable; patchy clay films on ped faces; medium acid; clear, smooth boundary.

B22t—22 to 37 inches, brown (10YR 4/3) silty clay loam; few, very dark grayish-brown (10YR 3/2), organic stains; moderate, medium and fine, subangular blocky structure; firm; thick continuous clay films on ped faces; medium acid; clear, smooth boundary.

B31t—37 to 60 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium, subangular blocky structure; firm; thin patchy clay films on ped faces; medium acid; clear, smooth boundary.

IIB32—60 to 65 inches, brown (10YR 4/3) sandy clay loam; few, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

IIC—65 to 72 inches, light yellowish-brown (10YR 6/4) gravelly sandy loam; massive; friable; calcareous.

Depth to calcareous gravelly sandy loam till or stratified sand and gravel ranges from 48 to 65 inches. The silty mantle ranges from 40 to 60 inches in thickness. The Ap horizon ranges from 6 to 9 inches in thickness and is dark grayish brown or dark brown. Where these soils have not been cultivated, the A1 horizon is silt loam and is black, very dark gray, or very dark brown. It ranges from 3 to 5 inches in thickness. The A2 horizon is 0 to 8 inches thick. Where present, it is silt loam and is brown or light brown. The B1 horizon is silt loam or light silty clay loam and ranges from 3 to 8 inches in thickness. It is brown or dark yellowish brown. The B2t horizon is silty clay loam or heavy silt loam and ranges from 15 to 50 inches in thickness. It is brown or dark yellowish brown. The B3 horizon is 0 to 28 inches thick. Where present, it is light silty clay loam or silt loam and is yellowish brown or brown. The IIB3 horizon is sandy clay loam or sandy loam, ranges from 3 to 18 inches in thickness, and is brown or dark brown. In some areas mottles are lacking in the lower part of the subsoil. The IIC horizon is light yellowish brown or yellowish brown.

St. Charles soils are associated with Flagg and Kidder soils. St. Charles soils are neither so red nor so deeply weathered into the till as Flagg soils. They have a thicker silty mantle than Kidder soils.

St. Charles silt loam, 0 to 2 percent slopes (SaA).—This nearly level soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 10 to more than 50 acres in size.

Included with this soil in mapping were small areas of Elburn, Flagg, Kidder, and Plano soils. In some areas the surface layer is darker colored than the one in the soil having the profile described as representative for the series. Also, in drainageways and depressions the surface layer is thicker and darker colored than in that soil, and in some areas the subsoil is mottled. Some areas have a silty mantle that is more than 60 inches thick. In some areas this soil is underlain by dolomite bedrock or sand and gravel outwash. Also included were some small areas of gently sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam.

This St. Charles soil has few limitations and can be cultivated intensively if management practices are used to supply regular additions of organic matter and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-3; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

St. Charles silt loam, 2 to 6 percent slopes (SaB).—This gently sloping soil is on till plains, broad ridgetops, and valley floors. The areas are irregular in shape and range from 10 to more than 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Elburn, Flagg, Kidder, Plano, and Whalan soils. In some areas the surface layer is darker colored than the one in this soil. Also, in drainageways and depressions the surface layer is thicker and darker colored than in this soil, and in some areas the subsoil is mottled. Some areas have a silty mantle that is more than 60 inches thick, and in some areas this soil is underlain by dolomite bedrock or sand and gravel outwash. Also included were some small areas of sloping and nearly level soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Some areas are moderately eroded.

This St. Charles soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

St. Charles silt loam, 6 to 12 percent slopes, eroded (SaC2).—This sloping soil is on till plains and on lower side slopes in areas where bedrock is relatively shallow. The areas are generally elongated in shape and range from 5 to 40 acres in size. In the profile of this soil, the surface layer is about 2 inches thinner than the one in the profile described as representative for the series, and it also contains subsoil material. In addition, the solum is about 8 inches thinner.

Included with this soil in mapping were small areas of Flagg, Kidder, Plano, and Whalan soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. In some areas this soil is underlain by dolomite bedrock. Also included were some small areas of gently sloping and moderately steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and small severely eroded areas where most of the original surface layer has been removed by erosion.

This St. Charles soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage of this soil is used for crops. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland

group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

St. Charles silt loam, 12 to 20 percent slopes (SaD).—This moderately steep soil is on till plains and on lower side slopes in areas where bedrock is relatively shallow. The areas are generally elongated and range from 5 to 40 acres in size. The profile of this soil is about 10 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were small areas of Kidder and Rotamer soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. Some small areas of this soil are underlain by dolomite bedrock. Also included were some areas of sloping and steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Some included areas are eroded.

This St. Charles soil is highly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage of this soil is in woods and pasture. The soil is suited to woods, pasture, and close-growing crops. If it is used for row crops, it is subject to severe erosion. (Capability unit IVe-1; woodland group 2r1; wildlife group 1; shrub and vine group 1; recreation group 1)

St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes (SbA).—This nearly level soil is on outwash plains. The areas are generally 20 to 120 acres in size and irregular in shape. The profile of this soil is similar to the one described as representative for the series but it is underlain by rapidly permeable sand or sand and gravel at depths of 36 to 60 inches.

Included with this soil in mapping were small areas of Dresden, Plano, St. Charles, and Warsaw soils and Plano soils, loamy variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. In some areas the silty mantle ranges from 20 to 36 inches in thickness, and in other areas it is more than 60 inches thick. Also included were areas where the lower subsoil is sandy and lacks appreciable gravel content. Small areas that are underlain by stratified silt and fine sand or bedrock below a depth of 4 feet, and areas of gently sloping soils also were included.

This St. Charles soil has few limitations and can be cultivated intensively if management practices regularly add organic matter and maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-3; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes (SbB).—This gently sloping soil is on low ridges and knobs on outwash plains and terraces. The areas are generally 20 to 50 acres in size and irregular in shape. The profile of this soil is similar to the one described as representative for the series, but it is underlain by rapidly permeable sand or sand and gravel at depths of 36 to 60 inches.

Included with this soil in mapping were small areas of Dresden, Plano, and St. Charles soils and Plano soils, loamy variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. In some areas the silty mantle ranges from 20 to 36 inches in thickness, and in other areas it is more than 60 inches thick. Also included were areas where the lower part of the subsoil is sandy and lacks appreciable gravel content and small areas that are underlain by stratified silt and fine sand or bedrock below a depth of 4 feet. Small areas of nearly level and sloping soils and moderately eroded areas were also included.

This St. Charles soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all of the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

St. Charles silt loam, gravelly substratum, 6 to 12 percent slopes, eroded (SbC2).—This sloping soil is on low ridges and knobs on outwash plains and terraces generally adjacent to steeper soils of uplands. The areas are generally 5 to 30 acres in size and elongated in shape. The profile of this soil is similar to the one described as representative for the series, but it is underlain by rapidly permeable sand or sand and gravel at depths of 36 to 60 inches.

Included with this soil in mapping were small areas of Dresden, Plano, and St. Charles soils and Plano soils, loamy variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Also included were areas where the lower part of the subsoil is sandy and lacks appreciable gravel content and small areas that are underlain by stratified silt and fine sand or bedrock below a depth of 4 feet. Small areas of gently sloping and moderately steep soils and moderately eroded areas also were included. Other inclusions are small severely eroded areas where most of the original surface layer has been removed by erosion and small areas where the silty mantle ranges from 20 to 36 inches in thickness.

This St. Charles soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Sebewa Series

The Sebewa series consists of poorly drained, nearly level, loamy soils that are underlain by stratified sand and gravel at depths of 20 to 40 inches. These soils are on outwash plains and terraces. Ground water is at or near the surface throughout the year unless the soils are drained.

In a representative profile, the surface layer is about 18 inches thick. It is black silt loam in the upper part and black clay loam in the lower part. The subsoil is about 12 inches thick. It is grayish-brown, firm clay loam in the upper part and gray, firm gravelly sandy clay loam in the lower part. The subsoil has strong-brown mottles. The substratum is light brownish-gray, calcareous sand and gravel and is at a depth of about 30 inches.

These soils can hold about 7 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate in the subsoil and rapid in the substratum. Depth of the root zone is limited by the high water table or, in drained areas, by sand and gravel. Natural fertility is moderate.

Where these soils are drained, most areas are used for corn, soybeans, small grains, and legumes. Undrained areas are generally in pasture or used as wildlife habitat.

Representative profile of Sebewa silt loam in a cultivated field, 790 feet west of State Route 213 and 390 feet south of fence line, NW¼SE¼SW¼ sec. 34, T. 4 N., R. 10 E.:

Ap—0 to 7 inches, black (N 2/0) silt loam; moderate, medium, granular structure; very friable; neutral; abrupt, smooth boundary.

A12—7 to 13 inches, black (N 2/0) silt loam; moderate, medium, granular structure; friable; mildly alkaline; clear, smooth boundary.

A13—13 to 18 inches, black (10YR 2/1) clay loam; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, fine, subangular blocky structure and moderate, medium, granular structure; firm; few iron-manganese concretions; mildly alkaline; clear, irregular boundary.

B21tg—18 to 24 inches, grayish-brown (10YR 5/2) clay loam; many, coarse, distinct, strong-brown (7.5YR 5/6) mottles; weak, fine, subangular blocky structure; firm; black (10YR 2/1) thin tongues of material from the A13 horizon; clay bridging of soil particles; clay flows in root channels; mildly alkaline; clear, wavy boundary.

IIB22tg—24 to 30 inches, gray (5Y 6/1) gravelly clay loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, fine, subangular blocky structure; firm; clay bridging of soil particles; clay flows in pores and root channels; moderately alkaline; clear, smooth boundary.

IIIC—30 to 60 inches, light brownish-gray (10YR 6/2) sand and gravel; single grain; loose; calcareous.

Depth to underlying calcareous sand and gravel ranges from 20 to 40 inches. The Ap horizon is 7 to 10 inches thick and is black or very dark brown. The A12 and A13 horizons are silt loam, loam, or clay loam and 2 to 13 inches thick. They have matrix colors of black or very dark brown. The B horizon is 10 to 24 inches thick and is gravelly in some places. It has matrix colors of grayish brown, gray, dark grayish brown, or very dark grayish brown. The IIC horizon has matrix colors of light brownish gray or grayish brown.

Sebewa soils are associated with Brookston, Kane, and Maumee soils. Sebewa soils are more poorly drained than Kane soils. They are more clayey and less sandy than Maumee soils. Sebewa soils are underlain by calcareous sand and gravel, but Brookston soils are underlain by gravelly sandy loam till.

Sebewa silt loam (0 to 2 percent slopes) (Se).—This nearly level soil is on outwash plains and terraces. The areas are generally 20 to more than 500 acres in size and elongated in shape.

Included in mapping were small areas of Adrian, Brookston, Colwood, Mahalasville, Marshan, Maumee, and Navan soils. Also included were small areas that have a loam or sandy loam surface layer, areas where the dark-colored surface layer is only 4 to 10 inches thick, and other areas where the dark-colored surface layer is more than 24 inches thick. Some small areas are highly calcareous throughout the upper solum and contain many snail shells and shell fragments. A few small areas have bog iron up to several inches in diameter mixed in the surface layer. A few areas have an organic surface layer up to 14 inches thick. Other inclusions are areas that have a buried, dark-colored surface layer and buried organic layers, and small areas that have alternate bands of sandy and clayey material throughout the solum. Some areas are more sandy throughout the solum than this Sebewa soil. The underlying stratified sand and gravel is mixed with loamy till or lacustrine silt, fine sands, or clays in some areas. In some areas the depth to calcareous sand and gravel is more than 40 inches.

Unless drained, this Sebewa soil is subject to ponding during wet periods and after heavy rain. Open-ditch or surface drainage is used for dependable crop production. Tile drainage can be used where measures are taken to prevent the underlying sand from filling the tile. If the water table is lowered excessively by ditching, this soil loses the beneficial effects of free water in the lower part of the soil.

Where this soil is drained, it is suited to all of the farm and most vegetable crops commonly grown in the county. Undrained areas are used for pasture or wildlife habitat. (Capability unit IIw-5; woodland group 4w1; wildlife group 5b; not placed in a shrub and vine group; recreation group 6)

Sisson Series

The Sisson series consists of deep, well-drained, nearly level to sloping soils in glacial lakebeds and drainage basins. These are loamy soils over stratified lacustrine deposits of calcareous silt and fine sand. These soils are not saturated for periods long enough to affect crop growth.

In a representative profile, the surface layer is dark grayish-brown loam about 7 inches thick. The subsoil is about 32 inches thick. It is dark-brown, friable loam in the upper part; dark yellowish-brown, firm heavy loam in the middle part; and dark yellowish-brown, friable fine sandy loam in the lower part. The substratum is pale-brown, calcareous, stratified silt and fine sand and is at a depth of about 39 inches.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate, and the root zone is deep. Natural fertility is moderate.

Sisson soils are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Sisson loam, 6 to 12 percent slopes, eroded, in a cultivated field, 30 feet west of Casey Road and 800 feet north of trees by farmstead, NE¼NE¼ SE¼ sec. 16., T. 4 N., R. 11 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; moderate, fine, subangular blocky structure; friable; mildly alkaline; abrupt, smooth boundary.

B1t—7 to 14 inches, dark-brown (10YR 4/3) loam; moderate, fine and medium, subangular blocky structure; friable; thin patchy clay films on some ped faces; clay flows in pores and channels; mildly alkaline; clear, smooth boundary.

B2t—14 to 23 inches, dark yellowish-brown (10YR 4/4) heavy loam; moderate, medium, subangular blocky structure; firm; thin patchy clay films on some ped faces; clay flows in pores and channels; mildly alkaline; clear, smooth boundary.

IIB3—23 to 39 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, medium, subangular blocky structure; friable; bands of fine sand and silt less than 1 inch thick; neutral; abrupt, wavy boundary.

IIC—39 to 60 inches, pale-brown (10YR 6/3), stratified silt and fine sand; massive; very friable; calcareous.

Depth to the underlying, calcareous, stratified silt and fine sand ranges from 24 to 42 inches. The Ap horizon ranges from 6 to 8 inches in thickness. It is dark grayish brown or dark brown. The B1t horizon ranges from 3 to 8 inches in thickness. The B2t horizon is heavy loam or heavy fine sandy loam and ranges from 4 to 10 inches in thickness. It is dark yellowish brown or dark brown. The IIB3 horizon is fine sandy loam, silt loam, or loam and is stratified. It is 6 to 18 inches in thickness. The IIC horizon is pale brown or light yellowish brown.

Sisson soils are associated with Darroch, Hebron, Jasper, and Zurich soils. Sisson soils have a lighter colored or thinner, dark-colored surface layer than Darroch and Jasper soils, and they are better drained than Darroch soils. Sisson soils contain more sand in the upper part of the subsoil than Zurich soils. They have more sand and less clay in the substratum than Hebron soils.

Sisson loam, 0 to 2 percent slopes (SkA).—This nearly level soil is in glacial lakebeds and drainage basins. The areas are variable in size and irregular in shape. The profile of this soil is about 2 inches thicker than the profile described as representative for the series.

Included with this soil in mapping were small areas of Darroch, Dresden, Jasper, and Zurich soils and Plano soils, loamy variant. In drainageways and depressions the surface

layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Also included were areas where the surface layer is silt loam or sandy loam and areas where the solum is more than 42 inches thick. In some areas a layer of loamy sand or sand is in the subsoil. Some small areas of gently sloping soils also were included.

This Sisson soil has few limitations and can be cultivated intensively if management practices are used to return organic matter regularly to the soil and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Sisson loam, 2 to 6 percent slopes (SkB).—This gently sloping soil is in glacial lakebeds and drainage basins. The areas are variable in size and irregular in shape. The profile of this soil is about 2 inches thicker than the profile described as representative for the series.

Included with this soil in mapping were small areas of Darroch, Dresden, Jasper, and Zurich soils and Plano soils, loamy variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Also included were areas where the surface layer is silt loam or sandy loam and areas where the solum is more than 42 inches thick. In some areas a layer of loamy sand or sand is in the subsoil. Some small areas of sloping and nearly level soils also were included.

This Sisson soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Sisson loam, 6 to 12 percent slopes, eroded (SkC2).—This sloping soil is on low ridges and knobs in glacial lakebeds and drainage basins. These areas are irregular in shape and generally less than 30 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, Jasper, and Zurich soils and Plano soils, loamy variant. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil, and in some areas the subsoil is mottled. Also included were areas where the surface layer is silt loam or sandy loam and areas where the solum is more than 42 inches thick. Also included were severely eroded areas where the surface layer is more clayey than the one in the profile described for this soil. The solum is less than 24 inches thick in many of these eroded areas. Small areas that are slightly eroded and small areas of gently sloping and moderately steep soils also were included.

This Sisson soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. Under good management, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Sogn Series

The Sogn series consists of somewhat excessively drained, gently sloping to very steep, loamy soils that are underlain by dolomite bedrock at depths of 4 to 16 inches. The dolomite is generally soft and weathered in the upper few inches and fragmentary and creviced in the upper few feet. Soil material generally fills these crevices. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is about 12 inches thick. It is black loam in the upper part and black gravelly loam in the lower part. The underlying dolomite is pale yellow, calcareous, fragmentary, and creviced and is at a depth of about 12 inches.

These soils can hold about 2 inches of water available to plants between the surface and the depth to bedrock. Permeability is moderate. The depth of the root zone is generally limited by the dolomite, but some roots extend into crevices that are filled with soil material. Natural fertility is low.

Many areas of gently sloping and sloping Sogn soils are used for corn, small grains, and legumes, but much of the acreage is in pasture and woods. Most areas of moderately steep, steep, and very steep Sogn soils are in pasture or woods.

Representative profile of Sogn loam, 12 to 20 percent slopes, in a pine plantation, 150 feet east of Johnson Road and 100 feet northeast of quarry, SW¼NW¼SW¼ sec. 6, T. 1 N., R. 12 E.:

A11—0 to 6 inches, black (10YR 2/1) loam; moderate, fine and medium, granular structure; very friable; neutral; clear, wavy boundary.

A12—6 to 12 inches, black (10YR 2/1) gravelly loam; moderate, fine and medium, granular structure; very friable; calcareous; abrupt, irregular boundary.

IIR—12 inches +, pale-yellow (2.5Y 7/4) dolomite bedrock, fragmentary and creviced.

Depth to dolomite ranges from 4 to 16 inches. The A horizon is loam or heavy silt loam. It is black or very dark brown. Reaction is neutral to mildly alkaline. The percentage of coarse fragments ranges from 5 to 35 percent; these fragments include angular chert, rounded gravel, and dolomite fragments that range up to 2 feet in length.

Sogn soils have a thinner solum and the underlying dolomite is at a shallower depth than in the associated Edmund, Rockton, and Whalan soils.

Sogn loam, 2 to 6 percent slopes (SoB).—This gently sloping soil is on ridgetops and upper side slopes. The areas are generally less than 30 acres in size and are elongated in shape. The profile of this soil is about 1 inch thicker than the profile described as representative for the series.

Included with this soil in mapping were moderately eroded areas, areas that have a heavy silt loam surface layer, and small areas that have a sandy loam or loamy sand surface layer. Also included were small areas of Edmund and Rockton soils. Other inclusions are small areas of sloping soils and areas that have dolomite fragments in the surface layer. Small areas that have bedrock at the surface are generally indicated on the soil map by the symbol for rock outcrop.

This Sogn soil has moderate permeability and very low available water capacity. It is slightly susceptible to erosion. Tillage is hampered by dolomite fragments in some areas. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. Because of very low available water capacity and a shallow root zone, this soil is better suited to hay and pasture than to other uses.

(Capability unit VIs-5; woodland group 4f1; wildlife group 8; shrub and vine group 2; recreation group 11)

Sogn loam, 6 to 12 percent slopes, eroded (SoC2).—This sloping soil is on narrow ridgetops and side slopes. The areas are generally 15 to 50 acres in size and are elongated in shape. The profile of this soil is about as thick as the profile described as representative for the series, but it is moderately eroded and the surface layer is slightly more clayey.

Included with this soil in mapping were areas that have a heavy silt loam surface layer and small areas that have a sandy loam or loamy sand surface layer. The more sandy areas are generally indicated on the soil map by the symbol for sand spots. Also included were small areas of Edmund and Rockton soils. Other inclusions are uneroded areas and small severely eroded areas. Some areas have dolomite fragments in the surface layer. Small areas that have bedrock at the surface are generally indicated on the soil map by the symbol for rock outcrop. Small areas of gently sloping and moderately steep soils also were included.

This Sogn soil has moderate permeability and very low available water capacity. It is moderately susceptible to erosion. Tillage is hampered by dolomite fragments in some areas. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Some of the acreage is used for crops. Because of very low available water capacity, a shallow root zone, and the erosion hazard, this soil is better suited to pasture and woods than to most other uses. (Capability unit VIs-5; woodland group 4f1; wildlife group 8; shrub and vine group 2; recreation group 11)

Sogn loam, 12 to 20 percent slopes (SoD).—This moderately steep soil is on side slopes in areas underlain by bedrock that have been deeply incised by natural drainageways. The areas are generally 5 to 30 acres in size and are elongated in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were areas that have a heavy silt loam surface layer and small areas that have a sandy loam surface layer. Also included were small areas of Edmund, Eleva, and Rockton soils. The Eleva soils are generally on the lower part of the slopes. Other inclusions are eroded areas, small areas of bedrock outcrops, and areas that have dolomite fragments in the surface layer. Small areas of sloping and steep soils also were included.

This Sogn soil has moderate permeability and very low available water capacity. It is highly susceptible to erosion. Tillage is hampered by dolomite fragments in some areas.

Some of the acreage is used for crops and pasture, but much of it is in woods. Because of very low available water capacity and the erosion hazard, this soil is better suited to pasture, woods, and wildlife habitat than to most other uses. (Capability unit VIs-5; woodland group 4r1; wildlife group 8; shrub and vine group 2; recreation group 11)

Sogn loam, 30 to 45 percent slopes (SoF).—This very steep soil is on side slopes in areas underlain by bedrock that have been deeply incised by natural drainageways. The areas are generally 5 to 20 acres in size and are elongated in shape. The profile of this soil is about 3 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were areas that have a heavy silt loam surface layer and small areas that have a sandy loam surface layer. Also included are small areas of Eleva soils, generally on the lower part of the slopes. Other inclusions were small areas of bedrock outcrops and areas that have dolomite fragments in the surface layer. Small areas of moderately steep and steep soils also were included.

This Sogn soil has moderate permeability and very low available water capacity. It is very highly susceptible to erosion.

Most of the acreage is in woods, but some areas are in pasture. This soil is better suited to woods and wildlife habitat than to most other uses. (Capability unit VIIs-5; woodland group 4r1; wildlife group 8; shrub and vine group 2; recreation group 11)

Troxel Series

The Troxel series consists of deep, well drained and moderately well drained, silty soils. These nearly level and gently sloping soils are on foot slopes and in natural drainageways. Most areas are nearly level. Some areas are saturated with water at depths of 3 to 5 feet during wet periods.

In a representative profile, the surface layer is about 38 inches thick. It is very dark gray silt loam in the upper part and black silt loam in the lower part. The subsoil is at least 22 inches thick. It is dark-brown, friable light silty clay loam in the upper part and brown, firm clay loam in the lower part.

These soils can hold about 12 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas of these soils are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county. These soils are subject to occasional flooding of short duration, and the gently sloping areas are slightly susceptible to erosion.

Representative profile of Troxel, silt loam, 0 to 3 percent slopes, in a cultivated field, 40 feet south of Whitmore Road and 165 feet east of fence, NE¼NE¼SE¼ sec. 17, T. 3 N., R. 11 E.:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; moderate, medium and coarse, granular structure; very friable; plentiful roots; mildly alkaline; abrupt, smooth boundary.

A12—8 to 23 inches, black (10YR 2/1) silt loam; weak, thick, platy structure, parting to moderate, medium, granular structure; very friable; mildly alkaline; clear, smooth boundary.

A13—23 to 30 inches, black (10YR 2/1) silt loam; weak, thick, platy structure, parting to moderate, fine, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

A1b—30 to 38 inches, black (10YR 2/1) silt loam; weak, medium, granular structure; very friable; slightly acid; abrupt, smooth boundary.

B1tb—38 to 46 inches, dark-brown (10YR 3/3) light silty clay loam; weak, medium, granular structure; friable; thin patchy clay films on some ped faces and in some pores; medium acid; clear, smooth boundary.

B21tb—46 to 55 inches, brown (10YR 4/3) clay loam; moderate, fine and very fine, subangular blocky structure; firm; continuous clay films on ped faces and in pores and channels; strongly acid; gradual, smooth boundary.

B22tb—55 to 60 inches, brown (10YR 4/3) clay loam; weak, fine, subangular blocky structure; firm; continuous clay films on ped faces and in pores and channels; medium acid.

Thickness of the solum ranges from 5 to 8 feet. The silty overwash ranges from 24 to 40 inches in thickness. The A11, or the Ap, horizon ranges from 7 to 10 inches in thickness. It is black, very dark brown, very dark gray, or very dark grayish brown. The A12 horizon ranges from 11 to 18 inches in thickness. It is black or very dark brown. The A13 horizon ranges from 6 to 12 inches in thickness. It is very dark brown, very dark gray, very dark grayish brown, or black. The A1b horizon ranges from 6 to 12 inches in thickness. It is very dark gray, very dark grayish brown, dark brown, or black. The B1tb horizon ranges from 7 to 12 inches in thickness. It is dark grayish brown, dark

brown, or dark yellowish brown. The B21tb horizon is heavy loam, clay loam, or silty clay loam and ranges from 6 to 10 inches in thickness. It is brown or dark yellowish brown. The B22t horizon is heavy loam, clay loam, or sandy clay loam. It is brown or dark yellowish brown. Faint to distinct mottles occur throughout the B horizon of the buried soil in some areas.

Troxel soils are associated with Elburn, Juneau, Millington, and Worthen soils. Troxel soils have a thicker, darker colored surface layer than Juneau soil. They are better drained than Elburn soils. Troxel soils have more clay in the subsoil than Worthen soils. Troxel soils are better drained and are not so calcareous as Millington soils.

Troxel silt loam, 0 to 3 percent slopes (TrA).—The major areas of this soil occur as elongated tracts in natural drainageways and at the base of slopes where sediment has been deposited by runoff. Most areas are 10 to 40 acres in size.

Included with this soil in mapping were small areas of Elburn, Juneau, and Worthen soils. Also included were small areas that have less than 24 inches of overwash, areas that have a loam or sandy loam surface layer, areas that have loam and sandy loam strata in the overwash, and areas that lack the buried silty clay loam subsoil. Small areas where the overwash is underlain by sands or stratified materials and areas that have up to 5 percent slope also were included.

This Troxel soil can be cultivated intensively if flooding and erosion are controlled. This soil is suited to all the crops commonly grown in the county and to pasture. (Capability unit I-2; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 7)

Warsaw Series

The Warsaw series consists of well-drained, nearly level to sloping, loamy soils that are underlain by stratified sand and gravel at a depth of 24 to 40 inches. These soils are on outwash plains and terraces. They are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is about 14 inches thick. It is very dark brown silt loam in the upper part and very dark grayish-brown loam in the lower part. The subsoil is about 22 inches thick. It is dark-brown, friable loam in the upper part; dark yellowish-brown, firm clay loam and sandy clay loam in the middle part; and dark yellowish-brown, firm gravelly sandy clay loam in the lower part. The substratum is light yellowish-brown, calcareous sand and gravel and is at a depth of about 36 inches.

These soils can hold about 7 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate in the subsoil and rapid in the substratum. The depth of the root zone is limited by sand and gravel. Natural fertility is moderate.

Most areas of these soils are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Warsaw silt loam, 0 to 2 percent slopes, in a cultivated field, 3,300 feet south of U. S. Highway No. 14 and 1,980 feet east of Fellows Road, NW¼ SE¼SE¼ sec. 4, T. 3 N., R. 11 E.:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; moderate, medium and coarse, granular structure; very friable; neutral; abrupt, smooth boundary.

A12—8 to 14 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B1t—14 to 19 inches, dark-brown (10YR 3/3) loam; moderate, medium, subangular blocky structure; friable; thin patchy clay films on a few ped faces and in old root channels; medium acid; clear, smooth boundary.

B21t—19 to 25 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; clay bridging between sand grains; clay films on some ped faces; medium acid; clear, wavy boundary.

B22t—25 to 31 inches, dark yellowish-brown (10YR 3/4) sandy clay loam; moderate, medium, subangular blocky structure; firm; clay bridging between sand grains; clay films on some ped faces; medium acid; clear, smooth boundary.

IIB23t—31 to 36 inches, dark yellowish-brown (10YR 3/4) gravelly sandy clay loam; moderate, medium, subangular blocky structure; firm; thick continuous clay films; medium acid; clear, smooth boundary.

IIC—36 to 60 inches, light yellowish-brown (10YR 6/4) sand and gravel; single grain; loose; calcareous.

Depth to underlying sand and gravel ranges from 24 to 40 inches. The A horizon is loam or silt loam and ranges from 10 to 18 inches in thickness. It is black, very dark brown, or very dark grayish brown. The B1t horizon is 0 to 5 inches thick. Where present, it is loam or silt loam and is dark brown or brown. The B2t horizon is heavy loam, clay loam, or silty clay loam and ranges from 4 to 8 inches in thickness. It is dark brown, brown, or dark yellowish brown. The IIB2t horizon is sandy clay loam and is gravelly in the lower part. It ranges from 3 to 14 inches in thickness and is dark yellowish brown, dark brown, or brown. The IIC horizon is yellowish brown or light yellowish brown.

Warsaw soils are associated with Dresden, Kane, and Lorenzo soils and Oshtemo soils, dark variant. Warsaw soils have a thicker, dark-colored surface layer than Dresden soils. They are deeper over sand and gravel than Lorenzo soils. Warsaw soils have a thinner solum and are finer textured than Oshtemo soils, dark variant. They are better drained than Kane soils.

Warsaw silt loam, 0 to 2 percent slopes (WaA).—This nearly level soil is on outwash plains. The areas are generally 50 to 500 acres in size and irregular in shape. In approximately 60 percent of the acreage, the surface layer is silt loam, and in 40 percent it is loam. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, Kane, Lorenzo, and Plano soils and Oshtemo soils, dark variant. Also included were small areas that have a sandy surface layer. In drainageways and depressions the surface layer is thicker than the one in this soil, and in some areas the subsoil is mottled. Other inclusions are areas where the silty mantle ranges from 20 to 36 inches in thickness and areas where the solum ranges from 40 to 60 inches in thickness. In some areas the sand and gravel outwash is underlain by stratified silt and fine sand, generally at depths below 45 inches. Small areas of gently sloping soils also were included.

This Warsaw soil has slow runoff. Management practices are needed that improve tilth, regularly add organic matter to the soil, and increase water infiltration. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. It is well suited to irrigation and, if irrigated, can be used for more intensive production of garden and truck crops. (Capability unit IIs-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Warsaw silt loam, 2 to 6 percent slopes (WaB).—This gently sloping soil is on low ridges and knobs on outwash plains and terraces. The areas are generally 15 to 50 acres in size and irregular in shape on the outwash plains. Along terraces the areas are generally long, narrow strips adjacent to the steeper uplands. In approximately 55 percent of the acreage, the surface layer is silt loam, and in 45 percent it is loam. The profile of this soil is about 2 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, Kane, Lorenzo, and Plano soils and soils of the

Plano series loamy variant, and Oshtemo series, dark variant. Also included were small areas that have a sandy loam surface layer and moderately eroded areas where the dark-colored surface layer is not as thick and is slightly more clayey than the one in the soil having the profile described as representative for the series. Also, in drainageways and depressions the surface layer is thicker and darker colored than the one in that soil, and in some areas the subsoil is mottled. Other inclusions are areas where the silty mantle ranges from 20 to 36 inches in thickness and areas where the solum ranges from 40 to 60 inches in thickness. In some areas the sand and gravel outwash is underlain by stratified silt and fine sand or glacial till, generally at depths below 45 inches. Small areas of nearly level and sloping soils were also included.

This Warsaw soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. It is suited to irrigation, especially in the less sloping areas. If irrigated, this soil can be used for more intensive production of garden and truck crops. (Capability unit IIe-2; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Warsaw silt loam, 6 to 12 percent slopes, eroded (WaC2).—This sloping soil is on low ridges and knobs on outwash plains and terraces generally adjacent to the uplands. It is also on side slopes of narrow drainageways. The areas are generally 5 to 40 acres in size and elongated in shape. In approximately 55 percent of the acreage, the surface layer is silt loam, and in 45 percent it is loam. The profile of this soil is about 4 inches thinner than the profile described for the series. In addition, the dark-colored surface layer is thinner, more clayey, and generally more sandy.

Included with this soil in mapping were small areas of Dresden, Griswold, Lorenzo, Plano, and St. Charles soils and Oshtemo soils, dark variant. Also included were small areas that have a sandy loam surface layer and uneroded areas. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Other inclusions are areas where the silty mantle ranges from 20 to 36 inches in thickness and areas where the solum ranges from 40 to 60 inches in thickness. In some areas the sand and gravel outwash is underlain by stratified silt and fine sand or glacial till, generally at depths below 45 inches. Small areas of gently sloping and moderately steep soils also were included. In a few small areas the sand and gravel outwash is underlain by bedrock at depths below 5 feet.

This Warsaw soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-2; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Watseka Series

The Watseka series consists of somewhat poorly drained, nearly level soils that are sandy to a depth of 60 inches or more. These soils are on sandy outwash plains and terraces. Unless drained, they are saturated with water at depths of 1 to 3 feet during wet periods.

In a representative profile, the surface layer is about 14 inches thick. It is very dark brown loamy fine sand in the upper part and dark-brown loamy fine sand in the lower part. The subsoil is about 17 inches thick. It is dark yellowish-brown, very friable loamy fine sand in the upper part; brown, very friable loamy fine sand in the middle part; and yellowish-brown, very friable loamy fine sand in the lower part. The subsoil has very pale brown, yellowish-brown, and yellowish-red mottles. The substratum is light yellowish-brown, yellowish-brown, and brownish-yellow medium and fine sand and is at a depth of about 31 inches. The substratum has yellowish-brown and strong-brown mottles.

These soils can hold about 5 inches of water available to plants between the surface and a depth of 5 feet. Permeability is rapid. Depth of the root zone is limited by the seasonal high water table or, in drained areas, by the underlying sand. Natural fertility is low.

Where these soils are drained, most areas are used for corn, soybeans, hay, and pasture. Undrained areas are used for unimproved pasture or wildlife habitat.

Representative profile of Watseka loamy fine sand, in a cultivated field, 80 feet south of Beloit-Newark Road and 200 feet west of fence line, NE¼NW¼NE¼ sec. 21, T. 1 N., R. 10 E.:

Ap—0 to 9 inches, very dark brown (10YR 2/2) loamy fine sand; weak, medium, subangular blocky structure; very friable; moderately alkaline; abrupt, smooth boundary.

A3—9 to 14 inches, dark-brown (10YR 3/3) loamy fine sand; weak, medium, subangular blocky structure; very friable; worm and root channels filled with very dark brown (10YR 2/2) soil material from the Ap horizon; moderately alkaline; clear, smooth boundary.

B1—14 to 19 inches, dark yellowish-brown (10YR 3/4) loamy fine sand; few, fine, distinct, very pale brown (10YR 7/4) mottles; weak, medium, subangular blocky structure; very friable; worm and root channels filled with very dark brown (10YR 2/2) soil material from the Ap horizon; mildly alkaline; clear, wavy boundary.

B2—19 to 24 inches, brown (10YR 4/3) loamy fine sand; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very friable; neutral; clear, wavy boundary.

B3—24 to 31 inches, yellowish-brown (10YR 5/4) loamy fine sand; many, fine, faint, yellowish-brown (10YR 5/6) mottles and few, fine, distinct, yellowish-red (5YR 5/8) mottles; very weak, medium, subangular blocky structure; very friable; neutral; clear, smooth boundary.

C1—31 to 36 inches, light yellowish-brown (10YR 6/4) medium and fine sand; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; most sand grains are uncoated; neutral; clear, smooth boundary.

C2—36 to 42 inches, yellowish-brown (10YR 5/6) medium and fine sand; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; single grain; loose; many sand grains are uncoated; neutral; clear, smooth boundary.

C3—42 to 60 inches, brownish-yellow (10YR 6/6) medium and fine sand; single grain; loose; pockets of very pale brown (10YR 8/4) uncoated sand grains; neutral.

Depth to underlying outwash sand ranges from 24 to 36 inches. The Ap horizon is loamy fine sand or sand and ranges from 8 to 11 inches in thickness. It is black, very dark brown, or very dark gray. The A3 horizon is loamy fine sand or sand and ranges from 3 to 5 inches in thickness. It is very dark gray, very dark grayish brown, or dark brown. The B1 and B2 horizons are loamy fine sand or sand and range from 8 to 15 inches in combined thickness. They have matrix colors of dark grayish brown, dark yellowish brown, or brown. The B3 horizon is loamy fine sand or sand and ranges from 3 to 10 inches in thickness. The C horizon has matrix colors of light yellowish brown, yellowish brown, or brownish yellow.

Watseka soils are associated with Dickman, Gotham, and Hayfield soils and Billett soils, mottled subsoil variant. Watseka soils are somewhat poorly drained, but Gotham and Dickman soils are well drained.

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Watseka soils have more sand and less clay in their solum than do Hayfield soils and Billett soils, mottled subsoil variant.

Watseka loamy fine sand (0 to 2 percent slopes) (Wb).—This nearly level soil is on sandy outwash plains and terraces. Most areas are elongated in shape and are from 10 to 100 acres in size.

Included with this soil in mapping were small areas of Billett, Dickman, Gotham, Hayfield, Marshan, and Maumee soils, and Billett soils, mottled subsoil variant. Also included were small areas that have a sandy loam surface layer and small areas where the dark-colored surface layer is less than 10 inches thick. Small areas that are underlain by lacustrine silt and fine sand also were included.

This Watseka soil is somewhat poorly drained, and some small areas are subject to ponding unless drained. Some areas of this soil receive runoff from adjacent uplands. Open-ditch or surface drainage is needed for crop production. If drained, this soil is subject to soil blowing, and if the water table is lowered excessively, the beneficial effects of free water are lost in the lower part of the soil.

Where this soil is drained, most of the acreage is used for crops. If properly managed, this soil is suited to row crops, small grains, and hay. Fertilization and protection from soil blowing are necessary for dependable crop production. Undrained areas are used for unimproved pasture and wildlife habitat. (Capability unit IVw-5; woodland group 3w2; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Wauconda Series

The Wauconda series consists of deep, somewhat poorly drained, nearly level and gently sloping soils in glacial lakebeds and drainage basins. These soils are commonly adjacent to the more sloping, better drained soils on uplands or in slightly elevated areas in the lake basin. These are silty soils over stratified lacustrine deposits of calcareous silt and fine sand. Unless drained, these soils are saturated with water at depths of 1 to 3 feet during wet periods.

In a representative profile, the surface layer is very dark gray silt loam about 8 inches thick. The subsoil is about 29 inches thick. It is brown, friable silt loam in the upper part; brown and light brownish-gray, firm silty clay loam in the middle part; and light brownish-gray, friable silt loam that has thin strata of very fine sand in the lower part. The substratum is light olive-gray, yellow, and light brownish-gray, calcareous, stratified silt and fine sand and is at a depth of about 37 inches. There are yellowish-brown, yellowish-red, very dark grayish-brown, and grayish-brown mottles below a depth of 12 inches in the subsoil and in the substratum.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The depth of the root zone is limited by the seasonal high water table. Natural fertility is moderate.

Where the Wauconda soils are drained, they are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county. Undrained areas are used for unimproved pasture and wildlife habitat.

Representative profile of Wauconda silt loam, 0 to 3 percent slopes, in a cultivated field, 30 feet south of County Road N and 660 feet east of the junction of County Road N and Hobbs Road, NE¼NW¼NW¼ sec. 10 T. 4 N., R. 14 E.:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; weak, fine and medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B1—8 to 12 inches, brown (10YR 5/3) silt loam; moderate, fine, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

B21t—12 to 18 inches, brown (10YR 5/3) silty clay loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles and common, medium, faint, grayish-brown (10YR 5/2) mottles; moderate, fine, subangular blocky structure; firm; clay films on most ped faces; mildly alkaline; clear, smooth boundary.

B22tg—18 to 32 inches, light brownish-gray (2.5Y 6/2) silty clay loam; common, medium, prominent, yellowish-brown (10YR 5/6 or 5/8) mottles and few, medium, prominent, yellowish-red (5YR 4/6) mottles; moderate, fine and medium, subangular blocky structure; firm; continuous clay films on horizontal and vertical ped faces; very dark brown (10YR 2/2) clay flows in channels; mildly alkaline; gradual, smooth boundary.

IIB23tg—32 to 37 inches, light brownish-gray (2.5Y 6/2) silt loam; common, medium, prominent, yellowish-brown (10YR 5/6 or 5/8) mottles and weak, fine, prominent, very dark grayish-brown (10YR 3/2) mottles; weak, medium, subangular blocky structure; friable; very thin strata of very fine sand in the lower part; clay films on some ped faces and in channels; mildly alkaline; abrupt, smooth boundary.

IIC1g—37 to 56 inches, light olive-gray (5Y 6/2), stratified silt and fine sand; common, medium, distinct, yellowish-brown (10YR 5/8) and brownish-yellow (10YR 6/6) mottles; massive; very friable; calcareous; abrupt, smooth boundary.

IIC2g—56 to 66 inches, mixed light brownish-gray (2.5Y 6/2) and yellow (10YR 7/8) very fine and fine sand; some bands of silt; weak, medium, platy structure; very friable; calcareous.

Depth to the underlying stratified silt and fine sand ranges from 30 to 42 inches and commonly extends beyond the depth to carbonates. The depth to carbonates ranges from 24 to 40 inches. The A horizon ranges from 6 to 9 inches in thickness. It is black, very dark gray, or very dark brown. The B1 horizon ranges from 3 to 7 inches in thickness. The B2t horizon ranges from 15 to 25 inches in thickness and has matrix colors of brown, light brownish gray, or grayish brown. The IIB horizon is loam or silt loam and ranges from 2 to 8 inches in thickness. It has matrix colors of light brownish gray or grayish brown. The IIC horizon has matrix colors of light olive gray, yellow, light brownish gray, or grayish brown, and in some profiles it is a mixture of two or more of these colors.

Wauconda soils are associated with Aztalan, Darroch, and Zurich soils. Wauconda soils are more poorly drained than Zurich soils. They have less sand in the upper part of the solum than Darroch soils. Wauconda soils have more sand and less clay in the substratum than Aztalan soils.

Wauconda silt loam, 0 to 3 percent slopes (WcA).—This soil is in glacial lakebeds and drainage basins in irregularly shaped areas generally less than 40 acres in size.

Included with this soil in mapping were small areas of Colwood, Elburn, Kane, Sisson, and Zurich soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil. Also included were small areas where the texture of the surface layer is loam. In some areas the depth of the solum is greater than 42 inches. The surface layer is thicker in some areas than the one in this soil. Some areas do not show evidence of stratification in the subsoil.

This Wauconda soil is somewhat poorly drained. It receives runoff from adjoining areas and is subject to ponding in some areas during wet periods and after heavy rain. Drainage is needed for dependable crop production.

If drained, this soil is suited to all the farm and vegetable crops commonly grown in the county. Undrained areas are used for pasture and wildlife habitat. (Capability unit IIw-2; woodland group 3w1; wildlife group 5a; not placed in a shrub and vine group; recreation group 5)

Westville Series

The Westville series consists of deep, well drained and moderately well drained, nearly level to sloping, loamy soils underlain by gravelly sandy loam glacial till. Some areas of

these soils are saturated with water at depths of 3 to 5 feet in wet periods.

In a representative profile, the surface layer is dark grayish-brown loam about 8 inches thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 70 inches thick. It is strong-brown, firm clay loam in the upper part; yellowish-brown, friable sandy clay loam in the middle part; and brown, friable heavy sandy loam in the lower part. The substratum is yellowish-brown, calcareous gravelly sandy loam and is at a depth of about 83 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Westville loam, 2 to 6 percent slopes, eroded, in a cultivated field, 30 feet north of fence line and 330 feet west of fence line at the edge of a woodlot, SW¼SW¼NW¼ sec. 15, T. 3 N., R. 11 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam; moderate, medium and fine, subangular blocky structure; friable; moderately alkaline; abrupt, smooth boundary.

A2—8 to 13 inches, brown (10YR 5/3) loam; weak, medium, subangular blocky structure; friable; dark grayish-brown (10YR 4/2) worm casts; mildly alkaline; clear, smooth boundary.

B21t—13 to 30 inches, strong-brown (7.5YR 5/6) clay loam; moderate, medium, subangular blocky structure; firm; thin, patchy, dark reddish-brown (5YR 3/4) clay films on some ped faces; clay flows in channels; slightly acid; gradual, wavy boundary.

B22t—30 to 37 inches, strong-brown (7.5YR 5/6) clay loam; moderate, medium and fine, subangular blocky structure; firm; few, thin, patchy, dark reddish-brown (5YR 3/2) clay films and many, thin, patchy, reddish-brown (5YR 4/4) clay films on ped faces; clay flows in channels; very strongly acid; gradual, wavy boundary.

B23t—37 to 48 inches, strong-brown (7.5YR 5/6) clay loam; weak, coarse, subangular blocky structure; firm; thin, patchy, dark reddish-brown (5YR 3/4) clay films on some ped faces; clay flows in channels; very strongly acid; gradual, wavy boundary.

B24t—48 to 70 inches, yellowish-brown (10YR 5/4) sandy clay loam; weak, coarse, subangular blocky structure; friable; thin, patchy, dark reddish-brown (5YR 3/4) clay films on some ped faces; clay flows in channels; very strongly acid; gradual, wavy boundary.

B3—70 to 83 inches, brown (10YR 4/3) heavy sandy loam; weak, coarse, subangular blocky structure; friable; neutral; clear, wavy boundary.

C—83 to 92 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; very friable; calcareous.

Depth to calcareous gravelly sandy loam till ranges from 45 to 90 inches. The A horizon is loam, silt loam, or sandy loam and ranges from 8 to 16 inches in thickness. The Ap horizon is dark grayish brown or brown and is 5 to 10 inches thick. Where these soils have not been cultivated, the A1 horizon is black, very dark brown, or very dark grayish brown and is 3 to 5 inches thick. The A2 horizon ranges from 4 to 12 inches in thickness. It is brown, dark grayish brown, or yellowish brown. The B1 horizon ranges from 0 to 8 inches in thickness. Where present, it is dark brown or dark yellowish brown. The B2t horizon is clay loam or sandy clay loam and ranges from 20 to 60 inches in thickness. It is strong brown, reddish brown, brown, yellowish brown, dark yellowish brown, or dark brown. The B3 horizon ranges from 0 to 25 inches in thickness and, where present, is sandy clay loam or heavy sandy loam. It is yellowish brown or brown. Profiles that lack base colors of a hue of 5YR in some part of the B horizon have clay films of that hue. Mottles are in the lower subsoil in some profiles.

Westville soils are associated with Pecatonica and Winnebago soils. Westville soils have more sand in the upper part of the subsoil than Pecatonica soils. They have a lighter colored or thinner, dark-colored surface layer than Winnebago soils.

Westville sandy loam, 0 to 2 percent slopes (WeA).—This nearly level soil is on broad till plains and till-covered ridgetops and valley floors in areas where bedrock is relatively shallow. The areas are generally less than 50 acres in size and irregular in shape. In the profile of this soil, there is more sand in the surface layer, subsurface layer, and upper part of the subsoil than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Kidder, Ostemo, Whalan, and Winnebago soils. In drainageways and depressions, the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. In some small areas the surface layer is loam. In some areas the surface layer is loamy sand, and many of these areas are indicated on the soil map by the symbol for sand spots. In some areas the surface layer is darker colored than the one in the soil having the profile described as representative for the series. Also included were areas where the subsoil is more sandy and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than by glacial till. Some small areas of gently sloping soils also were included.

This Westville soil is subject to soil blowing during dry periods. It can be cultivated intensively if management practices supply regular additions of organic matter, maintain tilth, and control soil blowing. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Westville sandy loam, 2 to 6 percent slopes (WeB).—This gently sloping soil is on broad till plains and till-covered ridgetops and valley floors in areas where bedrock is relatively shallow. The areas are generally less than 60 acres in size and irregular in shape. This soil has more sand in the surface layer, subsurface layer, and upper part of the subsoil than the soil having the profile described as representative for the series.

Included with this soil in mapping were small areas of Kidder, Oshtemo, Whalan, and Winnebago soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. In some small areas the surface layer is loam. In some areas the surface layer is loamy sand, and many of these areas are indicated on the soil map by the symbol for sand spots. In some areas the surface layer is darker colored than the one in the profile described as representative for the series. Some areas are moderately eroded. Also included were some areas where the subsoil is more sandy and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than by glacial till. Some small areas of nearly level and sloping soils also were included.

This Westville soil is slightly susceptible to erosion and is subject to soil blowing during dry periods. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion and soil blowing. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Westville sandy loam, 6 to 12 percent slopes, eroded (WeC2).—This sloping soil is on till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. These areas are generally less than 30 acres in size and are elongated. This soil has more sand in the surface

layer, subsurface layer, and upper part of the subsoil than the soil having the profile described as representative for the series.

Included with this soil in mapping were small areas of Kidder, Oshtemo, Whalan, and Winnebago soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. In some small areas the surface layer is loam. In some areas the surface layer is loamy sand, and many of these areas are indicated on the soil map by the symbol for sand spots. In some areas the surface layer is darker colored than the one in the profile described as representative for the series. Also included were areas where the subsoil is more sandy and areas where the subsoil is less red than the one in that soil. Other inclusions are uneroded areas and some small severely eroded areas where most of the original surface layer has been removed by erosion. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than by glacial till. Some small areas of gently sloping and moderately steep soils also were included with this soil.

This Westville soil is moderately susceptible to erosion and is subject to soil blowing during dry periods. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion and soil blowing. Most of the acreage is used for crops. This soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Westville loam, 0 to 2 percent slopes (WfA).—This nearly level soil is on till plains and on broad, till-covered ridgetops and valley floors in areas where bedrock is relatively shallow. The areas are generally less than 40 acres in size and are irregular in shape. In approximately 55 percent of the acreage, the surface layer is loam, and in 45 percent it is silt loam. In the profile of this soil, depth to the gravelly sandy loam substratum and thickness of the surface layer are about 3 inches more than in the profile described as representative for the series.

Included with this soil in mapping were small areas of Kidder, Pecatonica, Whalan, and Winnebago soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Substantial areas of this soil have a silty mantle up to 20 inches thick. In some small areas the surface layer is sandy loam and in some small areas it is darker colored than the one in the profile described as representative for the series. Also included were areas where the subsoil is more sandy and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than by glacial till. Some small areas of gently sloping soils also were included.

This soil has few limitations and can be cultivated intensively if management practices are used to return organic matter regularly and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the common farm and vegetable crops. Capability unit I-4; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Westville loam, 2 to 6 percent slopes, eroded (WfB2).—This gently sloping soil is on till plains and broad till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The areas generally are less than 50 acres in size and are irregular in shape. In approximately 60 percent of the acreage, the surface layer is loam, and in 40 percent it is silt loam. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Kidder, Pecatonica, Whalan, and Winnebago soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in this Westville soil, and in some areas the subsoil is mottled. Substantial areas have a silty mantle up to 20 inches thick. In some small areas the surface layer is sandy loam and in some areas it is darker colored than the one in this soil. Also included were areas where the subsoil is more sandy and areas where the subsoil is less red. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than by glacial till. Some small areas of nearly level and sloping soils also were included. Other inclusions are uneroded areas and some small severely eroded areas where most of the original surface layer has been removed by erosion.

This Westville soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Westville loam, 6 to 12 percent slopes, eroded (WfC2).—This sloping soil is on till plains and on till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The areas are generally less than 40 acres in size and are generally elongated in shape. In approximately 60 percent of the acreage, the surface layer is loam, and in 40 percent it is silt loam. The profile of this soil is about 10 inches thinner than the profile described as representative for the series.

Included in mapping were small areas of Kidder, Pecatonica, Whalan, and Winnebago soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the profile described for the series, and in some of these areas the subsoil is mottled. Some areas have a silty mantle up to 20 inches thick. In some small areas the surface layer is sandy loam and in some areas it is darker colored than the one in the soil described as representative for the series. Also included were areas where the subsoil is more sandy and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than by glacial till. Some small areas of gently sloping and moderately steep soils also were included. Other inclusions are uneroded areas and some small severely eroded areas where most of the original surface layer has been removed by erosion.

This Westville soil is moderately susceptible to erosion. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. If properly managed, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 2)

Whalan Series

The Whalan series consists of well-drained, nearly level to moderately steep, loamy soils that are underlain by dolomite bedrock at depths of 20 to 40 inches. The subsoil formed mainly in weathered glacial till, but in some areas

the lower part of the subsoil formed in clayey residuum from weathered dolomite. The dolomite is generally soft and weathered in the upper few inches and fragmentary and creviced in the upper few feet. Subsoil material generally fills these crevices. These soils are not saturated with water for periods long enough to affect crop growth.

In a representative profile, the surface layer is very dark grayish-brown loam about 6 inches thick. The subsoil is about 30 inches thick. It is brown, friable heavy loam in the upper part; dark yellowish-brown and dark-brown, firm clay loam in the middle part; and dark-brown, very firm clay in the lower part. The underlying dolomite is pale-yellow, calcareous, fragmentary, and creviced and is at a depth of about 36 inches.

These soils can hold about 7 inches of water available to plants between the surface and the depth to bedrock. Permeability is moderately slow. The depth of the root zone is generally limited by the dolomite, but some roots extend into crevices that are filled by subsoil material. Natural fertility is moderate.

Most areas of nearly level to sloping Whalan soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of the moderately steep soils are in pasture or woods.

Representative profile of Whalan loam, 2 to 6 percent slopes, eroded, in a cultivated field, 235 feet east of County Road K and 27 feet north of fence line, SW¼NW¼SW¼ sec. 8, T. 1 N., R. 11 E.:

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) loam; moderate, coarse and medium, granular structure; very friable; some brown (10YR 4/3) subsoil material mixed in this horizon by plowing; slightly acid; abrupt, smooth boundary.

B1—6 to 13 inches, brown (10YR 4/3) heavy loam; moderate, fine and medium, subangular blocky structure; friable; some worm channels filled with very dark grayish-brown (10YR 3/2) material from A horizon; medium acid; gradual, smooth boundary.

B21t—13 to 22 inches, dark yellowish-brown (10YR 4/4) light clay loam; moderate, fine and medium, subangular blocky structure; firm; clay bridging between sand grains; thin patchy clay films on some ped faces; few chert fragments; slightly acid; gradual, wavy boundary.

B22t—22 to 27 inches, dark-brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; continuous clay films on ped faces; neutral; clear, wavy boundary.

B23t—27 to 31 inches, dark-brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; thick continuous clay films on ped faces; slightly acid; clear, wavy boundary.

IIB24t—31 to 34 inches, dark-brown (7.5YR 4/4) heavy clay loam; moderate, fine and medium, subangular blocky structure; very firm; thick continuous clay films on ped faces; neutral; abrupt, smooth boundary.

IIB25t—34 to 36 inches, dark-brown (7.5YR 4/4) clay; moderate, fine and very fine, subangular blocky structure; very firm; thick, continuous, dark-brown (7.5YR 4/2) clay films on ped faces; neutral; abrupt, smooth boundary.

IIR—36 inches +, pale-yellow (2.5Y 8/4) dolomite bedrock; fragmentary and creviced.

Depth to dolomite ranges from 20 to 40 inches. The A horizon is loam, silt loam, or sandy loam and ranges from 5 to 15 inches in thickness. The Ap horizon is very dark grayish brown or dark grayish brown and is generally a mixture of these colors. Where the soil has not been cultivated, the A1 horizon is very dark brown or very dark grayish brown and ranges from 2 to 5 inches in thickness. The A2 horizon ranges from 0 to 6 inches in thickness and, where present, is dark yellowish brown or brown. The A3 horizon ranges from 0 to 4 inches in thickness and, where present, is yellowish brown. The B1 horizon ranges from 0 to 8 inches in thickness and, where present, is heavy silt loam or heavy loam. It is dark yellowish brown, yellowish brown, or brown. The texture of the B2t horizon is heavy loam or clay loam in the upper part and clay loam, silty clay, or clay in the lower part. The B2t horizon ranges from 10 to 25 inches in thickness and is dark yellowish brown, yellowish brown, brown, dark brown, or reddish brown. The content of coarse fragments ranges from 1 to 20 percent in the B2t horizon.

Whalan soils are associated with Edmund, Eleva, Rockton, and Sogn soils. Whalan soils have a thicker solum and are deeper to dolomite than Sogn and Edmund soils. Whalan soils have a lighter colored or thinner, dark-colored surface layer than Rockton soils. Whalan soils are underlain by dolomite, but Eleva soils are underlain by sandstone.

Whalan sandy loam, 2 to 6 percent slopes, eroded (WhB2).—This gently sloping soil is on broad ridgetops and side slopes. The areas are generally less than 30 acres in size and are elongated. The profile of this soil contains more sand in the surface layer and upper part of the subsoil than the profile described as representative for the series.

Included with this soil in mapping were small areas that have a loamy sand surface layer and small areas where the lower part of the subsoil is more sandy than the one in the soil having the profile described as representative for the series. Also, in drainageways and depressions the surface layer is thicker and darker colored than in that soil. Other inclusions are uneroded areas and small areas of nearly level and sloping soils. In some areas the depth to dolomite ranges from 40 to 60 inches. Small areas of Kidder and Westville soils and Gotham soils, bedrock variant, also were included.

This Whalan soil has moderate permeability. It is slightly susceptible to erosion and is subject to soil blowing during dry periods. Management practices are needed that improve tilth, supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. This soil is suited to all the farm and most vegetable crops commonly grown in the county. (Capability unit IIe-2; woodland group 2d2; wildlife group 1; shrub and vine group 1; recreation group 10)

Whalan sandy loam, 6 to 12 percent slopes, eroded (WhC2)—This sloping soil is on narrow ridgetops and side slopes. The areas are generally less than 20 acres in size and are elongated in shape. The profile of this soil is about 2 inches thinner than the profile described as representative for the series. In addition, it contains more sand in the surface layer and upper part of the subsoil.

Included with this soil in mapping were small areas that have a loamy sand surface layer and small areas that are more sandy in the lower part of the subsoil than the soil having the profile described as representative for the series. Also, in drainageways and depressions the surface layer is thicker and darker colored than in that soil. Other inclusions are uneroded areas and small areas of gently sloping or moderately steep soils. In some areas the depth to dolomite ranges from 40 to 60 inches. Small areas of Kidder and Westville soils and Gotham soils, bedrock variant, also were included.

This Whalan soil has moderate permeability. It is moderately susceptible to erosion and is subject to soil blowing during dry periods. Management practices are needed that improve tilth, supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most of the acreage is used for crops. This soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-2; woodland group 2d2; wildlife group 1; shrub and vine group 1; recreation group 10)

Whalan loam, 0 to 2 percent slopes (WlA).—This nearly level soil is on broad ridgetops. The areas generally are less than 20 acres in size and are irregular in shape. In approximately 55 percent of the acreage, the surface layer is loam, and in 45 percent it is silt loam. The profile of this soil is

about 4 inches thicker than the profile described as representative for the series.

Included with this soil in mapping were small areas where the depth to dolomite ranges from 40 to 60 inches and small areas where the silty mantle is greater than 20 inches thick. Other inclusions are small areas of gently sloping soils, small areas that have a sandy loam surface layer, and small areas of Rockton soils. Some small areas of moderately well drained soils that have gray mottles in the lower part of the subsoil also were included.

This Whalan soil has moderate permeability. Management practices are needed that improve tilth, regularly add organic matter to the soil, and increase moisture infiltration. The depth of the root zone for annual crops is generally limited by the dolomite.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIs-1; woodland group 2d2; wildlife group 1; shrub and vine group 1; recreation group 10)

Whalan loam, 2 to 6 percent slopes, eroded (WlB2).—This gently sloping soil is on broad ridgetops and upper side slopes. The areas generally are 20 to 160 acres in size and are elongated in shape. In approximately 60 percent of the acreage, the surface layer is loam, and in 40 percent it is silt loam. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Edmund, Rockton, Kidder, Sogn, and Westville soils. Other inclusions are uneroded areas and small areas of sloping soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in this soil, and in some areas the subsoil is mottled. Also included were small areas that have a sandy loam surface layer and some areas where the silty mantle is more than 20 inches thick. In some areas the depth to dolomite ranges from 40 to 60 inches.

This Whalan soil has moderate permeability. It is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-2; woodland group 2d2; wildlife group 1; shrub and vine group 1; recreation group 10)

Whalan loam, 6 to 12 percent slopes, eroded (WlC2).—This sloping soil is on narrow ridgetops and side slopes. The areas generally are 15 to 120 acres in size and are elongated in shape. In approximately 60 percent of the acreage, the surface layer is loam, and in 40 percent it is silt loam. The profile of this soil is about 2 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, Edmund, Kidder, Sogn, and Westville soils. Other inclusions are uneroded areas and some small, severely eroded areas where almost all of the original surface layer has been removed by erosion. Other inclusions are small areas of gently sloping soils and moderately steep soils. In drainageways and depressions the surface layer is thicker and darker colored than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Also included were small areas that have a sandy loam surface layer and some small areas where the silty mantle is more than 20 inches thick. Small areas that have bedrock at or near the surface are generally indicated on the soil map by the symbol for rock outcrop. In some areas the depth to dolomite ranges from 40 inches to generally more than 60 inches.

This Whalan soil has moderate permeability. It is moderately susceptible to erosion. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion.

Most of the acreage is used for crops. The soil is suited to all the farm crops commonly grown in the county. In the more sloping areas that have been damaged by erosion, surface crusting frequently reduces the emergence of small-seeded crops, such as alfalfa. (Capability unit IIIe-2; woodland group 2d2; wildlife group 1; shrub and vine group 1; recreation group 10)

Whalan loam, 12 to 20 percent slopes, eroded (WlD2).—This moderately steep soil is on side slopes in areas underlain by bedrock that have been deeply incised by natural drainageways. The areas generally are 10 to 30 acres in size and are elongated in shape. In approximately 65 percent of the acreage, the surface layer is loam, and in 35 percent it is silt loam. The profile of this soil is about 4 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, Edmund, Kidder, and Sogn soils. Other inclusions are uneroded areas that have never been cleared of trees and small, severely eroded areas where almost all of the original surface layer has been removed by erosion. Other inclusions are small areas of sloping and steep soils. Small areas that have bedrock at or near the surface are generally indicated on the soil map by the symbol for rock outcrop. In some areas the depth to dolomite ranges from 40 to 60 inches. In drainageways the surface layer is thicker and darker colored than the one in the soil having the representative profile. Some small areas that have a sandy loam surface layer also were included.

This Whalan soil has very rapid runoff and is highly susceptible to erosion. Most of the acreage is in hay, pasture, or woods. Row crops are grown in some of the less sloping areas. Many areas that were cultivated in the past are now in pasture or woods.

This soil is not suited to row crops unless erosion is controlled. It is better suited to close-growing crops or to woods. (Capability unit IVe-2; woodland group 2r1; wildlife group 1; shrub and vine group 1; recreation group 10)

Winnebago Series

The Winnebago series consists of well drained and moderately well drained, nearly level to sloping, loamy soils that are deep and are underlain by gravelly sandy loam glacial till. Some areas of these soils are saturated with water at depths of 3 to 5 feet in wet periods.

In a representative profile, the surface layer is about 11 inches thick. It is black silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The subsoil is about 66 inches thick. It is brown and reddish-brown, firm clay loam in the upper part; brown, firm sandy clay loam in the middle part; and brown, friable sandy loam in the lower part. The substratum is brown, calcareous gravelly sandy loam and is at a depth of about 77 inches.

These soils can hold about 11 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas of these soils are used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Winnebago silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 240 feet north of State Route 11 and 50 feet west of fence line, SW¼ SW¼SW¼ sec. 31, T. 3 N., R. 12 E.:

Ap—0 to 7 inches, black (10YR 2/1) silt loam; weak, medium, subangular blocky structure; friable; slightly acid; abrupt, smooth boundary.

A3—7 to 11 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—11 to 30 inches, brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm;, thin, patchy, dark reddish-brown (5YR 3/4) clay films on some ped faces; clay flows in channels; medium acid; clear, smooth boundary.

B22t—30 to 57 inches, reddish-brown (5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; dark reddish-brown (5YR 3/4) clay films on most ped faces; clay flows in channels; medium acid; clear, smooth boundary.

B23t—57 to 63 inches, brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; dark reddish-brown (5YR 3/2) clay films on most ped faces; clay flows in channels; medium acid; clear, smooth boundary.

B24t—63 to 70 inches, brown (7.5YR 4/4) sandy clay loam; moderate, medium, subangular blocky structure; firm; thin, patchy, dark reddish-brown (5YR 3/4) clay films on some ped faces; clay flows in channels; slightly acid; clear, smooth boundary.

B3—70 to 77 inches, brown (7.5YR 5/4) sandy loam; weak, medium, subangular blocky structure; friable; some clay bridging of sand grains; some clay flows in channels; mildly alkaline; clear, smooth boundary.

IC—77 to 87 inches, brown (7.5YR 5/4) gravelly sandy loam; massive; friable; calcareous.

Depth to calcareous gravelly sandy loam till ranges from 45 to 90 inches. The A horizon is loam or silt loam and ranges from 10 to 16 inches in thickness. It is black or very dark brown in the upper part and very dark grayish brown or dark brown in the lower part. The B1 horizon ranges from 0 to 8 inches in thickness and, where present, is dark yellowish brown or brown. The B2t horizon is clay loam or sandy clay loam and ranges from 20 to 60 inches in thickness. It is brown, reddish brown, or yellowish red. The B3 horizon is 0 to 20 inches thick. Where present, it is sandy loam or sandy clay loam and is brown, dark yellowish brown, or yellowish red. Profiles that lack base colors having a hue of 5YR in some part of the B horizon have clay films of that hue. Mottles are in the lower part of the subsoil in some profiles. The C horizon is brown or yellowish brown.

Winnebago soils are associated with Durand, Pecatonica, and Westville soils. Winnebago soils have more sand in the upper part of the subsoil than Durand and Pecatonica soils. They have a darker colored or thicker, dark-colored surface layer than Westville and Pecatonica soils.

Winnebago silt loam, 0 to 2 percent slopes (WnA).—This nearly level soil is on till plains and on broad, till-covered ridgetops and valley floors in areas where bedrock is relatively shallow. The areas generally are less than 50 acres in size and irregular in shape. In approximately 65 percent of the acreage, the surface layer is silt loam, and in 35 percent it is loam. In the profile of this soil, depth to the gravelly sandy loam substratum and thickness of the surface layer are about 3 inches more than the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Griswold, Rockton, and Westville soils and Oshtemo soils, dark variant. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Substantial areas in the eastern part of the county have a silty mantle up to 20 inches thick. In some areas, generally indicated on the soil map by the symbol for sand spots, the surface layer is sandy loam or loamy sand. Also included were areas where the subsoil is more sandy than the one in the soil having the profile described as representative for the series and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by sand, sand and gravel, or dolomite bedrock rather than by glacial till. Also included were some small areas of gently sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam.

This Winnebago soil has few limitations and can be cropped intensively if management practices are used to supply regular additions of organic matter and to maintain tilth. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-4; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Winnebago silt loam, 2 to 6 percent slopes, eroded (WnB2).—This gently sloping soil is on till plains and on broad, till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The areas are generally less than 60 acres in size and are irregular in shape. In approximately 60 percent of the acreage, the surface layer is silt loam, and in 40 percent it is loam. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Griswold, Rockton, and Westville soils and Oshtemo soils, dark variant. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Substantial areas in the eastern part of the county have a silty mantle up to 20 inches thick. In some areas, generally indicated on the soil map by the symbol for sand spots, the surface layer is sandy loam or loamy sand. Also included were areas where the subsoil is more sandy than the one in the soil having the profile described as representative for the series, and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by stratified silt and sand, sand, sand and gravel, or dolomite bedrock rather than by glacial till. Also included were some small areas of nearly level and sloping soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and some small severely eroded areas where most of the original surface layer has been removed by erosion.

This Winnebago soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1)

Winnebago silt loam, 6 to 12 percent slopes, eroded (WnC2).—This sloping soil is on till plains and on till-covered ridgetops, side slopes, and valley floors in areas where bedrock is relatively shallow. The areas generally are less than 30 acres in size and elongated in shape. In approximately 55 percent of the acreage, the surface layer is silt loam, and in 45 percent it is loam. The profile of this soil is about 10 inches thinner than the profile described as representative for the series.

Included with this soil in mapping were small areas of Durand, Griswold, Rockton, and Westville soils and Oshtemo soils, dark variant. In drainageways and depressions the surface layer is thicker than the one in the soil having the representative profile, and in some of these areas the subsoil is mottled. Some areas have a silty mantle up to 20 inches thick. In some areas, generally indicated on the soil map by the symbol for sand spots, the surface layer is sandy loam or loamy sand. Also included were areas where the subsoil

is more sandy than the one in the soil having the profile described as representative for the series, and areas where the subsoil is less red than in that soil. In some areas this soil is underlain by stratified silt and sand, sand, sand and gravel, or dolomite bedrock rather than by glacial till. Also included were some small areas of gently sloping and moderately steep soils and some small areas where the underlying till has a texture of silt loam, loam, or clay loam. Other inclusions are uneroded areas and some small, severely eroded areas where most of the original surface layer has been removed by erosion.

This Winnebago soil is moderately susceptible to erosion. Management practices are needed to conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1 woodland group 4o1; wildlife group 4; shrub and vine group 1; recreation group 1).

Worthen Series

The Worthen series consists of deep, well drained and moderately well drained, silty soils. These nearly level and gently sloping soils occur in natural drainageways and depressions and on foot slopes. Most areas are nearly level. Some areas of these soils are saturated with water at depths of 3 to 5 feet during wet periods.

In a representative profile, the surface layer is about 24 inches thick. It is very dark grayish-brown silt loam in the upper part and very dark brown silt loam in the lower part. The subsoil is more than 36 inches thick. It is dark-brown, very friable and friable silt loam in the upper part and yellowish-brown, friable silt loam in the lower part.

These soils can hold about 13 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is high.

Most areas of these soils are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county. These soils are subject to occasional flooding of short duration and, in depressional areas, are subject to ponding in wet periods. Sloping areas are slightly susceptible to erosion.

Representative profile of Worthen silt loam, 0 to 3 percent slopes, in a cultivated field, 220 feet east of State Route 184 and 800 feet north of Fenrick Road intersection, NW¼SW¼SW¼ sec. 18, T. 3 N., R. 12 E.:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; very friable; medium acid; clear, smooth boundary.

A12—10 to 24 inches, very dark brown (10YR 2/2) silt loam; weak, medium, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

B21—24 to 37 inches, dark-brown (10YR 3/3) silt loam; weak, medium, subangular blocky structure; very friable; slightly acid; clear, smooth boundary.

B22—37 to 47 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

B23—47 to 60 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; friable; pockets of dark-brown (10YR 3/3) material in worm channels; neutral.

Thickness of the solum ranges from 40 to 70 inches. The combined thickness of the A horizons ranges from 16 to 24 inches, and the dark-colored layers extend to a depth of more than 24 inches from the surface. The A11, or the Ap, horizon ranges from 6 to 10 inches in thickness. It is very dark brown, very dark gray, or very dark grayish brown. The A12 horizon ranges from 10 to 14 inches in thickness and is black, very dark brown, very dark gray, or very dark grayish brown. The B21 horizon ranges from 10 to 13 inches in thickness. It is dark brown, brown, or dark yellowish brown. The B22 horizon ranges from 4 to 10 inches in thickness. It is dark brown, brown, dark yellowish brown, or yellowish brown. The B23 horizon ranges from 6 to 13 inches in thickness and is brown, dark yellowish brown, or yellowish brown. Faint to distinct mottles are in the lower part of the B horizon in some areas.

Worthen soils are associated with Juneau, Millington, and Troxel soils. Worthen soils have a darker colored surface layer than Juneau soils and are less clayey in the lower part. Worthen soils have less clay in the subsoil than Troxel soils. They are better drained and not so calcareous as Millington soils.

Worthen silt loam, 0 to 3 percent slopes (WoA).—The major areas of this soil occur as elongated tracts in natural drainageways and at the base of slopes where sediment has been deposited by runoff. Most areas are 10 to 40 acres in size.

Included with this soil in mapping were small areas of Elburn, Juneau, and Troxel soils. Also included were small areas that have a loam or sandy loam surface layer, areas that have loam or sandy loam strata in the overwash, and areas that have slopes of as much as 5 percent.

This Worthen soil can be cropped intensively if flooding and erosion are controlled. It is used for all crops commonly grown in the county and for pasture. (Capability unit I-2; woodland group 2o2; wildlife group 7; shrub and vine group 1; recreation group 7)

Zurich Series

The Zurich series consists of deep, well drained and moderately well drained, nearly level to sloping soils in glacial lakebeds and drainage basins. These are silty soils over stratified lacustrine deposits of calcareous silt and fine sand. Some areas of these soils are saturated with water at depths of 3 to 5 feet during wet periods.

In a representative profile, the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is about 34 inches thick. It is yellowish-brown, very friable silt loam in the upper part; brown and yellowish-brown, firm silty clay loam in the middle part; and light yellowish-brown, friable, stratified silt loam, silt, and very fine sand in the lower part. Gray and brownish-yellow mottles are in the lower part of the subsoil. The substratum is yellowish-brown and light yellowish-brown, calcareous, stratified silt and fine sand and has brown and strong-brown mottles. The substratum is at a depth of about 37 inches.

These soils can hold about 10 inches of water available to plants between the surface and a depth of 5 feet. Permeability is moderate. The root zone is deep. Natural fertility is moderate.

Zurich soils are used for corn, soybeans, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Zurich silt loam, 2 to 6 percent slopes, in a cultivated field, 30 feet north of Old Highway 59 at Trescher Road, NE¼NE¼SE¼ sec. 7, T. 4 N., R. 13 E.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

B1—6 to 12 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; very friable; mildly alkaline; clear, smooth boundary.

B21t—12 to 26 inches, brown (7.5YR 4/4) silty clay loam; strong, fine, subangular blocky structure; firm; thick; continuous; dark-brown (7.5YR 4/2) clay films on most ped faces; slightly acid; gradual, smooth boundary.

B22t—26 to 37 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; firm; few,

thin, dark-brown (7.5YR 4/2) clay films; moderately alkaline; clear, smooth boundary.

IIB3—37 to 40 inches, light yellowish-brown (10YR 6/4), stratified silt loam, silt, and very fine sand; common, fine, prominent, gray (10YR 6/1) mottles and distinct, brownish-yellow (10YR 6/6) mottles; weak, medium, platy structure; friable; calcareous; clear, smooth boundary.

IIC—40 to 60 inches, yellowish-brown (10YR 5/4 to 5/6) and light yellowish-brown (10YR 6/4), stratified silt and fine sand; many, coarse, prominent, brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; moderate, medium and thin, platy structure; friable; calcareous.

Depth to the underlying stratified silt and fine sand ranges from 36 to 46 inches and commonly is greater than the depth to carbonates. The depth to carbonates ranges from 30 to 40 inches. The A horizon ranges from 6 to 8 inches in thickness. It is brown or dark grayish brown. The B1 horizon ranges from 3 to 6 inches in thickness and is brown, dark grayish brown, or yellowish brown. The B2t horizon ranges from 17 to 30 inches in thickness. It is brown, strong brown, yellowish brown, or dark yellowish brown. The IIB3 horizon is 0 to 9 inches thick. Where present, it is silt loam or stratified silt, silt loam, and very fine sand and is yellowish brown or light yellowish brown. The IIC horizon is brown, yellowish brown, light yellowish brown, or brownish yellow, and in some profiles it is a mixture of two or more of these colors. Mottles in the lower part of the subsoil are lacking in some areas.

Zurich soils are associated with Sisson and Wauconda soils. Zurich soils have less sand in the upper part of the subsoil than Sisson soils. Zurich soils are better drained than Wauconda soils.

Zurich silt loam, 0 to 2 percent slopes (ZuA).—This nearly level soil is in glacial lakebeds and drainage basins. The areas are generally irregular in shape and less than 40 acres in size. The profile of this soil is about 2 inches thicker than the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, St. Charles, and Wauconda soils. In drainageways and depressions the surface layer is thicker and darker than the one in the soil having the representative profile, and in some areas the subsoil is mottled. Also included were some small areas of gently sloping soils.

This Zurich soil has few limitations for cultivation and can be cropped intensively if management practices are used to supply regular additions of organic matter and to maintain tilth. Most areas are used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit I-3; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Zurich silt loam, 2 to 6 percent slopes (ZuB).—This gently sloping soil is in glacial lakebeds and drainage basins. The areas are generally irregular in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping were small areas of Dresden, St. Charles, Sisson, and Wauconda soils. In drainageways and depressions the surface layer is thicker and darker than the one in this soil, and in some areas the subsoil is mottled. Also included were some small areas of sloping soils and nearly level soils.

This Zurich soil is slightly susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. This soil is suited to all the farm and vegetable crops commonly grown in the county. (Capability unit IIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Zurich silt loam, 6 to 12 percent slopes, eroded (ZuC2).—This sloping soil is on low ridges and knobs in glacial lakebeds and drainage basins. These areas are irregular in shape and generally less than 30 acres in size. The profile of this soil is about 6 inches thinner than the profile described as representative for the series. Where the soil has been cultivated, subsoil material has been mixed into the surface layer.

Included with this soil in mapping were small areas of Dresden, Kidder, and Sisson soils. In drainageways and depressions the surface layer is thicker and darker than the one in the soil having the representative profile, and in some areas the subsoil is mottled. In addition, small severely eroded areas were included where the surface layer is more clayey than in that soil. Also included were areas where the solum is less than 24 inches thick and other small areas that are slightly eroded.

This Zurich soil is moderately susceptible to erosion. Management practices are needed that conserve moisture, reduce runoff, improve tilth, and control erosion. Most of the acreage is used for crops. Under proper management, this soil is suited to all the farm crops commonly grown in the county. (Capability unit IIIe-1; woodland group 2o1; wildlife group 1; shrub and vine group 1; recreation group 1)

Formation and Classification of the Soils

This section consists of three main parts. The first part tells how the factors of soil formation have affected the development of soils in Rock County. The second explains the system of soil classification currently used and places each soil series in some of the categories of that system. The third describes briefly the genesis and morphology of the soils.

Factors of Soil Formation

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

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in some cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be long or short, but some time is always required for differentiation of soil horizons. Generally, a long time is required for the development of distinct horizons.

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

Climate

Climate affects soil formation through the moisture and heat it contributes to an environment. It has a direct effect

on the weathering of rocks and the alteration of parent material through the mechanical action of freezing and thawing and the chemical action generated by the leaching of water. It has an indirect effect through its influence on plant and animal life. It provides a suitable environment for living organisms, and this is of special significance in the rate of plant growth, the accumulation of organic matter and the degree of soil fertility. Climate has an indirect effect on the clay content. Generally, the clay content tends to be greater in warmer, more humid climates. Soils of the Griswold and Plano series are examples of soils that show the influence of climate on soil formation.

Rock County has a cool, subhumid, continental climate that is characteristic of the north-central part of the United States. The effects of the continental, or macroclimate, are modified locally by variations in relief and by aspect.

Where slopes are steep, runoff is more rapid and less rainfall soaks into the soil. As a result, biological, mechanical, and chemical agents of weathering are retarded, and soil formation is slow. Soils of the Casco, Lorenzo, and Rotamer series are examples of soils that show the influence of local variations in relief.

The direction of slope affects the formation of soils. Where slopes face south or west, the soil is warmer and drier than where slopes face north, because south-facing slopes receive direct sunlight for longer periods and because prevailing winds are from the west and southwest. Soils on the cooler, more humid, north-facing slopes tend to support denser stands of trees, soils on south-facing slopes tend to support dominantly grassy vegetation.

Plant and animal life

Plants and animals in and on the soil provide organic matter and mix the soil material. They bring plant nutrients from the lower to the upper soil horizons.

Soils of the Kidder series are examples of soils that formed under forest cover. Soils of the Plano series are examples of soils that formed under prairie vegetation.

The influence of different kinds of vegetation on the formation of soils can be illustrated by the difference in color between soils that formed under forest and those that formed under prairie grasses. Soils that formed under forest have a lighter colored or thinner, dark-colored surface layer and are generally more acid than those that formed under grass. Soils that formed under grass have a thick, dark-colored surface layer. They accumulate more organic matter and retain it longer (*8*) than soils that formed under trees, and the humus contributes to their darker color. Soils that formed in places where the vegetation is a mixture of trees and grasses generally have characteristics of both forest and prairie soils.

Man's activities have had an important influence on the soils. He has greatly altered the original condition of many of the soils by clearing, burning, and cultivating. He has contributed to accelerated erosion by repeatedly removing plant cover from terraces and uplands; he has perpetuated grassland vegetation in normally wooded areas by repeated burning, which has destroyed seedling trees; he has contributed to loss of organic matter through overcultivation; he has reduced the infiltration rate and changed the loose, porous surface layer to clods through overcultivation and the use of heavy equipment; and he has altered the natural acidity or alkalinity of the soils by liming.

Man has also altered the soils by varying the kinds of vegetation that grow on them and by introducing new species of plants. He has improved natural drainage by constructing waterways and building water control structures.

Evidence of the effect of man's activity can be seen in areas where the soil has been eroded down to the subsoil or, in some places, into the substratum. Over much of Rock County, however, the gently sloping and sloping soils are deep enough and so dark colored that soil loss is not easily detected. That soil loss does occur is evidenced by the many buried soil profiles on foot slopes and along natural drainageways. These sediments, washed from the surrounding uplands that were cleared of their natural vegetation, are 3 or 4 feet deep in some areas. Soils of the Troxel and Worthen series are examples of soils formed in sediments that overlie older, buried soils.

Other changes brought by man's manipulation of the soil and landscape include general lowering of the water table through drainage and denuding the soil of its natural plant cover; the tendency towards more flash flooding because of the removal of woodland cover on the more sloping soils of the watershed; rapid filling of lakes and reservoirs with sediments; contamination of ground water with sewage effluent and fertilizer elements, especially nitrates; and the general effect of pesticides on soil organisms and ground water. All of the man's activities affect the soil in some way, but some of the changes will not be evident for many years.

Parent material

Most of the soils of Rock County were derived from parent materials that are a direct or indirect result of the glacier. Even the soils that formed in material weathered over bedrock, such as the Sogn and Edmund soils, which occur on the highest dolomite ridges and side slopes in the southwestern part of the county, show some glacial influence in the form of rounded pebbles of mixed origin. Soils of the Houghton, Palms, Adrian, and Rollin series, which formed in decomposed vegetation under conditions of very poor drainage, are an indirect result of the glacier through its damming action of earlier drainageways by glacial debris.

Glacial till and outwash are the most common parent materials in the county. There are also many lacustrine, alluvial, and colluvial deposits and much residuum from dolomite and sandstone. Overlying these parent materials in much of the county is a silty mantle that is also an important parent material. This mantle is thickest in the northern and eastern parts of the county and is thin or lacking in the southwestern part of the county. Its thickness is also related to slope; it is 3 to more than 5 feet thick in nearly level and gently sloping areas of outwash and till plains and is thinnest or absent on the steeper slopes. In large areas of Rock County, this silty mantle appears to be reworked loess. On the surface and throughout the solum of the deep, silty soils on the main outwash plain east of Janesville, there are a few pebbles that are difficult to explain by tipover of trees on these soils that supposedly formed under grass. Mixing by rodents may be partly responsible, but the presence of stratified silt and fine sand in some profiles is also noteworthy. This outwash plain does predate the Johnstown moraine as is explained in the subsection describing time as a soil-forming factor. It is reasonable to expect that at least some of the meltwater from the last glacier that formed the Johnstown moraine flowed across this area and mixed the earlier loess cap with a few pebbles. Since that time additional loess has been added

Much of the silty mantle on the more sloping uplands contains more sand than loess typically has, which suggests a

mixing of the original loess cap by wind, water, or tipover of trees.

When considering the parent material of the soils of Rock County, it is important to realize that many soils have formed in two or more kinds of parent material. Plano soils are examples of soils that formed in a silty mantle and also in gravelly sandy loam glacial till. Rockton and Whalan soils formed in glacial till and in residuum from dolomite. Plano soils, loamy variant, are examples of soils that formed in three parent materials. The upper part of these soils formed in a loamy mantle, the middle part in silty deposits, and the lower part in stratified sand and gravel outwash.

Glacial till is unstratified, unsorted glacial debris composed of clay, silt, sand, gravel, and boulders. Almost all of the till in Rock County has a texture of gravelly sandy loam, but a few small areas of finer textured till (loam, silt loam, or clay loam) are also present.

There is evidence of two ages of glacial till in the soils of Rock County. Following deposition of the earlier till, there was a long interglacial period during which the climate was presumably much like it is at present or even warmer. During this time the till was weathered deeply, and soils formed that had distinct reddish colors in the subsoil. During the advance of the last glacier, conditions favoring severe erosion ahead of the ice sheet resulted in the loss of much of the surface layer from these early soils, leaving only the more erosion-resistant subsoil. During or following the last glaciation, this subsoil was covered partly with glacial till but mostly with a thick silty mantle. The silty mantle ranges from 0 to 50 inches in thickness. Soils of the Flagg and Ogle series are examples of soils that have a thick silty mantle underlain by a distinctly reddish subsoil of earlier age. Soils of the Pecatonica and Durand series are examples of soils that have a moderately thick silty mantle. Soils of the Westville and Winnebago series are examples of soils that have a thin silty mantle or lack the silty mantle entirely. All the soils of these series have a thick solum, which varies as much as 8 or 9 feet in thickness in the Ogle and Flagg soils.

The soils that formed in the more recent glacial till have a shallower solum and have a subsoil that lacks the distinct reddish colors of the older weathered till. This more recent till also is covered by a silty mantle of loesslike material that ranges from 0 to 60 inches in thickness. Soils formed in both the younger and older till have similar textures in comparable horizons. The silty mantle develops into a silt loam surface layer and a silty clay loam subsoil. The underlying gravelly sandy loam glacial till generally weathers to clay loam and sandy clay loam in the lower part of the subsoil. Generally, the thickness of the silty mantle determines how much of the solum formed in the underlying till. Soils of the Plano and Ringwood series are examples of soils that were derived partly from recent till soils but have a thick and a moderately thick silty mantle, respectively. Almost all of the solum of these soils formed in the silty mantle, and relatively little weathering has occurred in the underlying till. Soils of the Griswold, Kidder, and Rotamer series are examples of recent till soils in which the silty mantle is thin or lacking completely. All or almost all of the solum of these soils formed in the till.

Most of the outwash in the county is stratified sand and gravel. These materials were deposited by water flowing from the melting glacier. Over the outwash there is a layer of finer textured material that was probably deposited during the final stages of glacial melting. These finer sediments eventually weathered to form the clay loam and sandy clay loam subsoil that occurs in many of these outwash soils. Over these sediments there is a silty mantle that ranges from 0 to 60 inches in thickness. Generally, the thickness of the silty mantle determines the amount of the solum that formed in the underlying outwash. Soils of the Warsaw and Lorenzo series are examples of outwash soils in which the silty mantle is thin or lacking completely. They generally are clay loam in the upper part of the subsoil and are gravelly sandy clay loam, gravelly sandy loam, or gravelly loamy sand in the lower part. All or almost all of the solum of these soils formed in outwash. Soils of the Oshtemo series and the Oshtemo series, dark variant, are examples of soils that lack the silty mantle entirely. They are sandy loam in the upper part of the subsoil and loamy sand in the lower part. The entire solum formed in the outwash.

Alluvial and colluvial deposits are also relatively important parent materials in the county. Most of these deposits are of recent origin and do not have distinct horizons. Most of the alluvium and all of the colluvium consists of deep silty sediments. These materials are deposited on stream bottoms and foot slopes by stream floods, local wash, creep, or slide of soil material from higher positions on the landscape. Representative soils formed in these materials are soils of the Juneau, Troxel, Worthen, and Otter series.

Lacustrine deposits consist of stratified silt and fine sand or stratified silt and clay. They are sedimentary deposits that were laid down in the still water of old glacial lakes. Most of the soils formed in lacustrine material in the county have a loamy solum underlain by stratified silt and fine sand. Soils of the Jasper, Colwood, and Darroch series are representative. A few soils that formed in lacustrine material in the county have a moderately thick silty mantle underlain by stratified silt and fine sand. Representative soils are those of the Zurich and Wauconda series. A third group of soils formed in lacustrine material have a loamy solum underlain by stratified silt and clay. Representative soils are those of the Hebron and Aztalan series.

Residuum from weathered bedrock is another important parent material in the county. There are two types of bedrock, dolomite and sandstone. The dolomite weathers to clayey residuum that is firm and plastic, and the sandstone weathers to sandy loam, loamy sand, or sand.

Soils of the Rockton and Whalan series formed in material that is dominantly of glacial origin, and relatively little weathering has occurred in the underlying dolomite. These soils are 24 to 40 inches deep, are underlain by dolomite, and have loam and clay loam textures throughout most of the subsoil. The lower part of the subsoil generally formed in a thin layer of clay residuum. Some areas of these soils have a thin silty mantle.

Other soils, such as those of the Edmund series, show more influence of dolomite residuum in their development and less glacial influence. These soils are 12 to 20 inches thick and are underlain by dolomite. They generally are clay loam or silty clay loam in the upper part of the subsoil and have approximately equal amounts of clay residuum in the lower part. Small areas of these soils have a thin silty mantle.

In the southwestern part of the county, geologic erosion has cut deep valleys through the dolomite cap into the underlying sandstone. Here, sandstone bedrock has been exposed to weathering along the lower parts of valley side slopes or on low hills where the dolomite cap has been completely removed. Soils of the Eleva series formed in the sandy residuum resulting from this weathering. These soils

are generally 20 to 40 inches thick over sandstone, and they have a subsoil of sandy loam.

Organic matter is the parent material for a number of soils in the county. It consists primarily of vegetation (sedges, reeds, and grasses) in various stages of decomposition. Soils of the Adrian and Palms series are representative of soils formed in 16 to 45 inches of organic material over mineral soil material. Soils of the Houghton series formed in more than 50 inches of organic material. Soils of the Rollin series formed in organic material over marl.

Relief and drainage

The hills, valleys, benches, and plains of Rock County have resulted from the work of rains, rivers, winds, glacial ice, and glacial meltwater over long periods of time. Where bedrock controls the topography, the resistance or lack of resistance of the underlying rocks has determined the relief. Relief, in turn, influences soil formation by controlling drainage, runoff, and other direct or indirect effects of water, including erosion. In many places the relief of a given soil can be correlated closely with the drainage, the thickness and organic-matter content of the A1 horizon, the depth of the solum, and the differentiation of horizons in the soil profile.

In Rock County the thickness of the surface layer and the organic-matter content are commonly related, directly or indirectly, to relief. The usual pattern in this county consists of a light-colored surface layer in the more sloping soils and a successively darker and thicker surface layer in the more gently sloping soils and in areas where the slope changes from convex to concave. Runoff is slower where the slopes are more gentle, and consequently more water soaks into the soil. As a result, plants grow better, and more organic matter accumulates in the A1 horizon.

In this county the relationship of relief to soil formation is shown by the general pattern of immature, steep soils and of progressively better developed, deeper soils that have more gentle slopes. The deeper soils contain more clay in the subsoil than the immature soils. Soils of the Rodman and Warsaw series are examples of soils that show the influence of relief on soil development. These soils formed in the same kind of parent material, but the Rodman soils, which generally are more sloping, lack the clay accumulation and well-defined structure in the B horizon of the deeper, more gently sloping Warsaw soils.

Drainage characteristics generally are reflected in the color, degree, and kind of mottling or gleying in the soil profile. Of the well-drained soils, those in the Dresden, Griswold, Lorenzo, Ringwood, and Warsaw series have similar drainage characteristics and are mottle free throughout the solum. Soils of the Pecatonica, Plano, and Westville series are well drained and moderately well drained. Many of the nearly level and gently sloping soils of these series have mottles in the lower part of the B horizon.

Soils of the Darroch, Elburn, Kane, and Locke series are representative of the somewhat poorly drained soils in the county. These soils are mottled throughout the B and C horizons. Soils of the Brookston, Mahalasville, Marshan, and Sebewa series are representative of the poorly drained soils in the county. These soils are generally mottled in the A horizon and are gleyed in the B and C horizons.

Time

Time is required by the active agents of soil development to form soils in parent materials. The length of time required for the formation of a given kind of soil depends on the parent material, relief, climate, and plant and animal life. Time, therefore, never acts as an independent variable.

In general, it seems probable that the silty mantle that covers much of Rock County was deposited during and after the advance of the Wisconsin-age glaciers. The last advance into Rock County was approximately 11,000 years ago (*10*). This period of till and silt deposition probably represents soil formation time zero for Kidder, Plano, and St. Charles soils, especially north of the Johnstown moraine.

As previously mentioned, the Durand, Ogle, Pecatonica, and related soils are thought to be older. These soils probably had a well-developed solum formed in an earlier till by the time the last stage of glaciation reached into Rock County. These earlier soils were truncated by erosion about this time and subsequently had their present surface materials added.

The main outwash plain east of Janesville is also thought to predate the Johnstown moraine. Logs from wells drilled north of the Johnstown moraine show stratified sand and gravel below the moraine. This would indicate that the outwash plain was originally much larger than at present, and the Johnstown moraine and accompanying ground moraine in the northern part of Rock County are relatively thin surface deposits on this earlier outwash plain.

Even if this is true, it is difficult to say that soils of the Plano series that are so extensive on the outwash plain predate the last glacier. Most of the solum of these soils formed in a silty mantle that could have been deposited during both stages of glaciation. It was mentioned earlier that the silty mantle shows evidence of being reworked loess. It seems likely that some of the meltwaters from the Johnstown moraine flowed across an earlier deposit of loess in this area.

Edmund and related soils have a solum formed partly in residum from dolomite bedrock and probably are much older than 11,000 years.

Some soils, because of their recent deposition, show little if any profile development. Soils of the Juneau, Otter, and Worthen series are examples of young soils that show little horizonation, although layering of sediments is evident in places, which illustrates the alluvial and colluvial origin of these soils.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of classifying soils currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study. Therefore, readers interested in developments of the current system should search the latest literature available (*9, 12*).

In table 12, the soil series of Rock County are placed in some categories of the current system.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system, the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. Most of the classes of the current system are briefly defined in the following paragraphs.

Order.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate these soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this, the Entisols and Histosols, occur in many different kinds of climate. Table 12 shows that the five soil orders in Rock County are Entisols, Inceptisols, Mollisols, Alfisols, and Histosols.

Entisols are light-colored, recent soils of mineral origin in which there has been little or no genetic horizon development. In Rock County this order is represented by soils of the Juneau series.

Inceptisols are mineral soils in which one or more genetic horizons have started to develop, but these soils do not contain an accumulation of illuvial clay. They are generally on young, but not recent, land surfaces. This order is represented by soils of the Rotamer series, thin variant.

Mollisols are mineral soils that have a thick, dark-colored surface layer and a high base saturation. Some of these soils contain an accumulation of clay, and others do not. Most of these soils formed under grasses or conditions of poor drainage. This order is the most extensive in the county. Soils of the Mahalasville, Ogle, and Plano series are examples of soils in this order.

Alfisols are mineral soils that contain an accumulation of clay but have a lighter colored or thinner, dark-colored surface layer than the Mollisols. The base saturation is not as high as in the Mollisols. These soils formed mostly under trees, but some formed under grass. This order also is extensive in Rock County. Soils of the Flagg, Kidder, Pecatonica, and Westville series are examples of soils in this order.

Histosols are organic soils that have formed in accumulated plant material under conditions of very poor drainage. This order is represented by soils of the Adrian, Houghton, Palms, and Rollin series.

Suborder.—Each order has been subdivided into suborders, primarily on the basis of the characteristics that seemed to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

Great Group.—Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that contain a pan that interferes with the growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 12, because it is the last word in the name of the subgroup.

Subgroup.—Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the great group.

Family.—Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

Series.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

Genesis and Morphology of the Soils

There are two distinct steps in the formation of soil. First is the accumulation of parent material, and second, the process of horizon differentiation. The downward movement of water is one of the prime factors in the transformation of parent material into a soil that has characteristic horizon differentiation.

The accumulation of parent material, is generally thought to be a very slow process, and this is true if the initial stages involved the weathering and disintegration of bedrock. Most of the earth's surface, however, is deeply mantled with the sediments from earlier weathering. In Rock County, the glacier deposited tremendous amounts of freshly ground rock material and the sediments of earlier weathering. These deposits, rich in weatherable minerals and plant food, favored rather rapid initial development of soils. Formation of the A1 horizon generally follows weathering. Soil profiles with A and C horizons, both of which may be thin, therefore can be found in all the very youngest soils.

The B horizon makes its appearance after the A1 horizon has become distinct, as a rule, although A and B horizons may be formed together. Some soils have AC profiles for a long time before there is any indication of a B horizon. As an example, many soils in the north-central part of Wisconsin have a thick, dark A1 horizon and little evidence of any B horizon. These soils formed in drift left by the glaciers some 8,000 years ago.

The soil at any given point on the landscape is the result of the interaction of the five soil-forming factors previously discussed. A soil is considered to be mature when the final equilibrium has been reached, and the process of transformation, or soil formation, has been completed. It is also customary to designate the intermediate, unstable states as immature soils. It is quite obvious, however useful this concept, that we do not know the final equilibrium point or if such a point does exist. The extreme case of soil development are the soils of the humid tropics that formed under conditions of severe weathering and leaching. Many of these soils are almost completely devoid of weatherable minerals and plant food, the only supply being tied up in living and dead organic matter.

TABLE 12.—*Classification of the soils*

Series	Family	Subgroup	Order
Adrian	Sandy or sandy-skeletal, euic, mesic	Terric Medisaprists	Histosols.
Aztalan	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.
Billett	Coarse-loamy, mixed, mesic	Mollic Hapludalfs	Alfisols.
Billett, mottled subsoil variant.	Coarse-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Brookston	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Casco	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Hapludalfs	Alfisols.
Colwood	Fine-loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Darroch	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.
Dickman	Sandy, mixed, mesic	Typic Hapludolls	Mollisols.
Dresden	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Mollic Hapludalfs	Alfisols.
Durand	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Edmund	Clayey, montmorillonitic, mesic	Lithic Argiudolls	Mollisols.
Elburn	Fine-silty, mixed, mesic	Aquic Argiudolls	Mollisols.
Eleva	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Flagg	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Gotham	Sandy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Gotham, bedrock variant	Coarse-loamy, mixed, mesic	Arenic Hapludalfs	Alfisols.
Griswold	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Hayfield	Fine-loamy over sandy or sandy skeletal, mixed, mesic.	Aquollic Hapludalfs	Alfisols.
Hebron	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Houghton	Euic, mesic	Typic Medisaprists	Histosols.
Jasper	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Juneau	Coarse-silty, mixed, nonacid, mesic	Typic Udifluvents	Entisols.
Kane	Fine-loamy over sandy or sandy skeletal, mixed, mesic.	Aquic Argiudolls	Mollisols.
Kidder	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Locke	Fine-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Lorenzo	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Argiudolls	Alfisols.
Mahalasville	Fine-silty, mixed, mesic	Typic Argiaquolls	Mollisols.
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, noncalcareous, mesic.	Typic Haplaquolls	Mollisols.
Maumee	Sandy, mixed, mesic	Typic Haplaquolls	Mollisols.
Millington	Fine-loamy, mixed, calcareous, mesic	Cumulic Haplaquolls	Mollisols.
Navan	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Ogle	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Oshtemo	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Oshtemo, dark variant	Coarse-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Otter	Fine-silty, mixed, mesic	Cumulic Haplaquolls	Mollisols.
Palms	Loamy, euic, mesic	Terric Medisaprists	Histosols.
Pecatonica	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Plano	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Plano, loamy variant	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Ringwood	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Rockton	Fine-loamy, mixed, mesic	Typic Arguidolls	Mollisols.
Rodman	Sandy-skeletal, mixed, mesic	Typic Hapludolls	Mollisols.
Rollin	Euic, mesic	Limnic Medisaprists	Histosols.
Rotamer	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Rotamer, thin variant	Coarse-loamy, mixed, mesic	Typic Eutrochrepts	Inceptisols.
St. Charles	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Argiaquolls	Mollisols.
Sisson	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Sogn	Loamy, mixed, mesic	Lithic Haplustolls	Mollisols.
Troxel	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Warsaw	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Argiudolls	Mollisols.
Watseka	Sandy, mixed, mesic	Aquic Hapludolls	Mollisols.
Wauconda	Fine-silty, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Westville	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Whalan	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Winnebago	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Worthen	Fine-silty, mixed, mesic	Cumulic Hapludolls	Mollisols.
Zurich	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.

Some of the soil series in Rock County contain good examples of soils in different stages of development, ranging from immature soils having only an A1 horizon to older soils having a distinct B horizon of clay accumulation.

It is now thought that a combination of basic or simple processes proceed in all soils and is responsible for horizon differentiation. All of these processes are at least potential processes in every soil. Four processes can be considered, and these four processes generally do not act separately. These processes are gains, losses, transfers, and transformations. Some of these changes promote horizon differentiation, and others retard or offset horizon differentiation. The balance among changes determines the nature of the soil at any given spot.

The major changes that promote horizon differentiation are gains, losses, and transfers of organic matter, soluble salts and carbonates, silicate clay minerals, sesquioxides, and silica. The major changes that retard or offset horizon differentiation are mixing of material from different horizons by burrowing animals, tipover of trees by wind, removal of materials by erosion and creep, recycling of nutrient elements through flora, and rapid accretion of sediments.

Gains in organic matter are an early step in the differentiation of horizons in most soils and are generally added to the surface horizon in greater quantities than to deeper horizons. In all the soils in this county, some organic matter has accumulated in the uppermost layers to form an A1 horizon. Much of the organic matter is humus. The quantity is small in some soils but fairly large in others. Such soils as those of the Casco series have a thin A1 horizon that is low in organic-matter content. Other soils, such as those of the Griswold, Plano, and Warsaw series, have a thick, dark-colored A1 horizon that is fairly high in organic-matter content.

Losses from the soil profile are due primarily to leaching by rainwater percolating downward. Leaching of carbonates and soluble salts takes place rapidly in humid regions, and the loss of calcium carbonate from the solum seems to precede strong horizonation of the subsoil. A high level of calcium carbonates seems to favor the development of a thick, dark-colored surface layer, because the calcium ions coagulate the humus colloids and these prevent their dispersion and subsequent removal. This is especially noticeable in shallow soils that formed in parent material high in calcium carbonates and in deeper soils formed under grasses that are efficient in recycling this material to the soil surface. Most of the carbonates and soluble salts have been leached out of the solum of most of the well-drained soils in Rock County. Even in the wettest soils, some leaching is indicated by a lower pH value throughout the solum than in the parent material. Leaching of the very wet soils is slow because movement of water through the profile is slow.

The silicate clay minerals are also leached from the surface horizons and redeposited in the subsoil. This is especially true of well-drained, medium-textured soils in the humid regions. Under moist conditions certain minerals, principally feldspars and micas, weather to form silicate clay minerals. Following dry periods, wetting seems to lead to disruption of the fabric and to dispersion of the clay. Once dispersed, the clay moves with the percolating water and stops where the percolating water stops. Water percolating in noncapillary voids commonly is stopped by capillary withdrawal into the soil fabric. During this withdrawal the clay is filtered out and deposited on the walls of voids and on ped faces. These clays, commonly called clay films, appear as brown, waxylike material under 10- and 20-power magnification, and when analyzed in the laboratory the horizons of clay accumulation contain more total clay and more fine clay than the horizon above or below. Since the development of a horizon of clay accumulation is very slow, the presence of clay films indicates a relatively old, stable landform in contrast to many younger soils developing on flood plains and stream terraces.

Accumulation of silicate clay minerals has contributed to development of horizons in many soils of the county. Nearly all of the well drained and moderately well drained, loamy and silty soils are in an advanced stage of development, and they contain horizons of clay accumulation. The sandy soils do not contain horizons of clay accumulation, because they contain few minerals that weather to produce clay. Most of the more poorly drained soils do not have horizons of clay accumulation, or they exhibit them to a lesser degree than the better drained soils. This is because the conditions of alternate wetting and drying, so vital to clay movement, generally are not present in wet soils. In addition, wet soils and other immature soils have not developed well-defined structural peds and cleavage plains that, together with desiccation cracks, permit the downward movement of clay minerals.

The reduction and transfer of iron has occurred in all the very poorly drained, poorly drained, and somewhat poorly drained soils of the county. In these naturally wet soils, this process, called gleying, is of importance in horizon differentiation. In Rock County it is most pronounced in soils of the Brookston, Colwood, Mahalasville, and Navan series. The gray colors of the deeper horizons of wet soils indicate the reduction of iron oxides. This reduction is commonly accompanied by some transfer of the iron, which may be local or general in character. After it has been reduced, iron may be removed completely from some horizons, or even from the entire profile. More commonly in this county, it has been moved a short distance, then has stopped in the horizon of its origin or in a nearby horizon. In some of the soils, iron has been segregated within the deeper horizons to form yellowish-red, strong-brown, or yellowish-brown mottles. Spots of black manganese also are common.

The differentiation of the A1 horizon from the deeper horizons in poorly drained soils is caused by the reduction and transfer of iron. Horizon differentiation also results partly from a greater accumulation of organic matter in the surface layer. In soils of the Millington and Otter series, the accumulation of organic matter masks the gray colors that result from the accumulation of iron compounds in the reduced state.

From the foregoing brief discussion, it can be seen that the processes of soil formation are complicated and for several reasons not fully understood at this time. The study of morphology and classification is, to a large extent, a study of soils as they occur on the undisturbed landscape. This makes it necessary to go to the place where the soil occurs rather than to make convenient laboratory study. The study is further complicated by the fact that soil is an open system, in which substances are continually being added or removed. In addition, the processes involved are not everywhere the same in kind and degree. The study of this most important resource is a young science, dating back to about the year 1900.

General Nature of the County

Rock County was created from part of Milwaukee County in 1836 by the Territorial Legislature, but the county did not have its present boundaries until 1838 and was not fully organized until 1839. At that time, Rock County had only one town, Rock, and remained so until 1842. The present 20 towns were all organized between 1842 and 1849. The county derives its name from the Rock River.

Until the close of the Black Hawk War in 1832, the entire valley of the Rock River was under control of various Indian tribes. The first white man to come to the county was Joseph Thiebeau, a French-Canadian fur trader, who, in 1824, settled on the present site of the city of Beloit. The first permanent settlement by white men in Rock County was along the Rock River on land that is within the boundaries of the present city of Janesville.

Rock County grew rapidly during its early years. In 1850 there were 20,750 residents; by 1890 there were 43,220 residents; and by 1960 this figure had increased to 113,913 residents.

Janesville was incorporated as a city in 1853, followed by Beloit in 1857. Other communities were incorporated as follows: Edgerton, in 1883; Evansville, in 1896; Clinton, in 1882; Orfordville, in 1900; Milton, in 1904; Footville, in 1918; and Milton Junction, in 1949.

Climate[6]

The climate of Rock County is continental. It is characterized by marked changes in weather that are common to locations in the interior of a large land mass of the middle latitudes. The length of daylight ranges from approximately 15 1/2 hours late in June to 9 hours late in December.

Winters are cold and snowy; summers are warm and have periods that are hot and humid. Spring and fall are sometimes short, and during these seasons the weather often seems to be a mixture of winter and summer. Changes in the weather can be expected every few days in winter and spring. Table 13 gives average temperature and precipitation data compiled from records at the Beloit Weather Station. These data are fairly representative of the county.

During the period of record, the highest temperature recorded was 110° F. and the lowest was -27°. The number of days when the temperature has reached 90° or above has averaged 21 per year. It has ranged from 52 in 1936 to none in 1902 and 1915. The average annual number of days with temperatures dropping to 0° or below is 13, but the number has ranged from 41 days in 1963 to 2 days in 1939.

The probabilities of the last freezing temperatures in spring and the first in fall are shown in table 14. The average length of the growing season, that is, the number of days between the last date in spring when the temperature is 32° F. or lower and the first date in fall when it is 32° or lower, is 165 days. These data are from records kept at Beloit. Across the county, it is likely that minimum temperatures vary considerably on calm, clear nights, depending on relief, kinds of soil, and other physical characteristics. Valleys generally are several degrees cooler than areas at higher elevations.

Precipitation is adequate for farming, although soil moisture generally is deficient to some degree in July and August. Severe droughts affecting all crops are rare. Approximately 60 percent of the yearly precipitation falls in the 5-month period, May through September. Since the beginning of weather records in 1850, there have been only 4 months without measurable amounts of precipitation. The chance of receiving at least 1 inch of rain in a 7-day period during the summer is greatest in the first half of June. At this time a weekly rainfall of at least 1 inch can be expected more often than 4 years in 10. The driest part of summer is at the end of August, when the probability is that during a 7-day period a trace of moisture will be received 3 years out of 10. The number of days in a year when 0.01 inch or more of precipitation falls averages 115, but it ranges from 105 to 125 days in 2 years out of 3.

Thunderstorms occur on an average of 40 days a year. In some years they have occurred on as few as 21 days, and in other years on as many as 55 days. Hail falls on an average of 3 days a year, but in some years none has fallen, and in other years hail has fallen on as many as 7 days. The most frequent time for summer thunderstorms is from noon until midnight; the most probable time for severe storms is between 2 p.m. and 7 p.m. in July.

The average annual snowfall is about 30 inches, but the annual total varies greatly from year to year. In the last 30 years, 65.6 inches of snow fell in the winter of 1951-52, but only 9.0 inches was measured in the winter of 1967-68. The average date of the first snowfall of 1 inch or more is December 1. The chance of receiving this snowfall by November 9 is 1 year in 10, and by December 23, 9 years in 10.

Frost generally penetrates the ground to a depth of only a few inches in winters when snow cover is early and lasts until spring, but penetration has exceeded a depth of 4 feet in years when snow cover is light or late in coming and temperatures are normal or below normal.

Records of windspeed, sunshine, and humidity are not available for Rock County, but the following data taken from records kept at Madison in Dane County approximate conditions in this county. Prevailing winds are westerly in winter and southerly in summer. March, April, and November are the windiest months, when the average windspeed is about 12 miles per hour. July and August are least windy, and the average windspeed in those months is about 9 miles per hour. Windspeed in excess of 50 miles an hour can be expected in half the years, and these winds are generally from the southwest or west. The wind has averaged less than 4 miles per hour 10 percent of the time, 4 to 12 miles per hour 50 percent of the time, 13 to 31 miles per hour 40 percent of the time, and more than 31 miles per hour less than 1 percent of the time.

About 40 percent of the possible sunshine is received in November and December, 50 to 60 percent from January through April, and 60 percent or more from May through October. The approximate range in relative humidity in each season of the year is given in table 15.

Farming and Industries

About 70 percent of the farmland in Rock County is in capability classes I, II, and III. All of this acreage can be farmed intensively if adequate conservation practices are followed.

Wheat was the first staple crop grown in Rock County. Until 1860, wheat generally was a profitable crop and was

[6]By HANS E. ROSENDAL, climatologist for Wisconsin, National Weather Service, U.S. Department of Commerce.

TABLE 13.—*Temperature and precipitation data at Beloit, Wis.*

Month	Temperature				Precipitation				
						One year in 10 will have—			
	Average daily maximum	Average daily minimum	Average monthly highest maximum	Average monthly lowest minimum	Average	Less than--	More than--	Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Number	Inches
January	30	13	48	-12	1.6	0.5	2.4	21	5.2
February	34	17	50	-7	1.2	.3	2.2	16	5.4
March	45	27	66	5	2.0	1.0	3.1	6	4.4
April	60	38	78	25	2.8	1.4	4.2	2	.6
May	72	49	87	33	3.5	1.8	4.9	(1/)	(2/)
June	80	58	92	44	4.2	2.3	5.6	0	0
July	86	63	96	50	4.0	1.8	5.9	0	0
August	84	61	95	48	3.9	1.7	5.6	0	0
September	76	53	88	36	3.6	1.1	7.2	0	0
October	65	43	81	27	2.2	.5	4.4	(1/)	(2/)
November	48	30	68	10	2.3	.7	4.0	2	1.5
December	33	18	51	-4	1.4	.6	2.3	11	3.3
Year	59	39	[3]98	[4]-15	32.7	24.0	40.0	59	4.4

[1] Less than one-half day.

[2] Trace.

[3] Average annual highest maximum.

[4] Average annual lowest minimum.

TABLE 14.—*Probabilities of last freezing temperatures in spring and first in fall*

(Data from records at Beloit Weather Station)

Probability	Dates for given probability at temperature of--				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	April 6	April 12	April 18	May 1	May 15
2 years in 10 later than	March 30	April 5	April 12	April 26	May 10
5 years in 10 later than	March 17	March 24	April 1	April 15	May 1
Fall:					
1 year in 10 earlier than	November 9	November 2	October 20	October 7	September 25
2 years in 10 earlier than	November 14	November 6	October 25	October 14	October 1
5 years in 10 earlier than	November 25	November 15	November 5	October 26	October 13

shipped to eastern cities through Lake Michigan ports, mainly Milwaukee and Racine. By 1860, more than 100,000 acres of land was in wheat, but thereafter the acreage declined rapidly. By 1900, the acreage of wheat in the county had been greatly reduced, whereas the acreage devoted to oats, corn, and hay was increasing rapidly.

Presently, the main farm enterprise in Rock County is dairying (fig. 27). The soils of Rock County are particularly well suited to dairying, and markets for milk are easily accessible to the large cities of Wisconsin and Illinois. Because of these favorable conditions, Rock County has become a leading dairy and livestock center in the State. In recent years the raising of beef cattle has increased in importance.

The trend in the county is towards fewer but larger farms. Mechanization and other technological advances have made the operation of larger farms more economical. The average size of farms was 129.1 acres in 1950, but by 1965 it had risen to 173.0 acres.

In 1959, approximately 80 percent of the cash income on farms was from the sale of livestock and related products. Of this total, dairy products accounted for most of the cash income. The most important cash crops were field corn, sweet corn, and peas.

TABLE 15.—*Relative humidity by seasons*

Season	Percentage of time relative humidity is--		
	Less than 50 percent	50 to 79 percent	More than 79 percent
Winter	5	55	40
Spring	20	45	35
Summer	15	45	40
Fall	15	45	40

Corn occupies the greatest acreage of all crops grown in Rock County. Tame hay, oats, and soybeans are the second, third, and fourth crops, respectively, in total acreage grown. Corn is grown on all soils suited to row crops in the county. It is generally harvested for grain in October or November, depending on the weather. Corn cut for silage normally is harvested when the grain begins to dent. If there is an early frost, the crop is harvested as soon as possible after the frost.

Oats also are an important crop in the county and are generally grown as a nurse crop for hay. Oats are commonly ground and mixed with corn for livestock feed. The straw is stored and used for livestock bedding.

Hay crops are grown extensively in the county. Where the soils are too steep for cultivation, most areas are used primarily for hay and pasture. Alfalfa is most commonly grown because it gives higher yields of good quality forage than other kinds of hay. It grows best on moderately deep and deep, well-drained soils that are fertile. Alfalfa is generally seeded in April with oats or other small grains. During the second year after planting, alfalfa is established and generally three cuttings are made. If properly limed and fertilized, a good stand of alfalfa ordinarily lasts from 4 to 6 years.

Soybeans can be grown on all the soils suited to row crops in the county. As a rule, they are planted in May or June and harvested in October or November. Soybeans are commonly ground and mixed with corn for livestock feed or are sold as a cash crop.

Rock County also produces sweet corn and peas that are sold as cash crops for processing as human food.

The early manufacturing industries in Rock County mainly served a small local market area. Activities, such as flour milling, lumbering, cabinet making, and wagon and harness making, were all prominent. The coming of the railroads enabled manufacturing activities to substantially broaden their markets. The cities of Beloit and Janesville emerged as transportation centers. Both cities had access to an abundant supply of hydroelectric power from the Rock River; consequently, they became manufacturing centers as well. The primary industry was metal fabrication, including the

Figure 27.—Dairy cattle grazing in a pasture of mixed alfalfa and bromegrass. The nearly level Plano soils in this pasture are well suited to this use.

production of farm implements, windmills, engines, fountain pens, and heavy machinery. Considerable growth also occurred in the industries producing textiles, leather goods, and sand and gravel. Technological advances caused considerable product alteration; for example, automobile manufacturing replaced farm implements to a large extent, but the dominant industry remained metal fabrication. This industrial orientation requires a skilled labor force. Rock County was settled by people from industrial regions, such as New England, New York, and northwestern Europe. These people had an industrial heritage and brought leadership and a productive labor supply to the county.

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Glossary

Acidity. See Reaction, soil.

Aggregate, soil, Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. Soils in Rock County are rated for available water capacity to a depth of 5 feet or to bedrock, whichever is shallower. Ratings to a depth of 5 feet or to bedrock are as follows: *Very high*, more than 12 inches; *high*, 9 to 12 inches; *medium*, 6 to 9 inches; *low*, 3 to 6 inches; *very low*, 0 to 3 inches.

Calcareous, soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

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 clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

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 and brittle; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour or are parallel to terraces or diversions. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Depth, soil. The depth, in inches, to a root-impeding layer or horizon. In this publication the following terms are used to describe soil depth: *Deep*, 40 to 60 inches; *moderately deep*, 20 to 40 inches; *shallow*, 10 to 20 inches; and *very shallow*, less than 10 inches.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage, natural. Refers to the conditions that existed during the development of the soil, 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 drainage are recognized.

Excessively drained soils commonly are very porous, are rapidly permeable, and have low water-holding capacity.

Somewhat excessively drained soils are very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and commonly have a texture intermediate between that of coarse-textured soils and fine-textured soils.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time; the water table is within 12

to 24 inches of the surface for part of the year; and in some of the soils mottles are below a depth of 6 to 16 inches in the lower part of the A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally are mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion, soil. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational or free water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part of a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solm, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Massive. Large uniform masses of cohesive soil, in some places with ill-defined and irregular breakage, as in some of the fine-textured alluvial soils; structureless.

Mottled. Irregularly marked with different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Ped. An individual natural soil aggregate, such as a crumb, prism, or a block, in contrast to a clod.

Permanent wilting point. See Wilting point.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability, and permeability rates, given in inches of water movement per hour, follow. These reflect hydraulic conductivity commonly used in soil survey testing procedure. *Very slow* (less than 0.06 inch per hour); *slow* (0.06 to 0.2 inch per hour); *moderately slow* (0.2 to 0.63 inch per hour); *moderate* (0.63 inch to 2.0 inches per hour); *moderately rapid* (2.0 to 6.3 inches per hour); *rapid* (6.3 to 20.0 inches per hour; and *very rapid* (greater than 20.0 inches per hour).

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour", soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderaltely alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil has formed.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope, soil. The incline of the surface of a soil. It is generally expressed in percentage of slope, which equals the number of feet of fall per 100 feet of horizontal distance. In this soil survey, the following slope groups and descriptive terms are generally used, although there are some exceptions to these slope groupings in the 0 to

3 percent mapping units and in combinations of D, E, or F mapping units:

A slope, 0 to 2 percent	Nearly level.
B slope, 2 to 6 percent	Gently sloping.
C slope, 6 to 12 percent	Sloping.
D slope, 12 to 20 percent	Moderately steep.
E slope, 20 to 30 percent	Steep.
F slope, 30 to 45 percent	Very steep.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that 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 variant. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Solum, soil. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsidence. Depression or lowering of the surface of a soil as the result of oxidation, drying, or compaction.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Subsurface layer. That part of the A horizon below the surface soil. In soils of weak profile development, the subsurface layer can be defined only in terms of arbitrary depths.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without causing damage. Terraces intended mainly for drainage have a deep channel that is maintained in a permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Variant. See Soil variant.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to an interpretative group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Predicted average yields of crops, table 1, p. 22.
Tree selection guide, table 2, p. 26.
Shrub and vine selection guide, table 3, p. 30.
Soil interpretations for wildlife habitat elements, table 4, p. 36.
Engineering data and interpretations, tables 6, 7, 8, and 9, pp. 42 through 79.
Soil limitations for recreational use, table 10, p. 80.
Acreage and extent of soils, table 11, p. 84.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Wildlife group	Shrub and vine group	Recreation group
			Symbol	Page	Symbol	Page	Number	Number	Number
Ad	Adrian muck	82	IVw-7	19	5w3	29	6	(1/)	8
Aw	Alluvial land, wet	82	Vw-14	20	4w2	29	5b	(1/)	6
AzA	Aztalan silt loam, 0 to 3 percent slopes	86	IIw-2	15	4w1	28	5a	(1/)	5
BlA	Billett sandy loam, 0 to 2 percent slopes	86	IIIs-4	18	3s2	25	1	2	3
BlB	Billett sandy loam, 2 to 6 percent slopes	87	IIIs-4	18	3s2	25	1	2	3
BmA	Billett sandy loam, mottled subsoil variant, 0 to 3 percent slopes	87	IVw-5	19	3w2	28	5a	(1/)	5
Br	Brookston silt loam	88	IIw-1	15	4w1	28	5b	(1/)	6
CaB2	Casco loam, 2 to 6 percent slopes, eroded	89	IIIe-3	17	3d1	28	3	2	4
CaC2	Casco loam, 6 to 12 percent slopes, eroded	89	IVe-3	18	3d1	28	3	2	4
CaD2	Casco loam, 12 to 20 percent slopes, eroded	89	VIe-3	20	3r1	28	3	2	4
CaE	Casco loam, 20 to 35 percent slopes	89	VIIe-4	20	3r1	28	3	2	4
Co	Colwood silt loam	90	IIw-1	15	4w1	28	5b	(1/)	6
Da	Darroch loam	91	IIw-2	15	4w1	28	5a	(1/)	5
DcA	Dickman sandy loam, 0 to 2 percent slopes	92	IVs-3	19	3s1	25	3	2	9
DcB	Dickman sandy loam, 2 to 6 percent slopes	92	IVs-3	19	3s1	25	3	2	9
DcC2	Dickman sandy loam, 6 to 12 percent slopes, eroded	92	IVs-3	19	3s1	25	3	2	9
DrA	Dresden silt loam, 0 to 2 percent slopes	93	IIs-1	15	2d2	25	1	1	2/ 1
DrB	Dresden silt loam, 2 to 6 percent slopes	93	IIe-2	14	2d2	25	1	1	2/ 1
DrC2	Dresden silt loam, 6 to 12 percent slopes, eroded	93	IIIe-2	16	2d2	25	1	1	2/ 1
DrD2	Dresden silt loam, 12 to 25 percent slopes, eroded	93	IVe-2	18	2r1	25	1	1	2/ 1
DuA	Durand silt loam, 0 to 2 percent slopes	94	I-4	14	4o1	28	4	1	1
DuB2	Durand silt loam, 2 to 6 percent slopes, eroded	94	IIe-1	14	4o1	28	4	1	1
DuC2	Durand silt loam, 6 to 12 percent slopes, eroded	95	IIIe-1	16	4o1	28	4	1	1
EdB2	Edmund loam, 2 to 6 percent slopes, eroded	95	IIIe-3	17	3d1	28	3	2	11
EdC2	Edmund loam, 6 to 12 percent slopes, eroded	96	IVe-3	18	3d1	28	3	2	11
EdD2	Edmund loam, 12 to 20 percent slopes, eroded	96	VIe-3	20	3r1	28	3	2	11
EdE	Edmund loam, 20 to 35 percent slopes	96	VIIe-4	20	3r1	28	3	2	11

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GUIDE TO MAPPING UNITS--Continued

Map symbol		Described on page	Capability unit		Woodland group		Wildlife group	Shrub and vine group	Recreation group
			Symbol	Page	Symbol	Page	Number	Number	Number
ElA	Elburn silt loam, 0 to 3 percent slopes	97	IIw-2	15	4w1	28	5a	(1/)	5
EmA	Elburn silt loam, gravelly substratum, 0 to 3 percent slopes	97	IIw-2	15	4w1	28	5a	(1/)	5
EoA	Elburn silt loam, overwash, 0 to 3 percent slopes	97	IIw-2	15	4w1	28	5a	(1/)	5
EvB	Eleva sandy loam, 2 to 6 percent slopes	98	IIIs-4	18	3s2	25	1	2	10
EvC2	Eleva sandy loam, 6 to 12 percent slopes, eroded	99	IIIe-7	17	3s2	25	1	2	10
EvD	Eleva sandy loam, 12 to 20 percent slopes	99	IVe-7	19	3r2	25	1	2	10
EvE	Eleva sandy loam, 20 to 35 percent slopes	99	VIe-7	20	3r2	25	1	2	10
FlA	Flagg silt loam, 0 to 2 percent slopes	100	I-3	13	2o1	24	1	1	1
FlB	Flagg silt loam, 2 to 6 percent slopes	100	IIe-1	14	2o1	24	1	1	1
GoA	Gotham loamy sand, 0 to 2 percent slopes	101	IVs-3	19	3s1	25	3	2	9
GoB	Gotham loamy sand, 2 to 6 percent slopes	101	IVs-3	19	3s1	25	3	2	9
GoC2	Gotham loamy sand, 6 to 12 percent slopes, eroded	101	IVs-3	19	3s1	25	3	2	9
GoD	Gotham loamy sand, 12 to 20 percent slopes	102	VIe-7	20	3r2	25	3	2	9
GpB2	Gotham loamy sand, bedrock variant, 2 to 6 percent slopes, eroded	102	IVs-3	19	3s1	25	3	2	9
GpC2	Gotham loamy sand, bedrock variant, 6 to 12 percent slopes, eroded	102	IVs-3	19	3s1	25	3	2	9
GrA	Griswold loam, 0 to 2 percent slopes	103	I-4	14	4o1	28	4	1	3/ 2
GrB2	Griswold loam, 2 to 6 percent slopes, eroded	103	IIe-1	14	4o1	28	4	1	3/ 2
GrC2	Griswold loam, 6 to 12 percent slopes, eroded	103	IIIe-1	16	4o1	28	4	1	3/ 2
GrD2	Griswold loam, 12 to 20 percent slopes, eroded	104	IVe-1	18	4o1	28	4	1	3/ 2
Ha	Hayfield loam	105	IIw-5	15	3w1	28	5a	(1/)	5
HeA	Hebron loam, 0 to 3 percent slopes	105	IIe-1	14	2o1	24	1	1	2
Ho	Houghton muck	106	IIIw-9	18	5w3	29	6	(1/)	8
JaA	Jasper loam, 0 to 2 percent slopes	106	I-4	14	4o1	28	4	1	2
JaB	Jasper loam, 2 to 6 percent slopes	107	IIe-1	14	4o1	28	4	1	2
JuA	Juneau silt loam, 0 to 3 percent slopes	107	I-2	13	2o2	24	7	1	7
KaA	Kane loam, 0 to 3 percent slopes	108	IIw-5	15	4w1	28	5a	(1/)	5
KdB	Kidder sandy loam, 2 to 6 percent slopes	109	IIe-1	14	2o1	24	1	1	2
KdC2	Kidder sandy loam, 6 to 12 percent slopes, eroded	109	IIIe-1	16	2o1	24	1	1	2
KdD	Kidder sandy loam, 12 to 20 percent slopes	109	IVe-1	18	2r1	25	1	1	2
KeA	Kidder silt loam, 0 to 2 percent slopes	110	I-4	14	2o1	24	1	1	2/ 1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Wildlife group	Shrub and vine group	Recreation group
			Symbol	Page	Symbol	Page	Number	Number	Number
KeB2	Kidder silt loam, 2 to 6 percent slopes, eroded	110	IIe-1	14	2o1	24	1	1	2/ 1
KeC2	Kidder silt loam, 6 to 12 percent slopes, eroded	110	IIIe-1	16	2o1	24	1	1	2/ 1
KeD2	Kidder silt loam, 12 to 20 percent slopes, eroded	110	IVe-1	18	2r1	25	1	1	2/ 1
KeE	Kidder silt loam, 20 to 30 percent slopes	111	VIe-1	20	2r1	25	1	1	2/ 1
LkA	Locke loam, 0 to 3 percent slopes	111	IIw-2	15	3w1	28	5a	(1/)	5
LoA	Lorenzo loam, 0 to 2 percent slopes	112	IIIs-4	18	3d1	28	3	2	4
LoB	Lorenzo loam, 2 to 6 percent slopes	112	IIIe-3	17	3d1	28	3	2	4
LoC2	Lorenzo loam, 6 to 12 percent slopes, eroded	112	IVe-3	18	3d1	28	3	2	4
LoD	Lorenzo loam, 12 to 20 percent slopes	113	VIe-3	20	3r1	28	3	2	4
Ma	Mahalasville silt loam	113	IIw-1	15	4w1	28	5b	(1/)	6
Mb	Mahalasville silt loam, overwash	114	IIw-1	15	4w1	28	5b	(1/)	6
Mc	Marsh	114	VIIIw-15	21	5w5	35	5b	(1/)	8
Md	Marshan loam	114	IIw-5	15	4w1	28	5b	(1/)	6
Me	Maumee loamy sand	115	IVw-5	19	3w2	28	5b	(1/)	6
Mf	Millington silt loam	116	IIw-1	15	4w1	28	5b	(1/)	6
Na	Navan silt loam	116	IIw-1	15	4w1	28	5b	(1/)	6
OgA	Ogle silt loam, 0 to 2 percent slopes	117	I-3	13	4o1	28	4	1	1
OgB	Ogle silt loam, 2 to 6 percent slopes	117	IIe-1	14	4o1	28	4	1	1
OoA	Oshtemo sandy loam, 0 to 2 percent slopes	118	IIIs-4	18	3s2	25	1	2	3
OoB	Oshtemo sandy loam, 2 to 6 percent slopes	118	IIIs-4	18	3s2	25	1	2	3
OoC2	Oshtemo sandy loam, 6 to 12 percent slopes, eroded	118	IIIe-7	17	3s2	25	1	2	3
OoD2	Oshtemo sandy loam, 12 to 25 percent slopes, eroded	119	IVe-7	19	3r2	25	1	2	3
OsA	Oshtemo sandy loam, dark variant, 0 to 2 percent slopes	120	IIIs-4	18	4o1	28	4	2	3
OsB	Oshtemo sandy loam, dark variant, 2 to 6 percent slopes	120	IIIs-4	18	4o1	28	4	2	3
OsC2	Oshtemo sandy loam, dark variant, 6 to 12 percent slopes, eroded	120	IIIe-7	17	4o1	28	4	2	3
Ot	Otter silt loam	121	IIw-1	15	4w2	29	5b	(1/)	6
Pa	Palms muck	121	IIw-8	16	5w3	29	6	(1/)	8
PeA	Pecatonica silt loam, 0 to 2 percent slopes	122	I-4	14	2o1	24	1	1	1
PeB2	Pecatonica silt loam, 2 to 6 percent slopes, eroded	122	IIe-1	14	2o1	24	1	1	1
PeC2	Pecatonica silt loam, 6 to 12 percent slopes, eroded	122	IIIe-1	16	2o1	24	1	1	1
PlA	Plano silt loam, 0 to 2 percent slopes	123	I-3	13	4o1	28	4	1	1
PlB	Plano silt loam, 2 to 6 percent slopes	124	IIe-1	14	4o1	28	4	1	1
PlC2	Plano silt loam, 6 to 12 percent slopes, eroded	124	IIIe-1	16	4o1	28	4	1	1
PmA	Plano silt loam, gravelly substratum, 0 to 2 percent slopes	124	I-3	13	4o1	28	4	1	1
PmB	Plano silt loam, gravelly substratum, 2 to 6 percent slopes	124	IIe-1	14	4o1	28	4	1	1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Wildlife group	Shrub and vine group	Recreation group
			Symbol	Page	Symbol	Page	Number	Number	Number
PnA	Plano loam, loamy variant, 0 to 2 percent slopes	125	I-4	14	4o1	28	4	1	2
PnB	Plano loam, loamy variant, 2 to 6 percent slopes	125	IIe-1	14	4o1	28	4	1	2
RnB2	Ringwood silt loam, 2 to 6 percent slopes, eroded	126	IIe-1	14	4o1	28	4	1	1
RnC2	Ringwood silt loam, 6 to 12 percent slopes, eroded	126	IIIe-1	16	4o1	28	4	1	1
Ro	Rock land	126	VIIs-5	20	(4/)	--	8	2	11
RpB	Rockton loam, 2 to 6 percent slopes	128	IIe-2	14	4o1	28	4	1	10
RpC2	Rockton loam, 6 to 12 percent slopes, eroded	128	IIIe-2	16	4o1	28	4	1	10
RpD2	Rockton loam, 12 to 20 percent slopes, eroded	129	IVe-2	18	4o1	28	4	1	10
RrC2	Rodman-Lorenzo complex, 6 to 12 percent slopes, eroded	129	VIs-5	20	4f1	29	3	2	4
RrE	Rodman-Lorenzo complex, 20 to 30 percent slopes	129	VIIs-5	20	4r1	29	3	2	4
RrF	Rodman-Lorenzo complex, 30 to 45 percent slopes	130	VIIs-5	20	4r1	29	3	2	4
Rs	Rollin muck	130	IVw-7	19	5w3	29	6	(1/)	8
RtB2	Rotamer loam, 2 to 6 percent slopes, eroded	131	IIe-1	14	3s2	25	1	1	2
RtC2	Rotamer loam, 6 to 12 percent slopes, eroded	131	IIIe-1	16	3s2	25	1	1	2
RtD	Rotamer loam, 12 to 20 percent slopes	131	IVe-1	18	3r2	25	1	1	2
RuE	Rotamer complex, 20 to 30 percent slopes	132	VIIe-4	20	3r2	25	1	2	4
RuF	Rotamer complex, 30 to 45 percent slopes	132	VIIe-4	20	3r2	25	1	2	4
SaA	St. Charles silt loam, 0 to 2 percent slopes	133	I-3	13	2o1	24	1	1	1
SaB	St. Charles silt loam, 2 to 6 percent slopes	133	IIe-1	14	2o1	24	1	1	1
SaC2	St. Charles silt loam, 6 to 12 percent slopes, eroded	133	IIIe-1	16	2o1	24	1	1	1
SaD	St. Charles silt loam, 12 to 20 percent slopes	134	IVe-1	18	2r1	25	1	1	1
SbA	St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes	134	I-3	13	2o1	24	1	1	1
SbB	St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes	134	IIe-1	14	2o1	24	1	1	1
SbC2	St. Charles silt loam, gravelly substratum, 6 to 12 percent slopes, eroded	134	IIIe-1	16	2o1	24	1	1	1
Se	Sebewa silt loam	135	IIw-5	15	4w1	28	5b	(1/)	6
SkA	Sisson loam, 0 to 2 percent slopes	135	I-4	14	2o1	24	1	1	2
SkB	Sisson loam, 2 to 6 percent slopes	136	IIe-1	14	2o1	24	1	1	2
SkC2	Sisson loam, 6 to 12 percent slopes, eroded	136	IIIe-1	16	2o1	24	1	1	2
SoB	Sogn loam, 2 to 6 percent slopes	136	VIs-5	20	4f1	29	8	2	11
SoC2	Sogn loam, 6 to 12 percent slopes, eroded	137	VIs-5	20	4f1	29	8	2	11
SoD	Sogn loam, 12 to 20 percent slopes	137	VIs-5	20	4r1	29	8	2	11

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group		Wildlife group	Shrub and vine group	Recreation group
			Symbol	Page	Symbol	Page	Number	Number	Number
SoF	Sogn loam, 30 to 45 percent slopes	137	VIIs-5	20	4r1	29	8	2	11
TrA	Troxel silt loam, 0 to 3 percent slopes	138	I-2	13	4o1	28	4	1	7
WaA	Warsaw silt loam, 0 to 2 percent slopes	138	IIs-1	15	4o1	28	4	1	2/ 1
WaB	Warsaw silt loam, 2 to 6 percent slopes	138	IIe-2	14	4o1	28	4	1	2/ 1
WaC2	Warsaw silt loam, 6 to 12 percent slopes, eroded	139	IIIe-2	16	4o1	28	4	1	2/ 1
Wb	Watseka loamy fine sand	140	IVw-5	19	3w2	28	5a	(1/)	5
WcA	Wauconda silt loam, 0 to 3 percent slopes	140	IIw-2	15	3w1	28	5a	(1/)	5
WeA	Westville sandy loam, 0 to 2 percent slopes	141	I-4	14	2o1	24	1	1	2
WeB	Westville sandy loam, 2 to 6 percent slopes	141	IIe-1	14	2o1	24	1	1	2
WeC2	Westville sandy loam, 6 to 12 percent slopes, eroded	141	IIIe-1	16	2o1	24	1	1	2
WfA	Westville loam, 0 to 2 percent slopes	142	I-4	14	2o1	24	1	1	3/ 2
WfB2	Westville loam, 2 to 6 percent slopes, eroded	142	IIe-1	14	2o1	24	1	1	3/ 2
WfC2	Westville loam, 6 to 12 percent slopes, eroded	142	IIIe-1	16	2o1	24	1	1	3/ 2
WhB2	Whalan sandy loam, 2 to 6 percent slopes, eroded	143	IIe-2	14	2d2	25	1	1	10
WhC2	Whalan sandy loam, 6 to 12 percent slopes, eroded	143	IIIe-2	16	2d2	25	1	1	10
WlA	Whalan loam, 0 to 2 percent slopes	143	IIs-1	15	2d2	25	1	1	10
WlB2	Whalan loam, 2 to 6 percent slopes, eroded	144	IIe-2	14	2d2	25	1	1	10
WlC2	Whalan loam, 6 to 12 percent slopes, eroded	144	IIIe-2	16	2d2	25	1	1	10
WlD2	Whalan loam, 12 to 20 percent slopes, eroded	144	IVe-2	18	2r1	25	1	1	10
WnA	Winnebago silt loam, 0 to 2 percent slopes	145	I-4	14	4o1	28	4	1	2/ 1
WnB2	Winnebago silt loam, 2 to 6 percent slopes, eroded	145	IIe-1	14	4o1	28	4	1	2/ 1
WnC2	Winnebago silt loam, 6 to 12 percent slopes, eroded	145	IIIe-1	16	4o1	28	4	1	2/ 1
WoA	Worthen silt loam, 0 to 3 percent slopes	146	I-2	13	2o2	24	7	1	7
ZuA	Zurich silt loam, 0 to 2 percent slopes	147	I-3	13	2o1	24	1	1	1
ZuB	Zurich silt loam, 2 to 6 percent slopes	147	IIe-1	14	2o1	24	1	1	1
ZuC2	Zurich silt loam, 6 to 12 percent slopes, eroded	147	IIIe-1	16	2o1	24	1	1	1

1/ Rating not given.

2/ The areas of these soils with a loam surface layer are in recreational group 2.

3/ The areas of these soils with a silt loam surface layer are in recreational group 1.

4/ Rock land is in woodland group 4f1, p. 29, where slopes are less than 12 percent, group 4r1, p. 29, where slopes are 12 percent or more.

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