United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Purdue University
Agricultural Experiment
Station and
Indiana Department of
Natural Resources,
Soil and Water
Conservation Committee

Soil Survey of Jasper County, Indiana

How To Use This Soil Survey

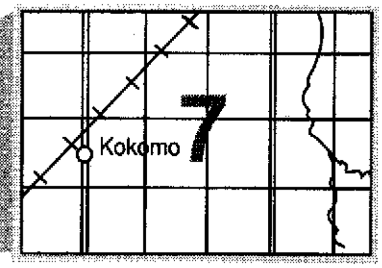
General Soil Map

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

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

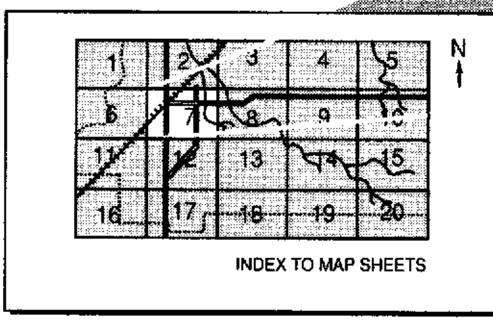
Detailed Soil Maps

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



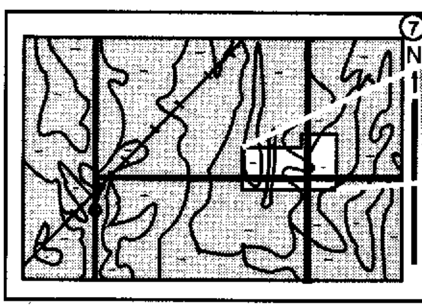
MAP SHEET

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

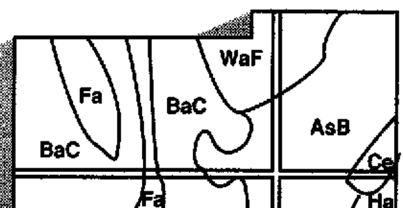


INDEX TO MAP SHEETS

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



MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Soil Conservation Service, the Purdue University Agricultural Experiment Station, and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Jasper County Soil and Water Conservation District. Financial assistance was made available by the Jasper County Commissioners.

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

Cover: Sunflowers on Rensselaer fine sandy loam, till substratum.

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Soil Series

Issued March 1990

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Summary of Tables

Foreword

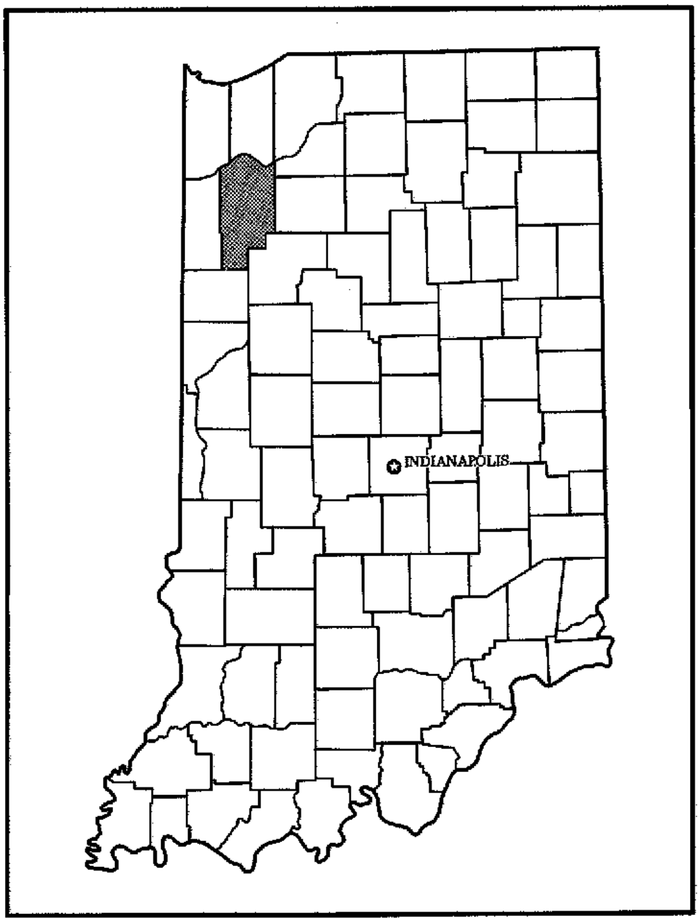
This soil survey contains information that can be used in land-planning programs in Jasper County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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

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

Robert L. Eddleman
State Conservationist
Soil Conservation Service



Location of Jasper County in Indiana.

Soil Survey of Jasper County, Indiana

By Benjamin F. Smallwood, Soil Conservation Service, and
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Soil and Water Conservation Committee

Fieldwork by Benjamin F. Smallwood and Jerry A. Thomas,
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Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
Purdue University Agricultural Experiment Station and Indiana Department
of Natural Resources, Soil and Water Conservation Committee

JASPER COUNTY is in the northwestern part of Indiana. It has an area of 359,321 acres, or about 561 square miles. The Kankakee River is the northern border of the county. Rensselaer is the county seat.

General Nature of the County

This section gives general information about the county. It describes history and settlement; climate; physiography, relief, and drainage; transportation facilities; manufacturing and business; and trends in population and land use.

History and Settlement

When early French explorers, trappers, and missionaries entered the area now known as Jasper County, they were received by the Potawatomi Indians. These Indians were part of the Miami Confederation and were the most powerful tribe northwest of the Wabash River (*11*).

The survey area was ruled by the French during the first quarter of the 18th century, by the British during the middle part of the century, and by the Americans during the latter quarter. The area was part of the Northwest Territory. In 1832, when the United States Government signed a treaty with the Indians, the area was opened for settlement. In that same year, the first permanent settlement in the area was established, within the present boundaries of Gilliam Township (*5*).

Subsequent settlement was slow until the end of the 19th century. Much of the county was unfavorable for settlement. One such unfavorable area was the great swamp in the northern part of the county. Drainage of this swamp began in the 1850's. This area was not ready for agricultural development, however, until the completion of the Kankakee Ditch in 1917.

Another area unfavorable for settlement was the large prairie grassland that made up most of the southern part of the county. This area supported a luxuriant cover of native prairie grasses. Historical accounts indicate that some of the grasses were tall enough to hide a man on horseback. The area was unfavorable for settlement because materials for fuel and home construction were not available, fire was a constant hazard, and the heavy sod could not be easily plowed.

When the early settlers arrived, the survey area had no roads. Supplies were carried in on foot or on horseback. Most of the early settlements were made along the edges of wooded areas or in those areas. Unlike the prairie grassland, the wooded areas provided construction material, fuel, and protection.

Jasper County was established in 1835. It was named after Sergeant Jasper, a hero of the Revolutionary War.

The original boundaries included part or all of Benton, Newton, and White Counties until 1859, when the present boundaries were established (*1*). Rensselaer was platted and surveyed in 1839 and was permanently incorporated in 1866.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Rensselaer, Indiana, in the period 1951 to 1978. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 27 degrees F, and the average daily minimum temperature is 18 degrees. The lowest temperature on record, which occurred at Rensselaer on January 16, 1972, is -22 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred at Rensselaer on July 14, 1954, is 103 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 36.6 inches. Of this, 23 inches, or about 63 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 5.3 inches at Rensselaer. Thunderstorms occur on about 40 days each year.

The average seasonal snowfall is 26 inches. The greatest snow depth at any one time during the period of record was 13 inches. On the average, 6 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Physiography, Relief, and Drainage

Most of Jasper County is a nearly level plain dissected by the Kankakee and Iroquois Rivers and their many tributaries. The county has four major physiographic areas—the Kankakee outwash plain, the Marseilles moraine, the Iroquois lacustrine plain, and the Tipton till plain.

The Kankakee outwash plain is characterized by a nearly level topography. Low, meandering sand dunes or ridges are in scattered areas throughout the plain. They consist of windblown material about 1 foot to 30 feet high. The larger areas of dunes lie in a general northeast-southwest direction and are made up of a series of small ridges. Many of these ridges are crescent shaped.

The Marseilles moraine lies in a northeast-southwest direction. It extends into the county directly north of Rensselaer. It is characterized by an undulating to rolling topography. Scattered sand ridges are along its northern boundary.

The Iroquois lacustrine plain also is oriented in a northeast-southwest direction. It generally is nearly level. Low sand ridges rise a few feet above the general ground level. Bedrock is at or near the surface in many areas on this plain.

The Tipton till plain has two distinct topographic areas. The area east of Carpenters Creek is characterized by a nearly level topography. The area west of the creek generally has a gently rolling topography and has narrow, steep slopes along drainageways. In a few areas on this plain, bedrock is at or near the surface.

Nearly all of Jasper County is in the basin of the Kankakee River, except for a few areas in the eastern part. Surface water in the northern one-third of the county drains westward through the Kankakee River, and that in the southern two-thirds generally drains westward through the Iroquois River and its tributaries. The water in one small area in the southeast corner of Milroy Township drains east into the Tippecanoe River. The county has no major lakes, but a few small ponds have been constructed.

The highest point in the county is 770 feet above sea level. It is in Carpenter Township, in the southwest corner of section 32, near the Benton County line. The lowest point in the county is 635 feet above sea level. It is in the southern part of Keener Township, in the northeast corner of section 30, near the Dehaan Ditch (*15*).

Transportation Facilities

Jasper County has about 150 miles of state and federal roadways, including Interstate 65, Federal Highways 24 and 231, and State Highways 10, 14, 16, 49, 110, and 114. The county has 923 miles of county roads. Approximately 42 percent of these roads are paved.

Two public airports in Jasper County provide airfreight and commuter services. Many small airports service private planes. The county also is served by three railroads.

Manufacturing and Business

Agriculture is the economic base of Jasper County. The county has many agriculture-supporting businesses and manufacturers. Firms are actively engaged in research, food-product processing, and the manufacture of storage bins (*4*). Important fruit and vegetable growers and shippers are located within the county. Commodity brokers, butchers, livestock breeders, and veterinarians are active in the county.

Local agencies provide farm management services, aerial crop dusting, and grain elevators for exchange and storage. Farm suppliers include equipment, seed, and fertilizer dealers. Numerous drainage contractors and suppliers of peat, gravel, sand, and topsoil are throughout the county.

Trends in Population and Land Use

The population of Jasper County has increased slowly during the past 25 years (*10*). It was 20,429 in 1970 (*7*). In 1975, the population was 24,381 and the population density was 43 people per square mile. From 1960 to 1970, the growth rate was 8.4 percent (*8*). From 1970 to 1975, it was 19.3 percent. In 1980, the population was 26,182.

About 86 percent of the county is farmed. The chief farm products are cash-grain crops, specialty crops, and livestock. In recent years the extent of urban development has increased, especially in the northwestern part of the county. Urban expansion is expected to continue as new subdivisions are platted throughout the county.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

Survey Procedures

Dr. Richard A. Weismiller, formerly Earth Science Research Program Leader, Laboratory for Application of Remote Sensing, Purdue University, helped prepare this section.

The general procedures followed in making this survey are described in the Soil Conservation Services National Soils Handbook and the *Soil Survey Manual* (*12*). Geology maps and soil laboratory data from adjacent counties were reviewed before and during the survey. The use of remotely sensed data was important during the progress of the survey. U.S. Geologic Survey topographic maps, at a scale of 1:24,000, helped the soil scientists to relate land and image features.

Before the actual fieldwork began, the staff at Purdue University's Laboratory for Application of Remote Sensing used Landsat-collected multispectral scanner data and computer-assisted classification techniques to prepare spectral maps. These maps depicted the spectral patterns and boundaries of the soils throughout the county.

Individual atlas sheets were registered to each of the individual halftone positive mylars, which were used as the mapping base. At a scale of 1:15,840, each pixel of the spectral atlas represented 0.5 acre. Distinctive symbols were used to depict each spectral class. An accompanying legend listed the soil series most likely to occur within specified areas.

As they mapped the soils on the halftone positive mylars, soil scientists traversed the landscape on foot, by pickup, or by three-wheel, all-terrain cycles. The traverses were made at intervals close enough for the scientists to locate contrasting soil areas of about 2 acres. The data collected were used to identify the kinds of soil and to establish the range of composition in each map unit.

The remotely sensed data were correlated with soil characteristics through comparisons of the spectral maps with conventionally prepared soil maps. These characteristics included the color, texture, and organic matter content of the surface layer and the drainage class. The final spectral maps were correlated only with drainage characteristics since this correlation proved to be the most consistent one.

The spectral information aided in the determination of map unit composition, both the type and the extent of the soils. The map unit inclusions were identified through the use of this information. The map unit Zadog-Maumee loamy sands was first identified through the use of this photo information.

Samples for chemical and physical analyses were taken from representative sites of several of the soils in the survey area. The chemical and physical analyses were made by the Soil Characterization Laboratory, Department of Agronomy, Purdue University. The results of the analyses are stored in a computerized data file at the laboratory. A description of the laboratory procedures can be obtained on request from the laboratory. The results of the studies can be obtained from the Department of Agronomy, Purdue University, and the Soil Conservation Service, State Office, Indianapolis, Indiana.

General Soil Map Units

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

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

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

The names, descriptions, and delineations of the soils identified on the general soil map of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the associations.

Soil Descriptions

Dominantly Deep, Nearly Level, Very Poorly Drained Soils That Are Subject to Flooding; on Bottom Land

These soils make up about 7 percent of the county. They have a high water table and are frequently flooded in late fall and early spring. Most areas are used for cultivated crops. A few are used as woodland. Most of the major soils are fairly well suited or poorly suited to agronomic uses and are generally unsuited to urban uses.

1. Suman-Craigmile-Prochaska Association

Deep, nearly level, very poorly drained, medium textured to coarse textured soils formed in silty and loamy alluvium over sandy deposits or in sandy alluvium; on bottom land

This association is in nearly level or slightly depressional areas on flood plains along large streams. The major soils are frequently flooded in late fall and early spring. The landscape is characterized by a gradual swale and swell topography. Slopes are 0 to 1 percent.

This association makes up about 7 percent of the county. It is about 40 percent Suman soils, 29 percent Craigmile soils, 21 percent Prochaska soils, and 10 percent minor soils.

The Suman soils are in broad depressional areas on the first bottoms of flood plains. Typically, they have a surface layer of black loam, a subsurface layer of black clay loam, and a subsoil of dark gray clay loam. These soils are moderately slowly permeable in the solum and rapidly permeable in the substratum.

The Craigmile soils are in broad depressional areas on the second bottoms of flood plains. Typically, they have a surface layer of black sandy loam and a subsurface layer of very dark gray sandy loam. These soils are moderately rapidly permeable in the upper part and rapidly permeable in the lower part.

The Prochaska soils are in broad depressional areas on the second bottoms of flood plains. Typically, they have a surface layer of very dark gray loamy sand, a subsurface layer of very dark gray loamy sand, and a subsoil of dark grayish brown, dark gray, and gray loamy sand. These soils are rapidly permeable.

Of minor extent in this association are the very poorly drained Sloan soils along narrow drainageways.

Most areas are used for cultivated crops. A few are used for pasture, woodland, or wetland wildlife habitat. This association is fairly well suited to cultivated crops and poorly suited to specialty crops. Flooding and wetness are the main management concerns. Earthen dikes and dams have been constructed in many areas to minimize the hazard of flooding, and extensive areas have been drained.

The Suman soils are well suited to trees, and the Craigmile and Prochaska soils are fairly well suited. Water-tolerant species should be selected for planting. Removing unwanted species improves the stands.

This association is generally unsuited to building site development and sanitary facilities, mainly because of the flooding.

Dominantly Deep, Nearly Level to Strongly Sloping, Well Drained to Somewhat Poorly Drained Soils That Are Subject to Wind Erosion and Drought; on Uplands

These soils make up about 19 percent of the county. They generally are sandy soils that have a low available water capacity and are highly susceptible to wind erosion. Nearly all areas are used for woodland or cultivated crops. A few are used for hay and pasture. The suitability of the major soils for agronomic uses ranges from poor to good. These soils are fairly well suited to urban uses.

2. Oakville-Morocco-Brems Association

Deep, nearly level to strongly sloping, well drained to somewhat poorly drained, coarse textured soils formed in sandy outwash; on uplands

This association is on knolls and ridges on outwash plains. Slopes range from 0 to 15 percent.

This association makes up about 19 percent of the county. It is about 48 percent Oakville soils, 27 percent Morocco soils, 23 percent Brems soils, and 2 percent minor soils.

The well drained or moderately well drained, nearly level to strongly sloping Oakville soils are on ridges and knolls. Typically, they have a surface layer of very dark grayish brown fine sand and a subsoil of dark brown, dark yellowish brown, and yellowish brown fine sand. These soils are rapidly permeable.

The somewhat poorly drained, nearly level Morocco soils are on swells. Typically, they have a surface layer of dark grayish brown loamy sand, a subsurface layer of light yellowish brown loamy fine sand, and a subsoil of very pale brown and light gray fine sand. These soils are rapidly permeable.

The moderately well drained, nearly level and gently sloping Brems soils are on slightly convex rises. Typically, they have a surface layer of dark brown loamy sand and a subsoil of dark yellowish brown, yellowish brown, and pale brown sand. These soils are rapidly permeable.

Of minor extent in this association are the very poorly drained Newton soils in depressional areas.

This association is used for cultivated crops, hay, pasture, specialty crops, and woodland. The major soils are poorly suited to cultivated crops. They are fairly well suited to specialty crops, such as asparagus, blueberries, and Christmas trees. Droughtiness and wind erosion are the main management concerns.

The major soils are well suited to trees. Containerized nursery stock or overstocking is needed to compensate for seedling mortality. Removing unwanted species improves the stands.

The Oakville and Brems soils are fairly well suited to building site development and sanitary facilities, and the Morocco soils are poorly suited. The slope, a poor filtering capacity, and the wetness are the main limitations.

Dominantly Deep, Nearly Level, Very Poorly Drained, Organic Soils That Are Subject to Wind Erosion; on Bottom Land and Uplands

These soils make up about 3 percent of the county. They are very high in organic matter content and have a high water table. Areas that are drained and cultivated are extremely susceptible to wind erosion. Most areas are used for cultivated crops or specialty crops, such as potatoes and mint. A few are used for pasture, woodland, or wetland wildlife habitat. The major soils are poorly suited to cultivated crops, well suited to specialty crops, and generally unsuited to urban uses.

3. Houghton-Muskego-Adrian Association

Deep, nearly level, very poorly drained soils formed in organic deposits or in organic deposits over coprogenous earth or sandy outwash; on bottom land and uplands

This association is in depressional areas on flood plains and outwash plains characterized by a gradual swale and swell topography. It also is in depressional areas on moraines. Slopes range from 0 to 2 percent.

This association makes up about 3 percent of the county. It is about 44 percent Houghton soils, 24 percent Muskego soils, 16 percent Adrian soils, and 16 percent minor soils.

The Houghton soils are in depressions on flood plains, outwash plains, and moraines. Typically, they are black muck in the upper part, very dark gray muck in the next part, and dark reddish brown muck in the lower part. These soils are moderately rapidly permeable to moderately slowly permeable.

The Muskego soils are in depressions on outwash plains and moraines. Typically, they are black muck in the upper part, dark brown muck in the next part, and grayish brown and gray coprogenous earth in the lower part. These soils are moderately rapidly permeable to moderately permeable in the organic layers and slowly permeable in the coprogenous material.

The Adrian soils are in depressions on outwash plains and moraines. Typically, they are black muck in the upper part, very dark gray muck in the next part, and pale brown and gray sand in the lower part. These soils are moderately rapidly permeable to moderately slowly permeable in the organic layers and rapidly permeable in the underlying sand.

Of minor extent in this association are the very poorly drained Ackerman, Edwards, and Warners soils in nearly level areas and in slight depressions.

Most areas are drained and are used for cultivated crops or specialty crops. A few are used for pasture, woodland, or wetland wildlife habitat. This association is poorly suited to cultivated crops and well suited to specialty crops, such as vegetables, potatoes, and mint. The wetness and the hazards of ponding and wind erosion are the main management concerns.

The major soils are poorly suited to trees. The main management concerns are the ponding, the wetness, and the hazard of windthrow.

The major soils are generally unsuited to building site development and sanitary facilities, mainly because of the ponding, the wetness, and excess humus.

Dominantly Deep, Nearly Level, Very Poorly Drained and Somewhat Poorly Drained Soils That Are Subject to Wind Erosion; on Uplands

These soils make up about 31 percent of the county. They have a seasonal high water table and are susceptible to wind erosion. Most areas are used for cultivated crops. A few are used for hay and pasture or for woodland. Most of the major soils are fairly well suited or poorly suited to agronomic uses and are generally unsuited or poorly suited to urban areas.

4. Maumee-Zadog-Watseka Association

Deep, nearly level, very poorly drained and somewhat poorly drained, coarse textured soils formed in sandy and loamy outwash; on uplands

This association is in nearly level or slightly depressional areas on outwash plains characterized by a gradual swale and swell topography. Slopes range from 0 to 2 percent.

This association makes up about 23 percent of the county. It is about 48 percent Maumee soils, 25 percent Zadog soils, 24 percent Watseka soils, and 3 percent minor soils.

The Maumee soils are very poorly drained. Typically, they have a surface layer and subsurface layer of very dark gray loamy sand. The substratum is grayish brown loamy sand in the upper part and light brownish gray sand in the lower part. These soils are rapidly permeable.

The Zadog soils are very poorly drained. Typically, they have a surface layer of black loamy sand, a subsurface layer of black fine sandy loam, and a subsoil of yellowish red and grayish brown sandy clay loam. These soils are moderately permeable in the solum and rapidly permeable in the substratum.

The Watseka soils are somewhat poorly drained. Typically, they have a surface layer of very dark gray loamy fine sand and a subsoil of grayish brown and light brownish gray fine sand. These soils are rapidly permeable.

Of minor extent in this association are the very poorly drained Mussey soils in nearly level areas and in slight depressions.

Most areas are drained and are used for cultivated crops. A few are used for pasture, woodland, or specialty crops. The Maumee and Zadog soils are fairly well suited to cultivated crops, but the Watseka soils are poorly suited. All three soils are fairly well suited to a wide variety of specialty crops, such as asparagus, blueberries, and potatoes (fig. 1). The seasonal wetness and the hazard of ponding are the main management concerns. Wind erosion is a hazard. Droughtiness can be a problem in summer.

The Maumee and Zadog soils are fairly well suited to trees. The Watseka soils are not wooded. Water-tolerant species should be selected for planting on the Maumee and Zadog soils. Removing unwanted species improves the stands.

The Maumee and Zadog soils are generally unsuited to building site development and sanitary facilities, and the Watseka soils are poorly suited. The wetness and the ponding are the main management concerns.

5. Gilford-Morocco Association

Deep, nearly level, very poorly drained and somewhat poorly drained, moderately coarse textured and coarse textured soils formed in loamy sediments over sandy outwash or in sandy outwash; on uplands

This association is in nearly level or slightly depressional areas on outwash plains characterized by a gradual swale and swell topography. Slopes range from 0 to 2 percent. They are commonly less than 1 percent.

This association makes up about 8 percent of the county. It is about 58 percent Gilford soils, 35 percent Morocco soils, and 7 percent minor soils.

The very poorly drained Gilford soils are in broad depressional areas. Typically, they have a surface layer of very dark gray fine sandy loam, a subsurface layer of very dark gray fine sandy loam, and a subsoil of grayish brown fine sandy loam. These soils are moderately rapidly permeable.

The somewhat poorly drained Morocco soils are on swells. Typically, they have a surface layer of dark grayish brown loamy sand, a subsurface layer of light yellowish brown loamy fine sand, and a subsoil of very pale brown and light gray fine sand. These soils are rapidly permeable.

Of minor extent in this association are the somewhat poorly drained Metamora and Watseka soils on slight rises.

Most areas are drained and are used for cultivated crops. A few are used for woodland, hay, pasture (fig. 2), or specialty crops.

The Gilford soils are fairly well suited to cultivated crops, but the Morocco soils are poorly suited. Both soils are fairly well suited to a wide variety of specialty crops, such as asparagus, blueberries, and Christmas trees. The hazard of ponding and the seasonal wetness are the main management concerns. Wind erosion is a hazard. Droughtiness can be a problem in summer.

The Gilford soils are fairly well suited to trees, and the Morocco soils are well suited. Water-tolerant species

Figure 1.—Potatoes on Watseka-Maumee loamy sands, in the foreground, and in an irrigated area of Ackerman and Muskego soils, in the background.

should be selected for planting. Removing unwanted species improves the stands.

The Gilford soils are generally unsuited to building site development and sanitary facilities, and the Morocco soils are poorly suited. The ponding and the wetness are the main management concerns.

Dominantly Deep, Nearly Level and Gently Sloping, Well Drained Soils; on Uplands

These soils make up about 4 percent of the county. They are susceptible to erosion. Most areas are used for cultivated crops. A few are used for hay, pasture, or woodland. The major soils are fairly well suited or well suited to agronomic and urban areas.

6. Parr-Ayr-Wawasee Association

Deep, nearly level and gently sloping, well drained, medium textured to coarse textured soils formed in loamy or sandy outwash over till; on uplands

This association is on knolls and ridges on recessional moraines. Slopes range from 1 to 6 percent.

This association makes up about 4 percent of the county. It is about 30 percent Parr soils, 21 percent Ayr soils, 19 percent Wawasee soils, and 30 percent minor soils.

The Parr soils are gently sloping. Typically, they have a surface layer of very dark gray fine sandy loam. The subsoil is brown fine sandy loam in the upper part, dark yellowish brown clay loam in the next part, and yellowish brown sandy clay loam in the lower part. These soils are moderately permeable.

The Ayr soils are nearly level and gently sloping. Typically, they have a surface layer of black loamy fine sand and a subsurface layer of very dark gray loamy sand. The subsoil is dark brown and brown sand in the upper part, yellowish brown loamy sand in the next part,

Figure 2.—A pastured area of Gilford and Morocco soils. Chelsea soils are on the ridge in the background.

and yellowish brown loam in the lower part. These soils are rapidly permeable in the upper sandy layers and moderately permeable in the lower part.

The Wawasee soils are gently sloping. Typically, they have a surface layer of dark grayish brown loam and a subsoil of dark brown and dark yellowish brown loam. These soils are moderately permeable.

Of minor extent in this association are the very poorly drained Brookston soils in depressional areas and drainageways and the well drained Metea and excessively drained Sparta soils on ridges and knolls.

Most areas are used for cultivated crops. A few are used for hay, pasture, or woodland. The Parr and Wawasee soils are well suited to cultivated crops, and the Ayr soils are fairly well suited. All three soils are fairly well suited to specialty crops. The hazard of erosion is the main management concern.

The Wawasee soils are well suited to trees. The Parr and Ayr soils are not wooded. Removing unwanted species improves the stands in areas of the Wawasee soils.

The Parr and Wawasee soils are well suited to building site development and sanitary facilities, and the Ayr soils are fairly well suited. The slope, the potential for frost action, the restricted permeability or a poor filtering capacity, and seepage are the main management concerns.

Dominantly Moderately Deep, Nearly Level and Gently Sloping, Well Drained and Very Poorly Drained Soils; on Uplands

These soils make up about 1 percent of the county. They are 20 to 40 inches deep over limestone bedrock. They are susceptible to erosion. Most areas are used for cultivated crops. A few are used for hay and pasture. The major soils are well suited or fairly well suited to agronomic uses. They are poorly suited or generally unsuited to urban uses.

7. Rockton-Faxon Association

Moderately deep, nearly level and gently sloping, well drained and very poorly drained, moderately coarse textured and medium textured soils formed in loamy outwash over limestone bedrock; on uplands

This association is in nearly level or slightly convex areas on outwash plains and ground moraines characterized by a swale and swell topography. Slopes range from 0 to 3 percent.

This association makes up about 1 percent of the county. It is about 59 percent Rockton soils, 39 percent Faxon soils, and 2 percent minor soils.

The well drained, nearly level and gently sloping Rockton soils are on swells. Typically, they have a surface layer and subsurface layer of very dark grayish brown fine sandy loam. The subsoil is dark yellowish brown loam in the upper part and brown sandy clay loam in the lower part. These soils are moderately permeable.

The very poorly drained, nearly level Faxon soils are in broad depressional areas. Typically, they have a surface layer of very dark gray loam. The subsoil is dark grayish brown loam in the upper part and gray sandy clay loam in the lower part. These soils are moderately permeable.

Of minor extent in this association are the moderately well drained Grovecity soils on rises.

Most areas are used for cultivated crops. A few are used for hay and pasture. This association is well suited to cultivated crops and fairly well suited to specialty crops. A shallow root zone, erosion, and wetness are the main management concerns.

The Rockton soils are poorly suited to building site development and sanitary facilities, and the Faxon soils are generally unsuited. The main limitations are the depth to bedrock, the shrink-swell potential, and the hazard of ponding.

Dominantly Deep, Nearly Level and Gently Sloping, Very Poorly Drained to Moderately Well Drained Soils; on Uplands

These soils make up about 35 percent of the county. They have a seasonal high water table. Most areas are used for cultivated crops. A few are used for hay, pasture, or woodland. Most of the major soils are well suited or fairly well suited to agronomic uses and are fairly well suited, poorly suited, or generally unsuited to urban uses.

8. Rensselaer, till substratum-Markton-Aubbeenaubbee Association

Deep, nearly level and gently sloping, very poorly drained and somewhat poorly drained, moderately coarse textured and coarse textured soils formed in loamy and sandy outwash over loamy till; on uplands

This association is in nearly level or slightly depressional areas on recessional moraines characterized by a swale and swell topography. Slopes range from 0 to 3 percent.

This association makes up about 7 percent of the county. It is about 64 percent Rensselaer soils, 16 percent Markton soils, 9 percent Aubbeenaubbee soils, and 11 percent minor soils.

The very poorly drained, nearly level Rensselaer soils are in broad depressional areas. They have a substratum of till. Typically, they have a surface layer of black fine sandy loam. The subsoil is very dark gray fine sandy loam in the upper part, gray sandy loam in the next part, and light gray loam in the lower part. These soils are moderately permeable.

The somewhat poorly drained, nearly level and gently sloping Markton soils are on rises. Typically, they have a surface layer of dark brown sand. The subsoil is brown and yellowish brown sand in the upper part and yellowish brown loam in the lower part. These soils are rapidly permeable in the upper sandy layers and moderately permeable in the lower part.

The somewhat poorly drained, nearly level and gently sloping Aubbeenaubbee soils are on rises. Typically, they have a surface layer of dark grayish brown fine sandy loam and a subsurface layer of brown fine sandy loam. The subsoil is dark brown sandy clay loam in the upper part, brown clay loam in the next part, and light brownish gray loam in the lower part. These soils are moderately permeable.

Of minor extent in this association are the somewhat poorly drained Metamora soils on slight rises, the very poorly drained Ackerman and Mussey soils in nearly level areas and slight depressions, and the well drained Metea soils on ridges and knolls.

Most areas are drained and are used for cultivated crops. A few are used for hay, pasture, or woodland. The Aubbeenaubbee and Rensselaer soils are well suited to cultivated crops, and the Markton soils are fairly well suited. All three soils are fairly well suited to specialty crops. The hazard of ponding and the wetness are the main management concerns. Wind erosion is a hazard.

The major soils are well suited to trees. Water-tolerant species should be selected for planting. Removing unwanted species improves the stands.

The Rensselaer soils are generally unsuited to building site development and sanitary facilities, and the Markton and Aubbeenaubbee soils are poorly suited. The ponding and the wetness are the major management concerns.

9. Rensselaer, till substratum-Darroch, till substratum-Wolcott Association

Deep, nearly level, very poorly drained and somewhat poorly drained, medium textured and moderately fine textured soils formed in loamy outwash over loamy till; on uplands

This association is in nearly level and slightly convex areas on ground moraines characterized by a swale and swell topography. Slopes range from 0 to 2 percent.

This association makes up about 8 percent of the county. It is about 43 percent Rensselaer soils, 26 percent Darroch soils, 14 percent Wolcott soils, and 17 percent minor soils.

The very poorly drained Rensselaer soils are in broad depressional areas. They have a substratum of till. Typically, they have a surface layer of very dark gray loam, a subsurface layer of very dark gray loam, and a subsoil of dark gray clay loam. These soils are moderately permeable.

The somewhat poorly drained Darroch soils are on swells. They have a substratum of till. Typically, they have a surface layer of very dark gray silt loam and a subsurface layer of very dark grayish brown clay loam. The subsoil is yellowish brown clay loam in the upper part and gray sandy clay loam in the lower part. These soils are moderately permeable.

The very poorly drained Wolcott soils are in broad depressional areas. Typically, they have a surface layer of black clay loam, a subsurface layer of very dark gray clay loam, and a subsoil of olive gray loam. These soils are moderately permeable.

Of minor extent in this association are the somewhat poorly drained Odell soils on slight rises and the excessively drained Sparta soils on rises and knolls. The Sparta soils have a loamy substratum.

Most areas are drained and are used for cultivated crops. A few are used for hay and pasture. This association is well suited to cultivated crops. It is fairly well suited to specialty crops. The wetness and the hazard of ponding are the main management concerns.

The Rensselaer soils are well suited to trees. The Darroch and Wolcott soils are not wooded. Water-tolerant species should be selected for planting on the Rensselaer soils. Removing unwanted species improves the stands.

The Rensselaer and Wolcott soils are generally unsuited to building site development and sanitary facilities, and the Darroch soils are poorly suited. The ponding and the wetness are the main management concerns.

10. Reddick-Andres-Corwin Association

Deep, nearly level and gently sloping, poorly drained to moderately well drained, moderately fine textured and medium textured soils formed in silty and loamy outwash over silty and loamy till; on uplands

This association is on knolls and in depressional areas on ground moraines and recessional moraines characterized by a swale and swell topography. Slopes range from 0 to 3 percent.

This association makes up about 5 percent of the county. It is about 35 percent Reddick soils, 33 percent Andres soils, 26 percent Corwin soils, and 6 percent minor soils.

The poorly drained, nearly level Reddick soils are in broad depressions and swales on ground moraines. Typically, they have a surface layer of black silty clay loam, a subsurface layer of very dark gray clay loam, and a subsoil of dark gray, olive gray, and gray clay loam. These soils are moderately permeable in the upper part and slowly permeable or very slowly permeable in the substratum.

The somewhat poorly drained, nearly level Andres soils are on swells on ground moraines. Typically, they have a surface layer of very dark gray loam and a subsoil of dark brown, dark yellowish brown, and pale brown clay loam. These soils are moderately permeable in the upper part and moderately slowly permeable in the substratum.

The moderately well drained, nearly level and gently sloping Corwin soils are on swells on ground moraines and recessional moraines. Typically, they have a surface layer and subsurface layer of very dark brown loam. The subsoil is dark brown loam in the upper part, dark yellowish brown and yellowish brown clay loam in the next part, and yellowish brown loam in the lower part. These soils are moderately permeable.

Of minor extent in this association are the somewhat poorly drained Metamora soils on slight rises.

Most areas are drained and are used for cultivated crops. A few are used for hay and pasture. This association is well suited to cultivated crops and fairly well suited to specialty crops. The hazard of ponding and the wetness are the main management concerns.

The Reddick soils are generally unsuited to building site development and sanitary facilities, and the Andres and Corwin soils are poorly suited. The ponding and the wetness are the main management concerns.

11. Montgomery-Strole-Nesius Association

Deep, nearly level and gently sloping, very poorly drained, somewhat poorly drained, and moderately well drained, moderately fine textured and coarse textured soils formed in silty and clayey lacustrine sediments or in sandy eolian deposits; on uplands

This association is in broad depressions and on slightly convex rises on lake plains characterized by a gradual swale and swell topography. Slopes range from 0 to 3 percent.

This association makes up about 4 percent of the county. It is about 43 percent Montgomery soils, 30 percent Strole soils, 17 percent Nesius soils, and 10 percent soils of minor extent.

The very poorly drained, nearly level Montgomery soils are in broad depressional areas. Typically, they have a surface layer of very dark gray silty clay loam and a subsoil of dark gray and dark grayish brown silty clay loam. These soils are slowly permeable.

The somewhat poorly drained, nearly level Strole soils are on swells. Typically, they have a surface layer and subsurface layer of very dark gray clay loam and a subsoil of olive brown and light olive brown clay and silty clay. These soils are slowly permeable.

The moderately well drained, nearly level and gently sloping Nesius soils are on slightly convex rises. Typically, they have a surface layer of very dark gray fine sand, a subsurface layer of dark brown fine sand, and a subsoil of dark yellowish brown, brown, yellowish brown, and strong brown fine sand. These soils are rapidly permeable.

Of minor extent in this association are the moderately well drained Lucas soils on ridges and knolls.

Most areas are drained and are used for cultivated crops. A few are used for hay, pasture, or woodland. The Montgomery soils are fairly well suited to cultivated crops, the Strole soils are well suited, and the Nesius soils are poorly suited. All three soils are fairly well suited to specialty crops. The wetness of the Montgomery and Strole soils and droughtiness in the Nesius soils are the main management concerns.

The Montgomery and Nesius soils are well suited to trees. The Strole soils are not wooded. Water-tolerant species should be selected for planting on the Montgomery soils. Removing unwanted species improves the stands.

The Montgomery soils are generally unsuited to building site development and sanitary facilities, the Strole soils are poorly suited, and the Nesius soils are fairly well suited. Ponding, wetness, and the shrink-swell potential are the major management concerns.

12. Rensselaer-Darroch-Nesius Association

Deep, nearly level and gently sloping, very poorly drained, somewhat poorly drained, and moderately well drained, medium textured and coarse textured soils formed in loamy and silty outwash or in sandy eolian deposits; on uplands

This association is in broad depressions and on slightly convex rises on outwash plains and lake plains characterized by a gradual swale and swell topography. Slopes range from 0 to 3 percent.

This association makes up about 7 percent of the county. It is about 59 percent Rensselaer soils, 29 percent Darroch soils, 7 percent Nesius soils, and 5 percent minor soils.

The very poorly drained, nearly level Rensselaer soils are in broad depressions on outwash plains. Typically, they have a surface layer and subsurface layer of very dark gray loam and a subsoil of dark gray, grayish brown, and gray loam and silt loam. These soils are moderately permeable.

The somewhat poorly drained, nearly level Darroch soils are on swells on outwash plains. Typically, they have a surface layer of very dark grayish brown loam. The subsoil is dark grayish brown loam in the upper part and brown and yellowish brown clay loam in the lower part. These soils are moderately permeable.

The moderately well drained, nearly level and gently sloping Nesius soils are on slightly convex rises on outwash plains and lake plains. Typically, they have a surface layer of very dark gray fine sand, a subsurface layer of dark brown fine sand, and a subsoil of dark yellowish brown, brown, yellowish brown, and strong brown fine sand. These soils are rapidly permeable.

Of minor extent in this association are the somewhat poorly drained Whitaker soils on slight rises.

Most areas are drained and are used for cultivated crops. A few are used for hay, pasture, or woodland. The Rensselaer and Darroch soils are well suited to cultivated crops, but the Nesius soils are poorly suited. All three soils are fairly well suited to specialty crops. The wetness of the Rensselaer and Darroch soils and droughtiness in the Nesius soils are the main management concerns.

The Rensselaer and Nesius soils are well suited to trees. The Darroch soils are not wooded. Water-tolerant species should be selected for planting on the Rensselaer soils.

The Rensselaer soils are generally unsuited to building site development and sanitary facilities, the Darroch soils are poorly suited, and the Nesius soils are fairly well suited. Ponding and wetness are the main management concerns.

13. Iroquois-Papineau-Simonin Association

Deep, nearly level, very poorly drained, somewhat poorly drained, and moderately well drained, moderately coarse textured and coarse textured soils formed in sandy and loamy outwash over silty and clayey lacustrine sediments; on uplands

This association is on swells and in depressional areas on outwash plains characterized by a swale and swell topography. Slopes range from 0 to 2 percent. They are commonly less than 1 percent.

This association makes up about 4 percent of the county. It is about 53 percent Iroquois soils, 22 percent Papineau soils, 16 percent Simonin soils, and 9 percent minor soils.

The very poorly drained Iroquois soils are in broad depressional areas. Typically, they have a surface layer of very dark brown fine sandy loam and a subsurface layer of very dark grayish brown sandy loam. The subsoil is dark grayish brown and gray sandy clay loam in the upper part and gray clay loam in the lower part. These soils are moderately permeable in the upper part and very slowly permeable in the substratum.

The somewhat poorly drained Papineau soils are on swells. Typically, they have a surface layer of very dark gray sandy loam and a subsurface layer of very dark gray sandy clay loam. The subsoil is grayish brown sandy clay loam in the upper part and grayish brown silty clay in the lower part. These soils are moderately permeable in the upper part of the solum and slowly permeable in the lower part and in the substratum.

The moderately well drained Simonin soils are on swells. Typically, they have a surface layer of very dark grayish brown loamy sand and a subsurface layer of dark brown loamy sand. The subsoil is dark brown sand in the upper part, yellowish brown fine sandy loam in the next part, and olive brown silty clay in the lower part. These soils are rapidly permeable in the upper part of the solum and very slowly permeable in the lower part and in the substratum.

Of minor extent in this association are the somewhat poorly drained Whitaker soils on slight rises.

Most areas are drained and are used for cultivated crops. A few are used for hay, pasture, or specialty crops. The Iroquois and Papineau soils are well suited to cultivated crops, and the Simonin soils are fairly well suited. All three soils are fairly well suited to specialty crops. The wetness of the Iroquois and Papineau soils and droughtiness in the Simonin soils are the main management concerns.

The Iroquois soils are generally unsuited to building site development and sanitary facilities, the Papineau soils are poorly suited, and the Simonin soils are fairly well suited. Ponding, wetness, and the shrink-swell potential are the main management concerns.

Broad Land Use Considerations

The soils in Jasper County vary widely in their suitability for major land uses. The general soil map is most useful in planning the general outline of land uses, but it cannot be used in the selection of sites for specific uses, such as urban structures.

About 63 percent of the acreage in the county is used for cultivated crops, mainly corn and soybeans. Most of this land is well suited or fairly well suited to cultivated crops. The Suman-Craigmile-Prochaska association is only fairly well suited because it is frequently flooded in the spring. Slight or moderate crop damage occurs some years, but the flooding usually occurs prior to the planting season.

Ponding and wetness are the major concerns in managing most of the associations for cultivated crops. Although several of the associations are severely limited by ponding and wetness, many of the soils in these associations are well suited to farming because an adequate drainage system has been installed. Erosion is the primary management concern in areas of the Parr-Ayr-Wawasee association. This association is well suited to cultivated crops if erosion is controlled. The Oakville-Morocco-Brems association is poorly suited to cultivated crops because of droughtiness and wind erosion. Some areas of this association are irrigated.

Approximately 10 percent of the acreage in the county is used for specialty crops. These crops are grown in numerous areas throughout the county, mainly in the Houghton-Muskego-Adrian association. The main speciality crops grown in areas of this association are mint and potatoes. The major soils are well suited to specialty crops. Ponding and wetness are the major management concerns. Many areas of this association not only are drained but also are irrigated at critical periods during the growing season.

The Suman-Craigmile-Prochaska association is the only association in the county that is poorly suited to specialty crops. This association is frequently flooded in late fall and early spring. The Maumee-Zadog-Watseka and Gilford-Morocco associations are fairly well suited to specialty crops, such as vegetables and mint. Seasonal wetness and ponding are the main management concerns in areas of these associations, but droughtiness can be a problem in summer. The Oakville-Morocco-Brems association is fairly well suited to specialty crops, such as blueberries and Christmas trees. Droughtiness and wind erosion are the main management concerns in areas of this association.

About 4.5 percent of the acreage in the county is woodland. Scattered small woodlots are throughout the county, but most of the woodland is in areas of the Oakville-Morocco-Brems and Rensselaer, till substratum-Markton-Aubbeenaubbee associations. The Houghton-Muskego-Adrian association is the only association in the county that is poorly suited to woodland. It is poorly suited because of ponding and the instability of the organic material. The Maumee-Zadog-Watseka association is fairly well suited to woodland, but ponding and windthrow are hazards. In the wetter areas of most of the associations, the use of equipment is restricted to the drier periods or to periods when the ground is frozen.

In 1980, about 4 percent of the acreage in the county was urban or built-up land. Deciding which land should be used for urban development is an important issue in the county. Each year a significant acreage in the northwestern part of the county is developed for urban uses.

Extensive areas in the county are so unfavorable for urban uses that development is not desirable or is nearly impossible. Soils on flood plains, such as those in the Suman-Craigmile-Prochaska association, are not suitable for urban development because of flooding. Flooding is also a problem in some areas of the Houghton-Muskego-Adrian association. The major limitations affecting urban development in this association are ponding and the instability of the organic material. In many areas of the other associations, ponding or wetness is a problem unless an extensive drainage system is installed.

The soils that are best suited to urban development are mainly in the Oakville-Morocco-Brems and Parr-Ayr-Wawasee associations. Most of the major soils in these associations are well suited or fairly well suited to urban uses. The chief limitation in areas of the Oakville-Morocco-Brems association is a poor filtering capacity in the soils. Parr and Wawasee soils are generally suitable for most urban uses.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Oakville sand, moderately wet, 1 to 3 percent slopes, is a phase of the Oakville series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Markton-Aubbeenaubbee complex, 1 to 3 percent slopes, is an example.

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

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

The names, descriptions, and delineations of the soils identified on the detailed soil maps of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

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

Soil Descriptions

Ab—Ackerman muck, drained. This deep, nearly level, very poorly drained soil is in broad depressions on outwash plains and moraines. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are irregularly shaped and are 20 to 60 acres in size. The dominant size is about 40 acres.

Typically, the surface layer is black muck about 10 inches thick. The substratum extends to a depth of 60 inches or more. The upper part is very dark grayish brown and dark gray, mottled coprogenous earth; the next part is dark gray, mottled sand that has thin strata of coprogenous earth; and the lower part is dark grayish brown, light olive brown, grayish brown, and gray sand. In places the substratum is marly or loamy material. In a few areas it does not have coprogenous earth. In some areas the coprogenous earth extends below a depth of 30 inches. In other areas it is within a depth of 10 inches. In a few places the muck is more than 14 inches thick.

Included with this soil in mapping are small areas of the very poorly drained Houghton soils in slightly lower positions on the landscape. These soils formed in organic material that is more than 51 inches thick. They make up about 1 percent of the map unit.

The available water capacity in the Ackerman soil is high. Permeability is slow in the coprogenous earth and rapid in the substratum. Runoff is very slow or ponded. The water table is near or above the surface from late winter through spring. The organic matter content is very high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas are drained and are used for cultivated crops or specialty crops. Because of the ponding and the wetness, this soil is poorly suited to these crops in undrained areas. It is fairly well suited to cultivated crops in drained areas where the water table is controlled. Drained areas are well suited to specialty crops, such as onions, cauliflower, mint, and potatoes.

A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep subsurface drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Excessive drainage by a subsurface drainage system can cause droughtiness. Controlling the water table with open ditches, subsurface drains, water-retention structures, and subsurface irrigation minimizes the droughtiness. Drainage systems should be designed so that they keep the water table at the level required by the crops during the growing season and raise the water table to the surface during the rest of the year. Such systems minimize oxidation and subsidence of the organic material and help to control wind erosion. Because the soil is unstable, caution is needed when heavy equipment is operated near ditches.

Measures that help to control wind erosion are needed in cultivated areas. Examples are a crop rotation that includes grasses and legumes, critical area planting, green manure crops, cover crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface.

This soil is poorly suited to grasses and legumes for hay and is fairly well suited to pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover helps to control wind erosion.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the ponding and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material also minimizes the damage caused by frost action.

The land capability classification is IVw. The woodland ordination symbol is 2W.

As—Adrian muck, drained. This deep, nearly level, very poorly drained soil is in depressions on outwash plains and moraines. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are oval and are 5 to 120 acres in size. The dominant size is about 10 acres.

Typically, the surface layer is black muck about 10 inches thick. The next 14 inches is very dark gray, friable muck. The substratum to a depth of 60 inches is pale brown and gray sand. In some places the muck is more than 51 inches thick. In other places it is underlain by coprogenous earth or marl. In some areas the muck is less than 16 inches thick. In a few areas mineral material has been washed in over the muck.

The available water capacity is high. Permeability is moderately slow to moderately rapid in the organic layers and rapid in the sandy layers. Runoff is very slow or ponded. The water table is near or above the surface from late fall through spring. The organic matter content is very high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas are drained and are used for cultivated crops or specialty crops. Because of the ponding and the wetness, this soil is poorly suited to these crops in undrained areas. It is fairly well suited to cultivated crops in drained areas where the water table is controlled. Drained areas are well suited to specialty crops, such as onions, cauliflower, mint, and potatoes.

A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep subsurface drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Excessive drainage by a subsurface drainage system can cause droughtiness. Controlling the water table with open ditches, subsurface drains, water-retention structures, and subsurface irrigation minimizes the droughtiness. Drainage systems should be designed so that they keep the water table at the level required by the crops during the growing season and raise the water table to the surface during the rest of the year. Such systems minimize oxidation and subsidence of the organic material and help to control wind erosion. Because the soil is unstable, caution is needed when heavy equipment is operated near open ditches.

Measures that help to control wind erosion are needed in cultivated areas. Examples are a crop rotation that includes grasses and legumes, critical area planting, green manure crops, cover crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface.

This soil is poorly suited to grasses and legumes for hay and is fairly well suited to pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, timely deferment of grazing, pasture rotation, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover helps to control wind erosion.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Crowning the roads, building them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and frost action.

The land capability classification is IVw. The woodland ordination symbol is 2W.

AtA—Andres loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on slightly convex rises on ground moraines. Areas are elongated and are 3 to 250 acres in size. The dominant size is about 80 acres.

Typically, the surface layer is very dark gray loam about 11 inches thick. The subsoil is dark brown, dark yellowish brown, and pale brown, mottled, firm clay loam about 23 inches thick. The substratum to a depth of 60 inches is yellowish brown, mottled silty clay loam. In some areas the subsoil and substratum have less clay. In a few areas they are stratified. In some places the substratum is loam glacial till that is moderately permeable. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the moderately well drained Corwin soils in the higher positions on the landscape and the very poorly drained Reddick soils in the lower positions. Also included are a few areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 10 percent of the map unit.

The available water capacity in the Andres soil is high. Permeability is moderate in the solum and moderately slow in the substratum. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions. The water table is at a depth of 1 to 3 feet during the spring.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main management concern. It can be reduced by open ditches, surface drains, and subsurface drains. A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. Erosion and runoff are hazards. They can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to fall-chisel and ridge-plant cropping systems. Cover crops and green manure crops help to maintain or improve tilth, water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes for hay and pasture. The wetness is the main management concern. It hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the wetness, this soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is severely limited as a site for local roads and streets because of low strength and frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

Because of the wetness and the moderately slowly permeable substratum, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field and mounding with better suited material help to overcome these limitations.

The land capability classification is IIw. No woodland ordination symbol is assigned.

AyB—Ayr loamy fine sand, 1 to 4 percent slopes. This deep, nearly level and gently sloping, well drained soil is on slightly convex rises on recessional moraines. Areas are irregularly shaped and are 3 to 60 acres in size. The dominant size is about 20 acres.

Typically, the surface layer is black loamy fine sand about 9 inches thick. The subsurface layer is about 8 inches thick. It is very dark brown loamy sand in the upper part and dark brown sand in the lower part. The subsoil is about 20 inches thick. It is brown, loose sand in the upper part; yellowish brown, very friable loamy sand in the next part; and yellowish brown, firm loam in the lower part. The substratum to a depth of 60 inches is brown loam. In some places the upper sandy material is more than 35 or less than 20 inches thick. In other places the dark surface layer is thinner. In some areas the surface layer is lighter colored. In a few places the surface soil and subsoil are more acid. In some areas they have more clay. In other areas the soil has more sand throughout. In places the surface layer is fine sandy loam or sandy loam. In a few places the substratum is stratified. In a few small areas the slope is more than 4 or less than 1 percent. In some moderately eroded areas, the subsoil is mixed with the lower part of the surface soil.

The available water capacity is moderate. Permeability is rapid in the upper part of the profile and moderate in the lower part. Runoff is slow. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for woodland, hay, or pasture.

This soil is fairly well suited to a wide variety of cultivated crops, such as corn, soybeans, and small grain. Droughtiness and wind erosion are the main management concerns. Cover crops, green manure crops, crop residue management, and water-management systems conserve soil moisture and help to maintain or improve tilth, water infiltration, aeration, and the organic matter content. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, critical area planting, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping systems. Irrigation systems reduce seasonal moisture stress and increase productivity. This soil can be irrigated 3 or 4 years out of 5. Subsurface drains should be installed in areas where hillside seepage occurs. To keep the drain lines from filling with sediment, a finely meshed filter should be used to cover the lines.

This soil is well suited to grasses and legumes for hay and pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. A permanent cover of drought-resistant grasses and legumes slows runoff, helps to control erosion, and conserves soil moisture. Irrigation helps to overcome droughtiness and helps to prevent excessive wind erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is suitable as a site for dwellings. The sides of shallow excavations are unstable unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of frost action, this soil is moderately limited as a site for local roads and streets. Replacing or strengthening the upper layer of the soil with better suited base material improves the ability of the roads and streets to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Installing deep wells upslope from the absorption field reduces the potential for contamination of shallow ground water. Mounding with better suited material improves the capacity of the field to filter the effluent.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

BeB—Brems loamy sand, 1 to 3 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on slightly convex rises on outwash plains. Areas are irregularly shaped and are 3 to 80 acres in size. The dominant size is about 10 acres.

Typically, the surface layer is dark brown loamy sand about 6 inches thick. The subsoil is sand about 34 inches thick. The upper part is dark yellowish brown and very friable, and the lower part is yellowish brown and pale brown, mottled, and loose. The substratum to a depth of 60 inches is yellowish brown, mottled sand. In some areas gray mottles are in the upper part of the subsoil or are below a depth of 40 inches. In other areas the dark surface layer is thicker. In a few areas the subsoil has a thin band of loam or clay loam. In places, iron accumulations are on the surface and iron stains that tend to mask the gray mottles are throughout the subsoil. In a few areas the slope is more than 3 or less than 1 percent.

Included with this soil in mapping are small areas of the very poorly drained Maumee and Zadog soils in the lower positions on the landscape. These soils make up about 8 percent of the map unit.

The available water capacity in the Brems soil is low. Permeability is rapid. Runoff is very slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 2 to 3 feet during winter and early spring.

Most areas of this soil are used for cultivated crops. A few are used for specialty crops, hay, pasture, or woodland. A few are idle.

Unless the hazards of drought and wind erosion are reduced, this soil is poorly suited to cultivated crops and specialty crops. It is fairly well suited to cultivated crops, such as corn, soybeans, and small grain, and to specialty crops, such as Christmas trees, asparagus, and blueberries, if it is irrigated and is protected by a system of conservation tillage that leaves crop residue on the surface. The soil is well suited to a no-till cropping system. Cover crops, green manure crops, and crop residue management conserve soil moisture and help to maintain or increase the organic matter content. Irrigation systems reduce seasonal moisture stress and increase productivity. The soil can be irrigated every year. Measures that help to control wind erosion are needed. Examples are crop rotations that include grasses and legumes, critical area planting, irrigation systems, cover crops, green manure crops, and conservation tillage systems that leave all or part of the crop residue on the surface.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. Irrigation minimizes droughtiness and helps to control wind erosion. A dense plant cover helps to control wind erosion and conserves soil moisture. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Pines, which have a deep taproot system, generally grow well. Seedling mortality is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the wetness, this soil is severely limited as a site for dwellings with basements and moderately limited as a site for dwellings without basements. Subsurface drains can lower the water table. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations are unstable unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is moderately limited as a site for local roads and streets because of the wetness. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts help to overcome this limitation.

Because of the wetness and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Perimeter drains around the absorption field lower the water table. Mounding with better suited material increases the filtering capacity of the absorption field and helps to overcome the wetness.

The land capability classification is IVs. The woodland ordination symbol is 4S.

Br—Brookston loam. This deep, nearly level, very poorly drained soil is in depressions and drainageways on recessional moraines. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are long and irregular in shape. They are 5 to 300 acres in size. The dominant size is about 50 acres.

Typically, the surface layer is black loam about 10 inches thick. The subsurface layer is about 3 inches of black clay loam. The subsoil is about 27 inches thick. The upper part is dark gray and gray, mottled, firm clay loam, and the lower part is olive brown, mottled, firm loam. The substratum to a depth of 60 inches is brown, mottled loam. In some places the soil has no till material within a depth of 40 inches. In other places the substratum is stratified. In a few areas the soil has more clay in the subsoil, the substratum, or both. In some areas the subsoil has less clay. In other areas the soil has about 12 inches of overwash.

Included with this soil in mapping are small areas of the well drained Octagon, Parr, and Wawasee soils in the higher positions on the landscape. Also included are some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 9 percent of the map unit.

The available water capacity in the Brookston soil is high. Permeability is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas of this soil are drained and are used for cultivated crops. A few are used for woodland, hay, or pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness and the ponding are the main management concerns. They can be overcome by open ditches, surface drains, and subsurface drains. A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. Pumps can be used where a suitable outlet is not available. Ponded areas are generally drained by an inlet pipe in conjunction with subsurface drains. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soil is well suited to fall plowing and to fall-chisel, till-plant, and ridge-plant cropping systems.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and alsike clover, for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are main management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

ChB—Chelsea sand, 2 to 6 percent slopes. This deep, gently sloping, excessively drained soil is on ridges on outwash plains. Areas are oval and are 3 to 40 acres in size. The dominant size is about 15 acres.

Typically, the surface layer is very dark grayish brown sand about 4 inches thick. The subsurface layer is about 36 inches of yellowish brown sand. The subsoil to a depth of 80 inches is yellowish brown, loose sand that has bands of dark brown, very friable loamy sand. In some areas the subsoil contains more clay. In a few areas it does not have textural bands. In some places the soil has gravel in the lower part. In other places it has a dark surface layer. In some areas the slope is more than 6 or less than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Gilford soils in the lower positions on the landscape. These soils make up about 3 percent of the map unit.

The available water capacity in the Chelsea soil is low. Permeability is rapid. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is loose and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for woodland, hay, or pasture. A few are used for cultivated crops.

Unless the hazards of drought and wind erosion are reduced, this soil is poorly suited to cultivated crops and specialty crops. It is fairly well suited to corn, soybeans, and small grain and to specialty crops, such as Christmas trees, if it is irrigated and is protected by a system of conservation tillage that leaves crop residue on the surface. The soil is well suited to a no-till cropping system. Cover crops, green manure crops, and crop residue management conserve soil moisture and help to maintain or increase the organic matter content. Irrigation systems reduce seasonal moisture stress and increase productivity. The soil can be irrigated every year. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by critical area planting, cover crops, green manure crops, irrigation systems, and a conservation tillage system that leaves all or part of the crop residue on the surface.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. The hazard of wind erosion and the droughtiness are the main management concerns. Irrigation helps to overcome the droughtiness and helps to prevent excessive wind erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is fairly well suited to trees. Pines, which have a deep taproot system, generally grow well. Seedling mortality is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings and for local roads and streets. The sides of shallow excavations are unstable unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capability can result in the pollution of ground water. Mounding with better suited material increases the filtering capacity of the absorption field. If possible, sanitary facilities should be connected to commercial sewage-treatment facilities.

The land capability classification is IVs. The woodland ordination symbol is 3S.

CoB—Corwin loam, moderately permeable, 1 to 3 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on slightly convex rises and ridges on ground moraines and recessional moraines. Areas are irregularly shaped and are 10 to 80 acres in size. The dominant size is about 20 acres.

Typically, the surface soil is very dark brown loam about 13 inches thick. The subsoil is about 27 inches thick. It is firm. In sequence downward, it is dark brown loam; dark yellowish brown clay loam; dark yellowish brown and yellowish brown, mottled clay loam; and yellowish brown, mottled loam. The substratum to a depth of 60 inches is yellowish brown, mottled loam. In some areas it contains more sand. In other areas it is stratified. In some places bedrock is within a depth of 60 inches. In other places carbonates are below a depth of 60 inches. In some areas the substratum is silt loam or silty clay loam glacial till and is slowly permeable. In a few areas the dark surface layer is thinner. In a few places the surface layer is lighter in color. In some areas it is clay loam or the channery or gravelly analogs of this texture. In other areas the lower part of the subsoil has a layer of sandy loam or of sand and gravel. In a few areas the surface layer has more sand. In a few places the soil is brown throughout. In a few areas the slope is more than 3 or less than 1 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Andres and very poorly drained Reddick soils. Andres soils are in the slightly lower areas. Reddick soils are in depressional areas. Also included are some small moderately eroded areas where the subsoil is mixed with the lower part of the surface soil and some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 8 percent of the map unit.

The available water capacity in the Corwin soil is high. Permeability is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions. The water table is at a depth of 2 to 4 feet during winter and early spring.

Most areas of this soil are used for cultivated crops. A few are used for hay and pasture.

This soil is well suited to a wide variety of cultivated crops, such as corn, soybeans, and small grain. Erosion is the main management concern. It can be controlled by a crop rotation that includes grasses and legumes and by terraces, diversions, water- and sediment-control basins, cover crops, green manure crops, grassed waterways, grade stabilization structures, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping systems. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. Subsurface drains should be installed in areas where hillside seepage occurs.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to alfalfa and other deep-rooted legumes. Water erosion is the main management concern. Overgrazing also is a management concern. It reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover slows runoff and helps to control erosion.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. Using adequately reinforced steel in concrete foundations, excavating layers that have a moderate shrink-swell potential and backfilling with sand or gravel, building structures on reinforced concrete slabs, and installing expansion joints help to prevent the damage caused by shrinking and swelling. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is moderately limited as a site for local roads and streets because of the wetness, the shrink-swell potential, and low strength. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts help to overcome the wetness. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and by shrinking and swelling. Replacing or strengthening the upper layer of the soil with better suited base material improves the ability of the roads and streets to support vehicular traffic.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. The moderate permeability also is a limitation. Interceptor drains around the absorption field lower the water table. Increasing the size of the absorption field helps to overcome the restricted permeability.

The land capability classification is IIe. No woodland ordination symbol is assigned.

Cp—Craigmile sandy loam, frequently flooded. This deep, nearly level, very poorly drained soil is in broad depressions on the second bottoms of flood plains. It is frequently flooded for long periods from late fall through spring. Areas are irregularly shaped and are 10 to 600 acres in size. The dominant size is about 100 acres.

Typically, the surface layer is black sandy loam about 10 inches thick. The subsurface layer is very dark gray sandy loam about 4 inches thick. The substratum extends to a depth of 60 inches or more. It is dark gray sandy loam in the upper part; grayish brown, mottled sand in the next part; and pale brown sand in the lower part. In places the soil has more silt and clay throughout. In a few areas it has more sand throughout. In some areas the dark surface layer is thinner. In a few areas, the solum has more clay and the substratum has less clay. In some places the surface layer and the upper part of the substratum are stained with iron or have small accumulations of iron. In other places the upper part of the substratum is not characterized by an irregular decrease in organic matter content. In a few areas the substratum is coarse sand.

Included with this soil in mapping are small areas of the very poorly drained Suman soils in the slightly lower landscape positions. These soils have more clay in the upper part than the Craigmile soil. They make up about 8 percent of the map unit.

The available water capacity in the Craigmile soil is moderate. Permeability is moderately rapid in the loamy material and rapid in the sandy material. The water table is at or near the surface from fall through spring. Runoff is very slow. Some areas are frequently ponded for brief periods by runoff from the surrounding soils. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops. A few are used for specialty crops, woodland, or wetland wildlife habitat.

If drained and protected from flooding, this soil is fairly well suited to a wide variety of cultivated crops, such as corn and soybeans. It is poorly suited to specialty crops. Small grain that is planted in the fall is subject to severe damage during prolonged periods of flooding. Planting short-season varieties of adapted crops in late spring reduces the extent of this damage. Some areas can be protected by dikes and levees. Pumps can be used in areas where suitable drainage outlets are not available.

To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile lines. Drained areas are frequently droughty during the summer. Controlled drainage and subsurface irrigation minimize the effects of droughtiness and increase productivity.

Measures that help to control wind erosion are needed in cultivated areas. Examples are crop rotations that include grasses and legumes, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes for hay and pasture. The wetness and the flooding are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand both the high water table during the spring and the droughty conditions during the summer should be selected for planting. Water-management practices, such as irrigation and drainage, are necessary. Irrigation helps to control wind erosion and helps to overcome the droughtiness. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover helps to control wind erosion.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the flooding, the wetness, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action, flooding, and wetness. Providing coarse grained subgrade or base material also minimizes the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Dc—Darroch loam. This deep, nearly level, somewhat poorly drained soil is on slightly convex rises on outwash plains and ground moraines. Areas are irregularly shaped and are 5 to 200 acres in size. The dominant size is about 25 acres.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is about 24 inches thick. The upper part is dark grayish brown, firm loam, and the lower part is brown and yellowish brown, mottled, firm clay loam. The substratum to a depth of 60 inches is dark yellowish brown very fine sand that has strata of silt loam. In some places the lower part of the solum and the substratum have more clay. In other places the dark surface layer is thinner. In a few areas the surface layer is light colored. In some areas the soil is underlain by moderately permeable loam till.

Included with this soil in mapping are small areas of the very poorly drained Rensselaer soils in the lower positions on the landscape. These soils make up about 5 percent of the map unit.

The available water capacity in the Darroch soil is high. Permeability is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions. The water table is at a depth of 1 to 3 feet during winter and early spring.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main management concern. It can be reduced by open ditches, surface drains, and subsurface drains. A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. To keep drain lines from filling with sediment, a finely meshed filter should be used to cover the lines. Excessive drainage by subsurface drainage systems can cause droughtiness. Wind erosion is a hazard. It can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to fall-chisel and till-plant cropping systems. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and ladino clover, for hay and pasture. The wetness is the main management concern. It hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the wetness, this soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is severely limited as a site for local roads and streets because of low strength and frost action. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Mounding with suitable material helps to overcome this limitation. Installing interceptor drains around the absorption field helps to lower the water table.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Dg—Darroch, till substratum-Odell complex. These deep, nearly level, somewhat poorly drained soils are on slightly convex rises on ground moraines. The Darroch soil is on the lower side slopes. The Odell soil is on the top of ridges and on the upper side slopes. Areas are about 65 percent Darroch soil and 25 percent Odell soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. The areas of the unit are irregularly shaped and are 3 to 300 acres in size. The dominant size is about 70 acres.

Typically, the surface layer of the Darroch soil is very dark gray silt loam about 10 inches thick. The subsurface layer is very dark grayish brown clay loam about 4 inches thick. The subsoil is about 16 inches thick. It is mottled and firm. The upper part is yellowish brown clay loam, and the lower part is gray sandy clay loam. The upper part of the substratum is gray very fine sand that has strata of loamy sand, loam, and sandy clay loam. The lower part to a depth of 60 inches is yellowish brown loam till. In places the loam till is within a depth of 40 inches. In some areas the dark surface layer is thinner. In other areas the soil does not have a dark surface layer.

Typically, the surface layer of the Odell soil is very dark gray loam about 10 inches thick. The subsurface layer is very dark gray, mottled clay loam about 4 inches thick. The subsoil is dark brown and brown, mottled, firm clay loam about 22 inches thick. The substratum to a depth of 60 inches is yellowish brown and brown, mottled loam. In some places it is silt loam or silty clay loam. In other places the subsoil has more sand throughout. In some areas the dark surface layer is thinner. In other areas the soil does not have a dark surface layer. In a few areas the upper part of the subsoil does not have gray mottles.

Included with these soils in mapping are small areas of the very poorly drained Rensselaer and Wolcott soils in depressions. Rensselaer soils have a till substratum. Also included are some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 10 percent of the map unit.

The available water capacity in the Darroch and Odell soils is high. Permeability is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions. The water table is at a depth of 1 to 3 feet during winter and spring.

Most areas of these soils are drained and are used for cultivated crops. A few are used as woodland.

If drained, these soils are well suited to a wide variety of cultivated crops, such as corn, soybeans, and small grain. Wetness is the main management concern. It can be reduced by open ditches, surface drains, and subsurface drains. A drainage system lowers the water table in early spring and allows the soils to warm up earlier in the spring. To keep drain lines in the Darroch soil from filling with sediment, a finely meshed filter should be used to cover the lines. Excessive drainage by subsurface drainage systems can cause droughtiness. Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soils are well suited to a till-plant cropping system.

If drained, these soils are well suited to grasses and legumes, such as bromegrass, red clover, and ladino clover, for hay and pasture. The wetness is the main management concern. It hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soils are too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the wetness, these soils are severely limited as sites for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations in the Darroch soil can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

These soils are severely limited as sites for local roads and streets because of low strength and frost action. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action. Providing coarse grained subgrade or base material minimizes the damage caused by low strength.

Because of the wetness, these soils are severely limited as sites for septic tank absorption fields. Installing interceptor drains around the absorption field and mounding with suitable material help to overcome this limitation.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Ed—Edwards muck, drained. This deep, nearly level, very poorly drained soil is in depressions on outwash plains and ground moraines. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are elongated and are 5 to 160 acres in size. The dominant size is about 20 acres.

Typically, the surface layer is black muck about 10 inches thick. The next layer is black and dark reddish brown, very friable muck about 10 inches thick. The substratum to a depth of 60 inches is grayish brown and gray marl. In some areas it is sandy, loamy, or mucky. In other areas the marl is within a depth of 20 inches. In some places 12 to 32 inches of mineral material overlies the marl. In other places the soil has scattered iron stains, accumulations of iron, or both.

The available water capacity is very high. Permeability is moderately rapid to moderately slow in the organic layers. Runoff is very slow or ponded. The water table is near or above the surface from fall through spring. The organic matter content is very high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops or specialty crops. A few are used as wildlife habitat.

Because of the ponding and the wetness, this soil is poorly suited to cultivated crops in undrained areas. It is fairly well suited to cultivated crops and well suited to specialty crops, such as onions, cauliflower, mint, and potatoes, if the water table is controlled. A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. Drainage systems should be designed so that they keep the water table at the level required by the crops during the growing season and raise the water table to the surface during the rest of the year. Such systems minimize oxidation and subsidence of the organic material and help to control wind erosion. Because the soil is unstable, caution is needed when heavy equipment is operated near open ditches.

Measures that help to control wind erosion are needed in cultivated areas. Examples are a crop rotation that includes grasses and legumes, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface.

This soil is poorly suited to grasses and legumes for hay and is fairly well suited to pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings also reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, low strength, and subsidence of the organic material, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, subsidence, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material minimizes the damage caused by subsidence and frost action.

The land capability classification is IVw. The woodland ordination symbol is 2W.

Fa—Faxon loam. This moderately deep, nearly level, very poorly drained soil is in broad depressions on ground moraines and outwash plains. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are irregularly shaped and are 20 to 300 acres in size. The dominant size is about 80 acres.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsoil is about 26 inches thick. The upper part is dark grayish brown, mottled, firm loam; the next part is gray, mottled, firm sandy clay loam; and the lower part is gray, mottled fine sandy loam. Consolidated limestone bedrock is at a depth of about 36 inches. In some areas the depth to bedrock is less than 20 or more than 40 inches. In other areas the soil has a stratified substratum. In a few places the substratum is clay or silty clay. In some areas the soil has more sand in the surface layer, subsoil, or both.

Included with this soil in mapping are small areas of the somewhat poorly drained Grovecity and well drained Rockton soils in the higher positions on the landscape. Also included are some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 4 percent of the map unit.

The available water capacity in the Faxon soil is moderate. Permeability also is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness and the ponding are the main management concerns. A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. Drainage measures should be designed in accordance with the depth to bedrock. Open ditches, surface drains, and subsurface drains reduce the wetness. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep subsurface drains from filling with sediment, a finely meshed filter should be used to cover the drains.

Wind erosion is a hazard in cultivated areas. It can be controlled by crop rotations that include grasses and legumes and by cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to fall plowing and to fall-chisel, till-plant, and ridge-plant cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and alsike clover, for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the ponding and the depth to bedrock, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material also minimizes the damage caused by frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Gf—Gilford fine sandy loam. This deep, nearly level, very poorly drained soil is in broad depressions on outwash plains. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are irregularly shaped and are 5 to 200 acres in size. The dominant size is about 80 acres.

Typically, the surface layer is very dark gray fine sandy loam about 10 inches thick. The subsurface layer is about 5 inches of very dark gray, mottled fine sandy loam. The subsoil is grayish brown, mottled, friable fine sandy loam about 13 inches thick. The upper part of the substratum is light gray and brown, mottled fine sand. The lower part to a depth of 60 inches is grayish brown sand. In a few places, the subsoil has more clay and the substratum is sand or gravelly sand. In some areas the subsoil has more sand. In a few areas the substratum is stratified. In places the surface layer has more clay.

Included with this soil in mapping are small areas of the excessively drained Chelsea and somewhat poorly drained Morocco soils in the higher positions on the landscape. These soils make up about 6 percent of the map unit.

The available water capacity in the Gilford soil is moderate. Permeability is moderately rapid. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops. A few are used for woodland, hay, or pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. It is fairly well suited to specialty crops (fig. 3). The ponding and the wetness are the main management concerns. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep drain lines from filling with sediment, a finely meshed filter should be used to cover the lines. Excessive drainage by a subsurface drainage system can cause droughtiness. Irrigation systems reduce seasonal moisture stress during the summer and increase productivity. The soil can be irrigated in 3 or 4 years out of every 5.

Measures that control wind erosion are needed in cultivated areas. Examples are a crop rotation that includes grasses and legumes, cover crops, green manure crops, irrigation systems, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to a till-plant cropping system. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and alsike clover, for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material also minimizes the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 4W.

GzB—Grovecity fine sandy loam, 1 to 3 percent slopes. This deep, nearly level and gently sloping, somewhat poorly drained soil is on slightly convex rises on ground moraines and outwash plains. Areas are irregularly shaped and are 3 to 200 acres in size. The dominant size is about 50 acres.

Typically, the surface soil is very dark gray fine sandy loam about 16 inches thick. The subsoil also is about 16 inches thick. It is brown, firm sandy loam in the upper part and dark yellowish brown, mottled, friable coarse sandy loam in the lower part. The substratum to a depth of 60 inches is yellowish brown, mottled fine sandy loam. In some places the subsoil and substratum contain less sand and more clay. In other places the dark surface soil is thinner. In some areas bedrock is within a depth of 40 inches. In a few areas the upper part of the subsoil has gray mottles. In some places the substratum is stratified. In other places the slope is less than 1 or more than 3 percent.

Included with this soil in mapping are small areas of the very poorly drained Faxon soils in the lower positions on the landscape. Also included are a few areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 4 percent of the map unit.

The available water capacity in the Grovecity soil is moderate. Permeability is moderately rapid. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 1.5 to 3.0 feet during winter and spring.

Most areas are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by terraces, diversions, water- and sediment-control basins, cover crops, green manure crops, irrigation systems, grassed waterways, grade stabilization structures, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping

Figure 3.—Mint in an area of Gilford fine sandy loam.

systems. Irrigation can reduce seasonal moisture stress and increase productivity. The soil can be irrigated in 3 or 4 years out of every 5. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

In areas where hillside seepage occurs, subsurface drains should be installed. To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile.

This soil is well suited to grasses and legumes, such as bromegrass and ladino clover, for hay and pasture. The wetness and the hazard of erosion are the main management concerns. The grasses and legumes that can withstand the high water table should be selected for planting. A dense plant cover slows runoff and helps to control erosion. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the wetness, this soil is moderately limited as a site for dwellings without basements and is severely limited as a site for dwellings with basements. Subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is severely limited as a site for local roads and streets because of frost action. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field and mounding with suitable material help to overcome this limitation.

The land capability classification is IIe. No woodland ordination symbol is assigned.

Ho—Houghton muck, drained. This deep, nearly level, very poorly drained soil is in depressions on outwash plains and moraines. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are oval and are 5 to 350 acres in size. The dominant size is about 50 acres.

Typically, the surface layer is black muck about 12 inches thick. The next 4 inches is very dark gray, friable muck. Below this to a depth of 66 inches is dark reddish brown muck. In places sandy, loamy, or marly material or coprogenous earth is within a depth of 51 inches. In some areas mineral material has been washed in over the muck.

Included with this soil in mapping are small areas of the very poorly drained Ackerman soils in the slightly higher landscape positions. These soils are underlain by coprogenous earth and sand. Also included are small areas of the well drained Ormas and Ormas Variant soils. These soils are in the higher areas surrounding the depressions. Included soils make up about 3 percent of the map unit.

The available water capacity in the Houghton soil is very high. Permeability is moderately rapid to moderately slow. Runoff is very slow or ponded. The water table is near or above the surface from fall through spring. The organic matter content is very high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and are used for specialty crops. A few are used for cultivated crops, woodland, hay, or pasture.

If drained, this soil is fairly well suited to corn and soybeans. It is well suited to specialty crops, such as mint and potatoes. The wetness and the ponding are the main management concerns. A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. The drainage systems should be designed so that they keep the water table at the level required by the crops during the growing season and raise the water table to the surface during the rest of the year. Such systems minimize oxidation and subsidence of the organic material.

Measures that help to control wind erosion are needed in cultivated areas. Examples are a crop rotation that includes grasses and legumes, critical area planting, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface.

If drained, this soil is fairly well suited to grasses and legumes for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, low strength, and subsidence of the organic material, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, subsidence, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts help to prevent the damage caused by frost action and ponding. Providing coarse grained subgrade or base material minimizes the damage caused by subsidence and frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Hp—Houghton muck, frequently flooded. This deep, nearly level, very poorly drained soil is in depressions on flood plains along the major streams. It is frequently flooded for long periods during fall, winter, and spring. Areas are elongated or oval and are 20 to 600 acres in size. The typical size is about 40 acres.

Typically, the surface layer is black muck about 10 inches thick. Below this to a depth of 66 inches is black, very dark brown, and very dark grayish brown, very friable muck. In places sandy, loamy, or marly material or coprogenous earth is within a depth of 51 inches. In some areas mineral material has been washed in over the muck.

Included with this soil in mapping are small areas of the very poorly drained Ackerman soils in the slightly higher landscape positions. These soils are underlain by coprogenous earth and sand. Also included are small areas of the well drained Ormas and Ormas Variant soils. These soils are in the higher areas surrounding large depressions. Included soils make up about 3 percent of the map unit.

The available water capacity in the Houghton soil is very high. Permeability is moderately rapid to moderately slow. Runoff is very slow. The organic matter content is very high in the surface layer. The water table is near the surface from fall through spring.

Most areas are used as wetland wildlife habitat. A few are wooded or pastured. Because of the flooding and the wetness, this soil is generally unsuited to cultivated crops. It is well suited to wetland wildlife habitat (fig. 4). It is frequently covered by backwater from the adjacent streams and drainageways. It supports aquatic and semiaquatic vegetation, such as cattails, rushes, sedges, waterlilies, pondweed, duckweed, and water-tolerant trees and shrubs. These plants provide cover, nesting sites, and food for many animals, including ducks, geese, and other birds. They also provide food and cover for deer, fox, raccoon, and muskrat.

Because of the flooding, the wetness, and subsidence, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the flooding, the wetness, and subsidence. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by flooding and wetness. Providing coarse grained subgrade or base material minimizes the damage caused by subsidence.

The land capability classification is VIIIw. No woodland ordination symbol is assigned.

Ir—Iroquois fine sandy loam. This deep, nearly level, very poorly drained soil is in broad depressions on outwash plains. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are irregularly shaped and are 40 to 50 acres in size. The dominant size is about 200 acres.

Typically, the surface layer is very dark brown fine sandy loam about 11 inches thick. The subsurface layer is about 5 inches of very dark grayish brown, mottled sandy loam. The subsoil is about 15 inches thick. It is mottled and firm. The upper part is dark grayish brown and gray sandy clay loam, and the lower part is gray clay loam. The substratum to a depth of 60 inches is gray, mottled silty clay. In some places the soil has more sand. In other places the substratum has less clay. In some areas the upper part of the solum has more clay. In a few areas, the substratum has more sand and limestone bedrock is within a depth of 40 inches. In places the solum is more than 42 inches thick. In a few areas the substratum is stratified and has more sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Papineau and Strole soils in the slightly higher positions on the landscape. Also included are areas of the moderately well drained Simonin soils in the higher positions. Included soils make up about 9 percent of the map unit.

The available water capacity in the Iroquois soil is high. Permeability is moderate in the solum and very slow in the substratum. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness and the ponding are the main management concerns. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface

Figure 4.—A clutch of eggs in an area of Houghton muck, frequently flooded, which provides food and cover for many kinds of wetland wildlife.

drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains.

Measures that help to control wind erosion are needed in cultivated areas. Examples are a crop rotation that includes grasses and legumes, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to a till-plant cropping system. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and alsike clover, for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is needed. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the ponding, the shrink-swell potential, and the very slow permeability, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned.

LuB2—Lucas silty clay loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is on ridges and knolls on lake plains and recessional moraines. Areas are irregularly shaped and are 3 to 15 acres in size. The dominant size is about 8 acres.

Typically, the surface layer is dark grayish brown silty clay loam about 8 inches thick. It is mixed with dark brown subsoil material in the lower part. The subsoil is dark brown and yellowish brown, firm clay about 16 inches thick. The substratum to a depth of 60 inches is brown silty clay. In some areas the soil has more sand. In a few places the surface layer is dark. In some places the substratum is stratified. In other places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the very poorly drained Montgomery soils in the lower positions on the landscape and the somewhat poorly drained Strole soils in the slightly lower positions. Also included are a few severely eroded areas where the subsoil is exposed. Included soils make up about 3 percent of the map unit.

The available water capacity in the Lucas soil is moderate. Permeability is slow in the solum and slow or very slow in the substratum. Runoff is rapid. The organic matter content is low in the surface layer. This layer is firm. If tilled when wet, it becomes cloddy as it dries. Because of the hard clods, seedbed preparation is difficult. The water table is at a depth of 2.5 to 4.0 feet during winter and early spring.

Most areas are used for cultivated crops. This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the main management concern. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, and conservation tillage systems that leave all or part of the crop residue on the surface. Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. In areas where hillside seepage occurs, subsurface drains should be installed.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to alfalfa and other deep-rooted legumes. Erosion is the main management concern. Overgrazing also is a management concern. It reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover slows runoff and helps to control erosion.

This soil is well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the shrink-swell potential, this soil is severely limited as a site for dwellings. Using adequately reinforced steel in concrete foundations, excavating layers that have a high shrink-swell potential and backfilling with sand or gravel, building structures on reinforced concrete slabs, and installing expansion joints help to prevent the damage caused by shrinking and swelling. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is severely limited as a site for local roads and streets because of low strength and the shrink-swell potential. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic and helps to prevent the damage caused by shrinking and swelling.

Because of the wetness and the very slow permeability, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field lowers the water table. Mounding with better suited material increases the depth to the water table and improves the ability of the field to absorb the effluent.

The land capability classification is IIIe. The woodland ordination symbol is 4C.

MaB—Markton-Aubbeenaubbee complex, 1 to 3 percent slopes. These deep, nearly level and gently sloping, somewhat poorly drained soils are on slightly convex rises on recessional moraines. The Markton soil is on the higher knobs and ridges. The Aubbeenaubbee soil is in the slightly lower, less sloping areas. Areas are about 55 percent Markton soil and 30 percent Aubbeenaubbee soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical. The areas of the unit are irregularly shaped and are 3 to 40 acres in size. The dominant size is about 10 acres.

Typically, the surface layer of the Markton soil is dark brown sand about 10 inches thick. The subsoil is about 28 inches thick. The upper part is brown, loose sand; the next part is yellowish brown, mottled, loose sand; and the lower part is yellowish brown, mottled, friable loam. The substratum to a depth of 60 inches is brown, mottled loam. In some places the sandy deposits are less than 20 or more than 40 inches thick. In other places the surface layer is dark. In some areas the lower part of the subsoil and the substratum are stratified. In a few areas the upper part of the subsoil is grayer. In a few places the subsoil is brown throughout. In some areas the substratum contains more clay.

Typically, the surface layer of the Aubbeenaubbee soil is dark grayish brown fine sandy loam about 10 inches thick. The subsurface layer is about 5 inches of brown, mottled fine sandy loam. The subsoil is about 18 inches thick. It is mottled and firm. The upper part is dark brown sandy clay loam, the next part is brown clay loam, and the lower part is light brownish gray loam. The substratum to a depth of about 60 inches is brown loam. In some areas the surface layer is dark. In a few areas it has more clay. In a few areas the lower part of the subsoil and the substratum are stratified. In places the solum is more acid. In a few areas the upper part of the subsoil is grayer. In some areas it has a brown layer. In other areas the slope is less than 1 or more than 3 percent.

Included with these soils in mapping are small areas of the very poorly drained Rensselaer soils in depressions and the well drained Metea soils in the higher positions on the landscape. Also included are some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Markton soil and high in the Aubbeenaubbee soil. Permeability is rapid in the sandy part of the Markton soil and moderate in the lower part. It is moderate in the Aubbeenaubbee soil. Runoff is slow on the Markton soil and medium on the Aubbeenaubbee soil. The organic matter content is low in the surface layer of both soils. This layer is very friable or friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 1 to 3 feet during winter and early spring.

Most areas of these soils are drained and are used for cultivated crops. A few are used for woodland, hay, or pasture.

If drained, these soils are fairly well suited to corn, soybeans, and small grain. Erosion by wind and water is the main management concern. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by terraces, diversions, water- and sediment-control basins, cover crops, green manure crops, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to a till-plant or no-till cropping system (fig. 5). Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

The wetness is a concern in managing cultivated areas. A drainage system lowers the water table and allows the soils to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Subsurface drains are needed in areas where hillside seepage occurs.

If drained, these soils are well suited to grasses and legumes, such as bromegrass, alfalfa, and ladino clover, for hay and pasture. Erosion and wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. A dense plant cover slows runoff and helps to control erosion. Overgrazing or grazing when the soils are too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

These soils are well suited to trees. Seedling mortality is moderate on the Markton soil, and plant competition is moderate on the Aubbeenaubbee soil. Seedlings survive and grow well if competing vegetation is controlled by site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the wetness, these soils are severely limited as sites for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations in the Markton soil can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

These soils are severely limited as sites for local roads and streets because of frost action. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of the wetness, these soils are severely limited as sites for septic tank absorption fields. Installing interceptor drains around the absorption field helps to lower the water table.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Markton soil is 4S, and that assigned to the Aubbeenaubbee soil is 4A.

McB—Martinsville fine sandy loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges and knolls on outwash plains and recessional

Figure 5.—No-till corn in an area of Markton-Aubbeenaubbee complex, 1 to 3 percent slopes.

moraines. Areas are irregularly shaped and are 15 to 50 acres in size. The dominant size is about 25 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is about 4 inches of brown loam. The subsoil is about 29 inches thick. The upper part is brown, friable loam; the next part is dark yellowish brown and yellowish brown, firm loam; and the lower part is yellowish brown, firm silt loam. The substratum to a depth of 60 inches is yellowish brown silt loam that has thin strata of fine sand. In some areas the upper part of the solum contains more sand. In other areas the substratum is sand and gravel. In a few areas the lower part of the solum and the substratum are not stratified. In some places the substratum is till. In other places the surface layer is dark. In a few areas the lower part of the solum has gray mottles. In some areas the slope is more than 6 or less than 2 percent.

Included with this soil in mapping are small areas of the well drained Ormas and Ormas Variant soils in the slightly higher positions on the landscape and the somewhat poorly drained Whitaker soils in the lower positions. Ormas and Ormas Variant soils are more sandy than the Martinsville soil. Also included are some areas of sandy soils that have a slope of more than 12 percent. Included soils make up about 15 percent of the map unit.

The available water capacity in the Martinsville soil is moderate. Permeability also is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for woodland, hay, or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by water- and sediment-control basins, terraces, diversions, cover crops, green manure crops, grassed waterways, irrigation systems, grade stabilization structures, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping systems. Crop residue management, cover crops, and green manure crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. Subsurface drains are needed in areas where hillside seepage occurs.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to alfalfa and other deep-rooted legumes. Erosion is the main management concern. A dense plant cover conserves soil moisture, slows runoff, and helps to control erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. It can be controlled by proper site preparation and by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings and septic tank absorption fields. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of frost action, this soil is moderately limited as a site for local roads and streets. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 4A.

MeA—Metamora fine sandy loam, moderately permeable, 0 to 1 percent slopes. This deep, nearly level, somewhat poorly drained soil is on slightly convex rises on recessional moraines. Areas are irregularly shaped and are 5 to 80 acres in size. The dominant size is about 40 acres.

Typically, the surface soil is very dark gray fine sandy loam about 15 inches thick. The subsoil is about 20 inches thick. It is brown, very friable fine sandy loam in the upper part; dark yellowish brown, firm fine sandy loam in the next part; and yellowish brown, mottled, firm sandy clay loam in the lower part. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the lower part of the solum and the substratum have more clay. In other areas they have more sand. In a few places the upper part of the subsoil has gray mottles. In some places the subsoil is brown throughout. In other places the surface layer is lighter colored. In some areas it has more sand. In other areas the slope is more than 1 percent.

Included with this soil in mapping are small areas of the well drained Octagon soils in the higher positions on the landscape. Also included are some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 3 percent of the map unit.

The available water capacity in the Metamora soil is high. Permeability is moderate. Runoff is slow. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 1 to 2 feet during winter and spring.

Most areas are drained and are used for cultivated crops. If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main management concern. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Wind erosion is a hazard. It can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to a till-plant cropping system. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Wetness and erosion are the main management concerns. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. A dense plant cover slows runoff and helps to control erosion. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the wetness, this soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is severely limited as a site for local roads and streets because of frost action. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field and mounding with suitable material help to overcome this limitation.

The land capability classification is IIw. The woodland ordination symbol is 4A.

MeB—Metamora fine sandy loam, moderately permeable, 1 to 4 percent slopes. This deep, nearly level and gently sloping, somewhat poorly drained soil is on slightly convex rises on recessional moraines. Areas are irregularly shaped and are 3 to 200 acres in size. The dominant size is about 40 acres.

Typically, the surface layer is very dark gray fine sandy loam about 8 inches thick. The subsoil is firm loam about 28 inches thick. The upper part is yellowish brown, and the lower part is yellowish brown, brown, and light brownish gray and is mottled. The substratum to a depth of 60 inches is brown loam. In some areas the surface layer has more clay. In a few areas the subsoil and substratum have more clay. In some places the surface layer is thicker and darker, and in other places it is light colored. In some areas the subsoil is brown throughout. In other areas the solum has more sand. In some places the substratum is stratified. In other places the slope is less than 1 or more than 4 percent.

Included with this soil in mapping are some severely eroded areas where the subsoil is mixed with the surface layer. Also included are some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 4 percent of the map unit.

The available water capacity in the Metamora soil is high. Permeability is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 1 to 2 feet during winter and spring.

Most areas of this soil are drained and are used for cultivated crops. A few are used for woodland, hay, or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion by wind and water is the main management concern. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to a till-plant cropping system. Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. Subsurface drains should be installed in areas where hillside seepage occurs.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Wetness and erosion are the main management concerns. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. A dense plant cover slows runoff and helps to control erosion. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the wetness, this soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is severely limited as a site for local roads and streets because of frost action. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Mounding with suitable material and installing interceptor drains around the absorption field help to overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol is 4A.

MkB—Metea loamy sand, moderately permeable, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on rises and knolls on recessional moraines. Areas are irregularly shaped and are 3 to 20 acres in size. The dominant size is about 10 acres.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsurface layer is about 20 inches thick. The upper part is brown and yellowish brown, very friable loamy sand, and the lower part is yellowish brown, loose sand. The subsoil is about 10 inches of dark yellowish brown, firm sandy clay loam. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is darker. In a few areas the lower part of the subsoil has gray mottles. In some places the upper part of the solum contains more clay. In other places the subsoil is dominantly gray. In some areas the sandy material is more than 40 or less than 20 inches thick. In other areas the substratum is stratified. In places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Aubbeenaubbee soils in the slightly lower positions on the landscape. Also included, in the slightly lower positions, are small areas of well drained soils that are less sandy than the Metea soil. Included soils make up about 4 percent of the map unit.

The available water capacity in the Metea soil is moderate. Permeability is rapid in the upper part of the solum and moderate in the lower part and in the substratum. Runoff is slow. The organic matter content is low in the surface layer. This layer is loose and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for woodland, hay, or pasture.

This soil is fairly well suited to corn, soybeans, and small grain. Droughtiness and wind erosion are the main management concerns. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping systems. Irrigation can reduce seasonal moisture stress and increase productivity. The soil can be irrigated in 3 or 4 years out of every 5. Crop residue management, green manure crops, and cover crops help to maintain the organic matter content. In areas where hillside seepage occurs, subsurface drains should be installed. To keep the drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. A permanent cover of drought-resistant grasses and legumes slows runoff, helps to control erosion, and conserves soil moisture. Irrigation helps to overcome the droughtiness and helps to prevent excessive wind erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. It can be controlled by proper site preparation and by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of frost action, this soil is moderately limited as a site for local roads and streets. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Installing deep wells upslope from the absorption field reduces the potential for contamination of shallow ground water. Mounding with better suited material increases the filtering capacity of the absorption field.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

Mp—Montgomery silty clay loam. This deep, nearly level, very poorly drained soil is in broad depressions on lake plains. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are long and irregular in shape and are 4 to 350 acres in size. The dominant size is about 100 acres.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is dark gray and dark grayish brown, mottled, firm silty clay loam about 12 inches thick. The substratum to a depth of 60 inches is gray, mottled silty clay loam. In places the solum has more sand. In some areas the substratum is silt loam or silty clay loam till.

Included with this soil in mapping are small areas of the moderately well drained Lucas and Simonin and somewhat poorly drained Papineau and Strole soils in the slightly higher positions on the landscape. These soils make up about 9 percent of the map unit.

The available water capacity in the Montgomery soil is high. Permeability is slow. Runoff is very slow or ponded. The water table is near or above the surface in winter and spring. The organic matter content is high in the surface layer. This layer is firm. If the soil is tilled when wet, large clods form. The clods become hard as they dry. They make seedbed preparation difficult.

Most areas of this soil are drained and are used for cultivated crops. A few are used for specialty crops, woodland, hay, or pasture.

If drained, this soil is fairly well suited to corn, soybeans, and small grain. Wetness and ponding are the main management concerns. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soil is well suited to fall plowing and to fall-chisel and ridge-plant cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and alsike clover, for hay and pasture. The wetness and the ponding are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is needed. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, the shrink-swell potential, and the slow permeability, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, low strength, and the shrink-swell potential. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by ponding. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and by shrinking and swelling.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Mu—Morocco loamy sand. This deep, nearly level, somewhat poorly drained soil is on slightly convex rises on outwash plains. Areas are long and irregular in shape and are 3 to 200 acres in size. The dominant size is about 10 acres.

Typically, the surface layer is dark grayish brown loamy sand about 9 inches thick. The subsurface layer is about 5 inches of light yellowish brown, mottled loamy fine sand. The subsoil is very pale brown and light gray, mottled, loose fine sand about 21 inches thick. The substratum to a depth of 60 inches is very pale brown, mottled fine sand. In some places the subsoil is dominantly brown and has gray mottles in the lower part. In other places the surface soil is thick and dark. In some areas the soil has iron accumulations on the surface and iron stains throughout the subsoil. The stains tend to mask the gray mottles. In places the subsoil has more clay. In a few places the substratum is very fine sand or coarse sand. In a few areas the subsoil has a thin layer of loam or clay loam. In some areas gravel is in the lower part of the subsoil and in the substratum. In other areas the soil is more alkaline.

Included with this soil in mapping are small areas of the very poorly drained Gilford, Maumee, Newton, and Zadog soils in the lower positions on the landscape. These soils make up about 12 percent of the map unit.

The available water capacity in the Morocco soil is low. Permeability is rapid. Runoff is very slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 1 to 2 feet during winter and spring.

Most areas of this soil are drained and are used for cultivated crops or specialty crops. A few are used for woodland, hay, or pasture.

This soil is poorly suited to cultivated crops. It is fairly well suited to specialty crops, such as asparagus, blueberries, and Christmas trees. Droughtiness and wind erosion are the main management concerns. Soil moisture can be conserved by cover crops, green manure crops, and crop residue management. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to a till-plant cropping system. Irrigation can reduce seasonal moisture stress during the summer and can increase productivity. The soil can be irrigated every year. The water table should be controlled by open ditches, subsurface drains, water-retention structures, and subsurface irrigation. To keep subsurface drain lines from filling with sediment, a finely meshed filter should be used to cover the lines.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alsike clover, for hay and is well suited to pasture. The grasses and legumes that can withstand both the seasonal high water table and the summer droughtiness should be selected for planting. Water-management practices, such as irrigation and drainage, are necessary. Irrigation helps to control wind erosion and helps to overcome the droughtiness. A dense plant cover conserves soil moisture and helps to control wind erosion. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the wetness, this soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of the wetness and frost action, this soil is moderately limited as a site for local roads and streets. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and wetness. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of the wetness and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field helps to lower the water table. Mounding with better suited material increases the depth to the water table and improves the ability of the field to filter the effluent.

The land capability classification is IVs. The woodland ordination symbol is 5S.

Mw—Muskego muck, drained. This deep, nearly level, very poorly drained soil is in depressions on outwash plains and moraines. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are irregularly shaped and are 5 to 160 acres in size. The dominant size is about 25 acres.

Typically, the surface layer is black muck about 10 inches thick. The next 8 inches is black and dark brown, very friable muck. The substratum to a depth of 60 inches is grayish brown and gray coprogenous earth. In some places it is sandy, marly, or loamy material. In other places the depth to coprogenous earth is more than 30 or less th1n 18 inches. In a few areas the muck is more than 51 inches thick. In some areas thin layers of hemic material are in the organic part of the profile below the surface layer.

The available water capacity is very high. Permeability is moderately rapid or moderate in the organic layers and slow in the coprogenous earth. Runoff is very slow or ponded. The water table is near or above the surface during most of the year. The organic matter content is very high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops or specialty crops. A few are used as wetland wildlife habitat.

Because of the ponding and the wetness, this soil is poorly suited to cultivated crops and specialty crops in undrained areas. It is fairly well suited to cultivated crops and well suited to specialty crops, such as mint, potatoes, onions, and cauliflower, if the water table is controlled. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. Drainage systems should be designed so that they keep the water table at the level required by the crops during the growing season and raise the water table to the surface during the rest of the year. Such systems minimize oxidation and subsidence of the organic material. If it is exposed, the coprogenous earth becomes cloddy. It is extremely difficult to rewet if it dries out. Because the soil is unstable, caution is needed when heavy equipment is operated near open ditches.

Measures that help to control wind erosion are needed in cultivated areas. Examples are a crop rotation that includes grasses and legumes, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to spring plowing.

This soil is poorly suited to grasses and legumes for hay and is fairly well suited to pasture. The wetness and the ponding are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. A dense plant cover helps to control wind erosion. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding and subsidence, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, subsidence, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material also minimizes the damage caused by subsidence and frost action.

The land capability classification is IVw. The woodland ordination symbol is 2W.

Mz—Mussey mucky sandy loam. This deep, nearly level, very poorly drained soil is in slight depressions on outwash plains. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are irregularly shaped and are 3 to 150 acres in size. The dominant size is about 10 acres.

Typically, the surface layer is black mucky sandy loam about 10 inches thick. The subsoil is dark grayish brown, mottled, firm clay loam about 3 inches thick. The upper part of the substratum is grayish brown and brown, mottled sand. The lower part to a depth of 60 inches is dark brown gravelly sand. In places the surface layer is sand. In a few areas it is thicker and is dark. In some areas it is not mucky. In other areas it is more acid. In a few places the subsoil has less clay. In some places it is thicker. In other places the substratum is not gravelly.

The available water capacity is low. Permeability is moderate in the solum and rapid in the substratum. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is very high in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and used for cultivated crops. A few are used as woodland or pasture.

If drained, this soil is fairly well suited to cultivated crops, such as corn, soybeans, and small grain. Ponding and wetness are the main management concerns. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Excessive drainage by a subsurface drainage system can cause droughtiness. Irrigation systems reduce seasonal moisture stress and increase productivity. The soil can be irrigated in 3 or 4 years out of every 5.

Wind erosion is a hazard in cultivated areas. It can be controlled by a crop rotation that includes grasses and legumes and by cover crops, green manure crops, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to a till-plant cropping system. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and alsike clover, for hay and pasture. The ponding and the wetness are the main management concerns. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. A dense plant cover helps to control wind erosion. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material also minimizes the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 3W.

NaB—Nesius fine sand, 1 to 3 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on slightly convex rises and ridges on lake plains and outwash plains. Areas are irregularly shaped and are 5 to 200 acres in size. The dominant size is about 40 acres.

Typically, the surface layer is very dark gray fine sand about 7 inches thick. The subsurface layer is about 11 inches of dark brown fine sand. The subsoil is dark yellowish brown, brown, strong brown, and yellowish brown, mottled, very friable fine sand about 33 inches thick. The substratum to a depth of 60 inches is grayish brown, mottled fine sand. In a few places the surface layer is light colored. In a few areas it is thicker and darker. In some areas the subsoil is brown throughout. In other areas it is dominantly gray or has gray mottles. In some places the soil has textural bands in the lower part of the subsoil, in the substratum, or in both. In other places the slope is more than 3 or less than 1 percent.

The available water capacity is low. Permeability is rapid. Runoff is very slow. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 2.5 to 4.0 feet from late fall through spring.

Most areas of this soil are used for cultivated crops. A few are used for woodland, hay, or pasture.

Unless the hazards of drought and wind erosion are reduced, this soil is poorly suited to cultivated crops and specialty crops. It is fairly well suited to cultivated crops, such as corn, soybeans, and small grain, and to specialty crops, such as Christmas trees, asparagus, and blueberries, if it is irrigated and is protected by conservation tillage systems that leave crop residue on the surface. The soil is well suited to a no-till cropping system. Cover crops, green manure crops, and crop residue management conserve moisture and help to maintain the organic matter content. Irrigation can reduce seasonal moisture stress and can increase productivity. The soil can be irrigated every year. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by green manure crops, irrigation systems, and conservation tillage.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. Irrigation minimizes droughtiness and helps to control wind erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are seedling mortality and plant competition. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings without basements and as a site for local roads and streets. It is moderately limited as a site for dwellings with basements because of the wetness. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of the wetness and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field lowers the water table. Mounding with better suited material increases the depth to the water table and improves the filtering capacity of the absorption field.

The land capability classification is IVs. The woodland ordination symbol is 3S.

Ne—Newton loamy fine sand, undrained. This deep, nearly level, very poorly drained soil is in broad depressions on outwash plains. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are elongated and irregular in shape and are 20 to 200 acres in size. The dominant size is about 80 acres.

Typically, the surface layer is very dark gray loamy fine sand about 10 inches thick. The subsurface layer is light brownish gray loamy fine sand about 5 inches thick. The substratum to a depth of 60 inches is light brownish gray fine sand. In a few areas the solum is less acid. In places the upper part of the substratum irregularly decreases in content of organic matter with increasing depth. In a few areas the soil has iron stains, accumulations, and concretions throughout. These tend to mask the gray colors. In some areas the subsoil has more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Morocco soils in the slightly higher positions on the landscape. Also included are the well drained Oakville soils on the highest part of the landscape. Included soils make up about 10 percent of the map unit.

The available water capacity in the Newton soil is low. Permeability is rapid. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer.

Most areas are in wooded sections of state-owned fish and game preserves. The trees in these areas, such as pin oak and eastern cottonwood, are of low commercial value. This soil is generally unsuited to cultivated crops and to grasses and legumes for hay and pasture. The wetness, the ponding, and the low available water capacity are the main management concerns. Because of the dense timber stands, draining this soil is very costly.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields and is severely limited as a site for local roads. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by ponding. The sides of shallow excavations can cave in unless they are temporarily reinforced.

The land capability classification is Vw. The woodland ordination symbol is 4W.

OaB—Oakville fine sand, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges on outwash plains. Areas are long and irregular in shape and are 5 to 200 acres in size. The dominant size is about 40 acres.

Typically, the surface layer is very dark grayish brown fine sand about 4 inches thick. The subsoil is dark brown, dark yellowish brown, and yellowish brown, loose fine sand about 30 inches thick. The substratum to a depth of 60 inches is light yellowish brown fine sand. In places the subsoil has textural bands. In a few areas the dark surface layer is thicker. In some areas it has more clay. In other areas the subsoil has more clay. In some places the lower part of the subsoil has gray mottles. In other places the substratum is coarse sand, is loam till, or is stratified. In a few places it is more acid. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the very poorly drained Newton and Zadog soils in the lower positions on the landscape. These soils make up about 10 percent of the map unit.

The available water capacity in the Oakville soil is low. Permeability is rapid. Runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for woodland, hay, or pasture. A few are used for cultivated crops.

Unless the hazards of drought and wind erosion are reduced, this soil is poorly suited to cultivated crops and specialty crops. It is fairly well suited to corn, soybeans, and small grain and to specialty crops, such as

Christmas trees and asparagus, if it is irrigated and is protected by a system of conservation tillage that leaves crop residue on the surface. The soil is well suited to a no-till cropping system. Cover crops, green manure crops, and crop residue management conserve moisture and increase the organic matter content. Irrigation can reduce seasonal moisture stress and can increase productivity. The soil can be irrigated every year. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by green manure crops, irrigation systems, and conservation tillage.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Droughtiness and wind erosion are the main management concerns. Irrigation minimizes droughtiness and helps to control wind erosion. A dense plant cover helps to control wind erosion, slows runoff, and conserves soil moisture. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings and for local roads and streets. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Mounding with better suited material increases the filtering capacity of the absorption field.

The land capability classification is IVs. The woodland ordination symbol is 4S.

OaC—Oakville fine sand, 6 to 15 percent slopes. This deep, moderately sloping and strongly sloping, well drained soil is on ridges on outwash plains. Areas are long and irregular in shape and are 5 to 150 acres in size. The dominant size is about 25 acres.

Typically, the surface layer is very dark brown fine sand about 4 inches thick. The subsoil is dark yellowish brown and brownish yellow, loose fine sand about 28 inches thick. The substratum to a depth of 60 inches is light yellowish brown fine sand. In places the subsoil has textural bands. In a few areas the dark surface layer is thicker. In some areas it has more clay. In other areas the subsoil has more clay or has gray mottles in the lower part. In places the substratum is coarse sand, is loam till, or is stratified. In a few areas it is more acid. In some areas the slope is less than 6 or more than 15 percent.

Included with this soil in mapping are small areas of the very poorly drained Newton and Zadog soils in the lower positions on the landscape. These soils make up about 12 percent of the map unit.

The available water capacity in the Oakville soil is low. Permeability is rapid. Runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for woodland, hay, or pasture. Because of droughtiness and wind erosion, this soil is generally unsuited to cultivated crops. It is poorly suited to grasses and legumes for hay and is fairly well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Irrigation minimizes droughtiness and helps to control wind erosion. A dense plant cover helps to control wind erosion, slows runoff, and conserves soil moisture. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the slope, this soil is moderately limited as a site for dwellings. Land grading can modify the slope. The buildings can be designed so that they conform to the natural slope of the land. Retaining walls may be needed. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is moderately limited as a site for local roads and streets because of the slope. The roads and streets should be built on the contour. Land shaping may be needed.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Mounding with better suited material increases the filtering capacity of the absorption field.

The land capability classification is VIs. The woodland ordination symbol is 4S.

ObB—Oakville sand, moderately wet, 1 to 3 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on slightly convex rises and ridges on outwash plains. Areas are irregularly shaped and are 5 to 50 acres in size. The dominant size is about 10 acres.

Typically, the surface layer is very dark gray sand about 3 inches thick. The subsoil is dark brown and yellowish brown, loose fine sand about 41 inches thick. The substratum to a depth of 60 inches is pale brown, mottled fine sand. In some places the upper part of the subsoil has gray mottles. In other places the subsoil has textural bands. In a few areas the dark surface layer is thicker. In some areas the subsoil has more clay. In other areas the soil is brown throughout. In a few places the substratum is coarse sand, is loam till, or is stratified. In a few areas it is more acid. In places the slope is more than 3 or less than 1 percent.

Included with this soil in mapping are small areas of the very poorly drained Zadog soils in the lower positions on the landscape. These soils make up about 2 percent of the map unit.

The available water capacity in the Oakville soil is low. Permeability is rapid. Runoff is very slow. The organic matter content is low in the surface layer. This layer is loose and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 3 to 6 feet from late fall to early spring.

Most areas of this soil are used as woodland. A few are used for cultivated crops or specialty crops.

Unless the hazards of drought and wind erosion are reduced, this soil is poorly suited to cultivated crops and specialty crops. It is fairly well suited to corn, soybeans, and small grain and to specialty crops, such as Christmas trees, if it is irrigated and is protected by a system of conservation tillage that leaves crop residue on the surface. The soil is well suited to a no-till cropping system. Cover crops, green manure crops, and crop residue management conserve moisture and increase the organic matter content. Irrigation can reduce seasonal moisture stress and can increase productivity. The soil can be irrigated every year. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by critical area planting, cover crops, green manure crops, irrigation systems, and conservation tillage.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. Irrigation minimizes droughtiness and helps to control wind erosion. A dense plant cover helps to control wind erosion and conserves soil moisture. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings without basements and as a site for local roads and streets. Because of the wetness, it is moderately limited as a site for dwellings with basements. Subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations can cave in unless they are reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of the wetness and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. Mounding with better suited material increases the filtering capacity of the absorption field and the depth to the water table. Installing interceptor drains around the absorption field helps to lower the water table.

The land capability classification is IVs. The woodland ordination symbol is 4S.

OcC2—Octagon fine sandy loam, 6 to 12 percent slopes, eroded. This deep, moderately sloping, well drained soil is on ridges and knolls on recessional moraines. Areas are irregularly shaped and are 5 to 60 acres in size. The dominant size is about 15 acres.

Typically, the surface layer is very dark gray fine sandy loam about 8 inches thick. It is mixed with dark brown subsoil material in the lower part. The subsoil is about 28 inches thick. It is dark brown, friable fine sandy loam in the upper part and dark yellowish brown and yellowish brown, firm loam in the lower part. The substratum to a depth of 60 inches is brown loam. In a few areas the dark surface layer is thicker. In a few places the soil has a lighter colored surface layer. In some places the substratum is stratified. In other places the surface layer has more sand. In a few areas it has more clay. In some areas the subsoil has more clay. In other areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the very poorly drained Brookston soils in the lowest position on the landscape and small areas of the somewhat poorly drained Metamora soils in the slightly lower positions. Also included are a few severely eroded areas where the subsoil is exposed and some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 5 percent of the map unit.

The available water capacity in the Octagon soil is moderate. Permeability also is moderate. Runoff is rapid. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas are used for cultivated crops. This soil is fairly well suited to corn, soybeans, and small grain. Erosion by water and wind is the main management concern. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by terraces, diversions, cover crops, green manure crops, irrigation systems, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping systems. Crop residue management, cover crops, and green manure crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. In areas where hillside seepage occurs, subsurface drains should be installed.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to alfalfa and other deep-rooted legumes. Erosion is the main management concern. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover slows runoff and helps to control erosion.

Because of the slope and the shrink-swell potential, this soil is moderately limited as a site for dwellings. Using adequately reinforced steel in concrete foundations, excavating layers that have a moderate shrink-swell potential and backfilling with sand or gravel, building structures on reinforced concrete slabs, and installing expansion joints help to prevent the damage caused by shrinking and swelling. Grading can modify the slope. The buildings can be designed so that they conform to the natural slope of the land. Retaining walls may be needed. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is moderately limited as a site for local roads and streets because of the the slope, low strength, and shrink-swell potential. Constructing the roads and streets on the contour and land shaping help to overcome the slope. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and by shrinking and swelling. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of the slope and the moderate permeability, this soil is moderately limited as a site for septic tank absorption fields. Mounding with better suited material and enlarging the absorption area improve the ability of the field to absorb the effluent. Installing the absorption field on the contour helps to overcome the slope.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

OrB—Ormas loamy fine sand, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges and knolls on outwash plains. Areas are elongated or irregular in shape and are 3 to 25 acres in size. The dominant size is about 8 acres.

Typically, the surface layer is dark brown loamy fine sand about 8 inches thick. The subsurface layer is about 29 inches thick. It is brown and yellowish brown loamy fine sand in the upper part and yellowish brown loamy sand in the lower part. The subsoil is about 13 inches thick. It is dark brown, firm sandy clay loam in the upper part and dark brown, friable gravelly fine sandy loam in the lower part. The substratum to a depth of 60 inches is brown gravelly coarse sand. In some areas the subsoil has textural bands. In other areas the surface layer has more sand. In places the subsoil has less clay. In a few areas the soil has more sand and less clay throughout. In some areas the surface layer is dark. In a few areas the substratum is stratified. In some places the lower part of the subsoil and the substratum have no gravel. In other places the slope is more than 6 or less than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Houghton soils in depressions and the well drained Martinsville soils in the slightly lower positions on the landscape. Martinsville soils are more clayey than the Ormas soil. Also included are a few severely eroded areas where the subsoil is exposed. Included soils make up about 3 percent of the map unit.

The available water capacity in the Ormas soil is low. Permeability is rapid and moderately rapid in the solum and very rapid in the substratum. Runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used as woodland or pasture.

This soil is fairly well suited to corn, soybeans, and small grain. Droughtiness and wind erosion are the main management concerns. Cover crops, green manure crops, and crop residue management conserve moisture and increase the organic matter content. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by critical area planting, cover crops, green manure crops, irrigation systems, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to a no-till cropping system. Irrigation can reduce seasonal moisture stress and can increase productivity.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. Irrigation minimizes droughtiness and helps to control wind erosion. A dense plant cover helps to control wind erosion, slows runoff, and conserves soil moisture. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of frost action, this soil is moderately limited as a site for local roads and streets. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. This hazard can be reduced by mounding with better suited material.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

OtB—Ormas Variant loamy sand, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges and knolls on outwash plains. Areas are irregularly shaped and are 3 to 40 acres in size. The dominant size is about 10 acres.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is dark brown, loose sand about 16 inches thick. The subsoil is dark brown, very friable loamy coarse sand about 9 inches thick. The upper part of the substratum is dark yellowish brown coarse sand. The next part is yellowish brown gravelly coarse sand. The lower part to a depth of 60 inches is dark yellowish brown coarse sand. In some places the surface layer is more acid. In other places the lower part of the solum has textural bands. In some areas the subsoil has more clay. In a few areas the dark surface layer is thicker. In some places the soil has more sand. In other places the substratum has no gravel. In some areas the slope is more than 6 or less than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained soils in depressions and the well drained Martinsville soils in the slightly lower positions on the landscape. Martinsville soils are more clayey than the Ormas Variant soil. Also included are a few severely eroded areas where the subsoil is exposed. Included soils make up about 9 percent of the map unit.

The available water capacity in the Ormas Variant soil is very low. Permeability is rapid. Runoff is slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used as woodland or pasture.

This soil is poorly suited to cultivated crops, such as corn, soybeans, and small grain. Droughtiness and wind erosion are the main management concerns. Cover crops, green manure crops, and crop residue management conserve moisture and improve or help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by critical area planting, cover crops, green manure crops, irrigation systems, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to a no-till cropping system. Irrigation can reduce seasonal moisture stress and can increase productivity.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. Irrigation minimizes droughtiness and wind erosion. A dense plant cover helps to control wind erosion, slows runoff, and conserves soil moisture. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings and for local roads and streets. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. This hazard can be reduced by mounding with better suited material.

The land capability classification is IVs. The woodland ordination symbol is 4S.

Pa—Papineau sandy loam. This deep, nearly level, somewhat poorly drained soil is on slightly convex rises on outwash plains. Areas are irregularly shaped and are 10 to 200 acres in size. The dominant size is about 80 acres.

Typically, the surface layer is very dark gray sandy loam about 10 inches thick. The subsurface layer is about 4 inches of very dark gray sandy clay loam. The subsoil is about 18 inches thick. It is grayish brown, mottled, and firm. The upper part is sandy clay loam, and the lower part is silty clay. The substratum to a depth of 60 inches is gray silty clay. In some areas the lower part of the solum and the substratum have less clay. In a few areas the upper part of the solum has more clay. In a few places the subsoil is dominantly brown. In some areas the substratum is stratified.

Included with this soil in mapping are small areas of the very poorly drained Iroquois and Montgomery soils in the lower positions on the landscape. Also included are the moderately well drained Simonin soils in the higher positions. Included soils make up about 6 percent of the map unit.

The available water capacity in the Papineau soil is moderate. Permeability is moderate in the upper part of the solum and slow in the lower part and in the substratum. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 1 to 3 feet in late winter and in spring.

Most areas of this soil are drained and are used for cultivated crops. A few are used for woodland, hay, or pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main management concern. A drainage system lowers the water table in the spring and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Measures that control wind erosion are needed. Examples are a crop rotation that includes grasses and legumes, cover crops, green manure crops, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to fall-chisel and till-plant cropping systems. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as bromegrass, ladino clover, and birdsfoot trefoil, for hay and pasture. The wetness is the main management concern. It can be reduced by surface and subsurface drains. The grasses and legumes that can withstand the high water table should be selected for planting. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the wetness and the shrink-swell potential, this soil is limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. Using adequately reinforced steel in concrete foundations, excavating layers that have a moderate shrink-swell potential and backfilling with sand or gravel, building the structures on reinforced concrete slabs, and installing expansion joints help to prevent the damage caused by shrinking and swelling. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is severely limited as a site for local roads and streets because of frost action and the shrink-swell potential. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action. Providing coarse grained subgrade or base material minimizes the damage caused by shrinking and swelling and by frost action.

Because of the wetness and the very slow permeability, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field helps to lower the water table. Mounding with better suited material and enlarging the absorption field help to compensate for the restricted permeability.

The land capability classification is IIw. No woodland ordination symbol is assigned.

PaB—Parr fine sandy loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges and knolls on recessional moraines. Areas are irregularly shaped and are 5 to 200 acres in size. The dominant size is about 70 acres.

Typically, the surface layer is very dark gray fine sandy loam about 10 inches thick. The subsoil is about 20 inches thick. It is brown, firm fine sandy loam in the upper part and dark yellowish brown and yellowish brown, firm clay loam in the lower part. The substratum to a depth of 60 inches is brown loam. In some places the upper part of the solum contains more sand. In other places the lower part of the subsoil has gray mottles. In some areas the surface layer is thinner or lighter colored. In other areas the subsoil and substratum are stratified. In a few places the solum is more than 35 inches thick. In some areas the slope is more than 6 or less than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Brookston soils in the lower positions on the landscape. Also included are a few severely eroded areas where the subsoil is exposed and some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 5 percent of the map unit.

The available water capacity in the Parr soil is moderate. Permeability also is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for woodland, hay, or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion by water and wind is the main management concern. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by terraces, divisions, water- and sediment-control basins, cover crops, green manure crops, grassed waterways, grade stabilization structures, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping systems. Crop residue management, cover crops, and green manure crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. In areas where hillside seepage occurs, subsurface drains should be installed.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to alfalfa and other deep-rooted species. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover slows runoff and helps to control erosion.

This soil is suitable as a site for dwellings. The shrink-swell potential is a limitation on sites for dwellings without basements. Using adequately reinforced steel in concrete foundations, excavating layers that have a moderate shrink-swell potential and backfilling with sand or gravel, building structures on reinforced concrete slabs, and installing expansion joints help to prevent the damage caused by shrinking and swelling. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of the shrink-swell potential, low strength, and frost action, this soil is moderately limited as a site for local roads and streets. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by shrinking and swelling and by frost action. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of the moderate permeability, this soil is moderately limited as a site for septic tank absorption fields. Mounding with better suited material and enlarging the absorption field help to compensate for the restricted permeability.

The land capability classification is IIe. No woodland ordination symbol is assigned.

PdB—Parr-Ayr complex, 2 to 6 percent slopes. These deep, gently sloping, well drained soils are on ridges and knolls on recessional moraines. The Parr soil is on the lower slopes and in depressions. The Ayr soil is on the higher ridges and on knobs. Areas are about 60 percent Parr soil and 30 percent Ayr soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. The areas of the unit are irregularly shaped and are 5 to 200 acres in size. The dominant size is about 70 acres.

Typically, the surface layer of the Parr soil is very dark gray fine sandy loam about 10 inches thick. The subsoil is about 21 inches thick. The upper part is brown, firm fine sandy loam; the next part is dark yellowish brown, firm clay loam; and the lower part is yellowish brown, firm sandy clay loam. The substratum to a depth of 60 inches is brown loam. In some areas the lower part of the subsoil has gray mottles. In some places the surface layer is thinner or lighter colored. In other places the subsoil and substratum are stratified.

Typically, the surface layer of the Ayr soil is very dark grayish brown loamy sand about 10 inches thick. The subsurface layer is about 4 inches of dark brown loamy fine sand. The subsoil is about 24 inches thick. It is dark brown and yellowish brown, friable loamy sand in the upper part and yellowish brown, friable sandy clay loam in the lower part. The substratum to a depth of 60 inches is yellowish brown loam. In some places the sandy material is less than 20 or more than 35 inches thick. In other places the surface layer is thinner or lighter colored. In a few places the surface layer contains more clay. In some areas the lower part of the subsoil has gray mottles. In a few areas the substratum is stratified. In places the slope is less than 2 or more than 6 percent.

Included with these soils in mapping are small areas of the very poorly drained Brookston soils in the lower positions on the landscape. Also included are a few severely eroded areas where the subsoil is exposed and some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 10 percent of the map unit.

The available water capacity in the Parr and Ayr soils is moderate. Permeability is moderate in the Parr soil. It is rapid in the upper part of the solum in the Ayr soil and moderate in the lower part and in the substratum. Runoff is medium on the Parr soil and slow on the Ayr soil. The organic matter content is moderate in the surface layer of both soils. This layer is friable or very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of these soils are used for cultivated crops. A few are used for woodland, hay, or pasture.

These soils are well suited to corn, soybeans, and small grain. Erosion by wind and water is the main management concern. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by terraces, diversions, water- and sediment-control basins, cover crops, green manure crops, grassed waterways, grade stabilization structures, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soils are well suited to till-plant and no-till cropping systems. In areas where hillside seepage occurs, subsurface drains should be installed. To prevent drainage tile in the Ayr soil from filling with sediment, a finely meshed filter should be used to cover the tile.

Droughtiness is a concern in managing cultivated areas of the Ayr soil. Cover crops, green manure crops, and crop residue management conserve moisture and help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. Irrigation systems can reduce seasonal moisture stress and can increase productivity.

These soils are well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. They are best suited to alfalfa and other deep-rooted legumes. Erosion by water and wind is the main management concern. A dense plant cover slows runoff, conserves moisture, and helps to control erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

These soils are suitable as sites for dwellings. The shrink-swell potential of the Parr soil is a limitation on sites for dwellings without basements. Using adequately reinforced steel in concrete foundations, excavating layers that have a moderate shrink-swell potential and backfilling with sand or gravel, building structures on reinforced concrete slabs, and installing expansion joints help to prevent the damage caused by shrinking and swelling. The sides of shallow excavations in the Ayr soil can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of the shrink-swell potential, low strength, and frost action, these soils are moderately limited as sites for local roads and streets. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by shrinking and swelling and by frost action.

Because of the moderate permeability, the Parr soil is moderately limited as a site for septic tank absorption fields. The Ayr soil is severely limited because of a poor filtering capacity, which can result in the pollution of shallow ground water. Mounding with better suited material helps to compensate for the restricted permeability in the Parr soil and increases the filtering capacity of the absorption fields in areas of the Ayr soil. Installing deep wells upslope from the absorption fields reduces the potential for contamination of ground water.

The land capability classification is IIe. No woodland ordination symbol is assigned.

Pf—Pits, quarries. This map unit consists of areas from which limestone bedrock or sand and gravel have been removed (fig. 6). The sand and gravel are excavated from ridges and knolls or are quarried through a slurry system and then screened (fig. 7). They are used primarily as fill material or as a subbase for roads. Limestone from the quarries is crushed and used as road-building material or as agricultural limestone. The pits are approximately 85 feet deep, have nearly vertical walls, and range from 5 to 40 acres in size.

This map unit supports very little vegetation. It is severely limited as a site for all engineering uses. If well managed, abandoned pits could be developed for some recreational uses or for wildlife habitat.

No land capability classification or woodland ordination symbol is assigned.

Figure 6.—Exposed limestone in an active quarry.

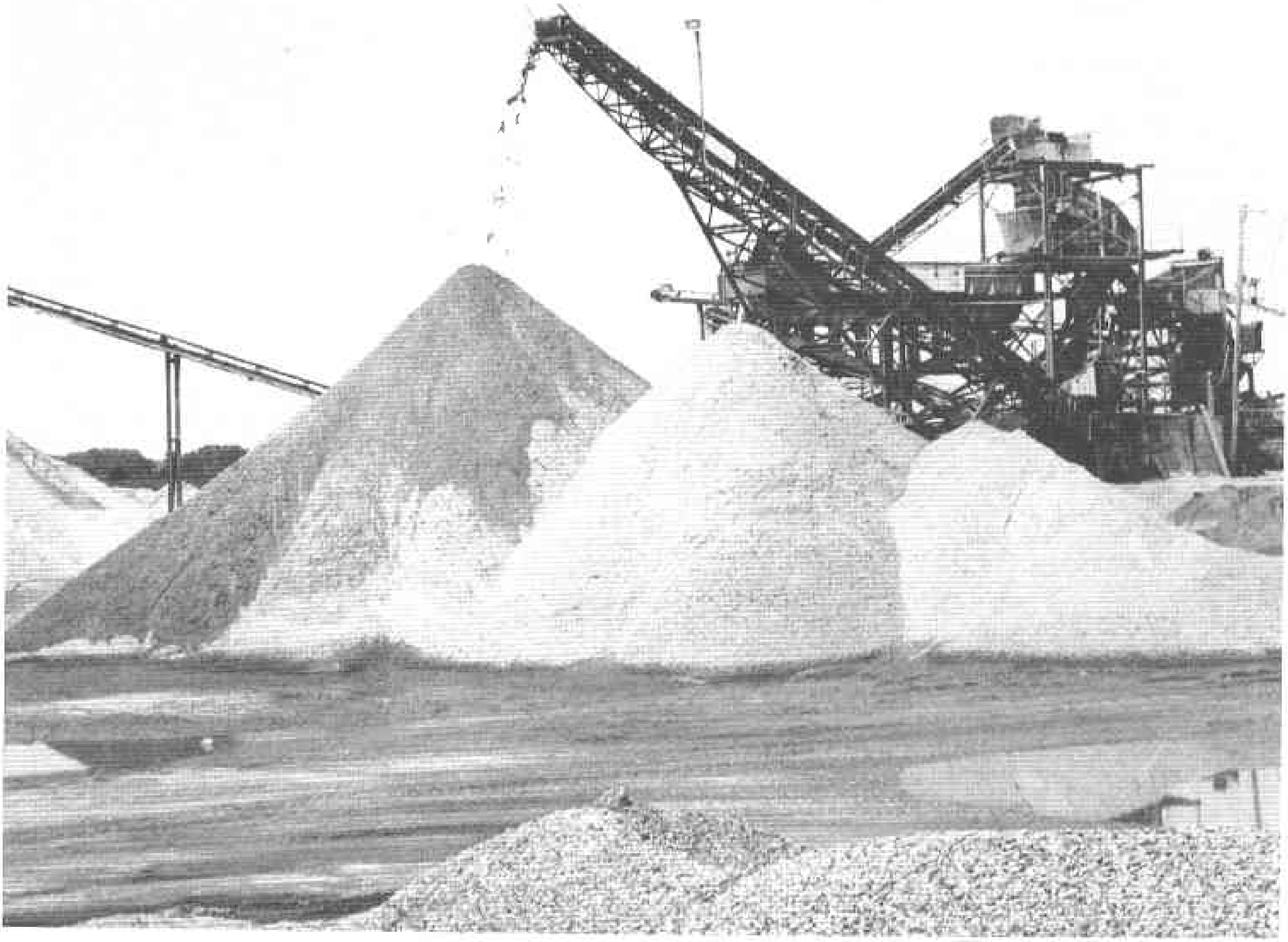

Figure 7.—An area of Pits, quarries, where sand and gravel are excavated through a slurry system.

Px—Prochaska loamy sand, frequently flooded. This deep, nearly level, very poorly drained soil is in broad depressions on the second bottoms of flood plains. It is frequently flooded for long periods during late fall, winter, and spring. Areas are broad and irregular in shape and are 20 to 600 acres in size. The dominant size is about 100 acres.

Typically, the surface soil is very dark gray loamy sand about 14 inches thick. The subsoil is dark grayish brown, dark gray, and gray, mottled, very friable loamy sand about 22 inches thick. The substratum to a depth of 60 inches is light brownish gray sand. In some places the subsoil has more clay. In other places the solum irregularly decreases in content of organic matter with increasing depth. In a few places small accumulations and concretions of iron tend to mask the grayish colors in the surface layer and in the upper part of the subsoil. In some areas the surface layer is mucky loamy sand. In other areas the subsoil has a layer of loam or clay loam. In places the lower part of the subsoil and the substratum are fine sand.

The available water capacity is low. Permeability is rapid. Runoff is very slow. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content. The water table is at or near the surface from fall through spring.

Most areas of this soil are drained and are used for cultivated crops. A few are used for specialty crops, woodland, or pasture.

If drained and protected from flooding, this soil is fairly well suited to corn and soybeans. It is poorly suited to specialty crops. Small grain that is planted in the fall is subject to severe damage during prolonged periods of flooding. Planting short-season varieties of adapted crops in late spring reduces the extent of this damage. Some areas can be protected by dikes and levees. The water table can be controlled by open ditches, surface drains, and subsurface drains. Pumps can be used in areas where suitable drainage outlets are not available. To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Drained areas are frequently droughty during the summer. Controlled drainage and subsurface irrigation minimize the effects of droughtiness.

Measures that help to control wind erosion are needed in cultivated areas. Examples are crop rotations that include grasses and legumes, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to a no-till cropping system. Cover crops, green manure crops, and crop residue management help to maintain the organic matter content.

If drained, this soil is well suited to grasses and legumes for hay and pasture. The wetness and the flooding are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand both the seasonal high water table and the summer droughtiness should be selected for planting. Irrigation helps to control wind erosion and helps to overcome the droughtiness. A dense plant cover helps to control wind erosion. Water-management practices, such as irrigation and drainage, are necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the flooding and the wetness. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by flooding and wetness.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

Rd—Reddick silty clay loam. This deep, nearly level, poorly drained soil is in broad depressions and swales on ground moraines. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are elongated or irregularly shaped and are 40 to 2,500 acres in size. The dominant size is about 1,000 acres.

Typically, the surface layer is black silty clay loam about 11 inches thick. The subsurface layer is about 6 inches of very dark gray clay loam. The subsoil is about 33 inches of dark gray, olive gray, and gray, mottled, firm clay loam and silty clay loam. The substratum to a depth of 60 inches is gray, mottled silty clay loam. In some places the subsoil contains less clay. In other places the content of clay is higher in the subsoil, the substratum, or both. In some areas the lower part of the subsoil and the upper part of the substratum are stratified. In a few areas the subsoil has a dominantly brown layer in the upper part.

Included with this soil in mapping are small areas of the somewhat poorly drained Andres soils in the slightly higher positions on the landscape and the moderately well drained Corwin soils in the higher positions. Also included are some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 9 percent of the map unit.

The available water capacity in the Reddick soil is high. Permeability is moderate in the solum and slow or very slow in the substratum. Runoff is very slow or ponded. The water table is near or above the surface in spring. The organic matter content is high in the surface layer. This layer is firm. If the soil is tilled when wet, large clods form. The clods become hard as they dry. They make seedbed preparation difficult.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness and ponding are the main management concerns. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soil is well suited to fall plowing, to fall chiseling, and to a ridge-plant cropping system in which the ridges follow the direction of natural drainage.

If drained, this soil is well suited to grasses and legumes for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is needed. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Re—Rensselaer loam. This deep, nearly level, very poorly drained soil is in broad depressions on outwash plains. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are irregularly shaped and are 10 to 360 acres in size. The dominant size is about 60 acres.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsurface layer is about 5 inches of very dark gray, mottled loam. The subsoil is about 27 inches thick. It is mottled and firm. The upper part is dark gray, grayish brown, and gray loam, and the lower part is gray silt loam. The substratum to a depth of 60 inches is gray, mottled silt loam that has thin strata of fine sand and very fine sand. In some areas bedrock is within a depth of 60 inches. In a few places the substratum is loam, silt loam, or silty clay loam till. In a few areas the subsoil and substratum have more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Darroch soils in the slightly higher positions on the landscape. These soils make up about 6 percent of the map unit.

The available water capacity in the Rensselaer soil is high. Permeability is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness and ponding are the main management concerns. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soil is well suited to fall plowing and fall chiseling, to a till-plant cropping system, and to a ridge-plant cropping system in which the ridges follow the direction of natural drainage.

If drained, this soil is well suited to grasses and legumes for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, low strength, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Rs—Rensselaer fine sandy loam, till substratum. This deep, nearly level, very poorly drained soil is in elongated depressions and drainageways on recessional moraines. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are irregular in shape and are 10 to 1,000 acres in size. The dominant size is about 100 acres.

Typically, the surface layer is black fine sandy loam about 9 inches thick. The subsurface layer is about 7 inches of very dark gray, mottled fine sandy loam. The subsoil is about 25 inches thick. The upper part is dark gray, mottled, friable loam; the next part is gray, mottled, friable sandy loam; and the lower part is light gray, mottled, firm loam. The upper part of the substratum is gray, mottled silt loam that has thin strata of loam, sandy loam, and sand. The lower part to a depth of 60 inches is gray, mottled loam till. In a few areas the surface layer contains more clay. In some areas the till is within a depth of 40 inches or below a depth of 60 inches. In other areas the substratum is not stratified and is loam, silt loam, or silty clay loam till. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Aubbeenaubbee soils in the slightly higher positions on the landscape. Also included are a few areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 10 percent of the map unit.

The available water capacity in the Rensselaer soil is high. Permeability is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness and ponding are the main management concerns. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soil is well suited to fall plowing and fall chiseling, to a till-plant cropping system, and to a ridge-plant cropping system in which the ridges follow the direction of natural drainage.

If drained, this soil is well suited to grasses and legumes for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material also minimizes the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Rw—Rensselaer, till substratum-Wolcott complex. These deep, nearly level, very poorly drained soils are in broad depressions on ground moraines. They are frequently ponded for brief periods by runoff from the surrounding soils. Areas are about 70 percent Rensselaer soil and 20 percent Wolcott soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. The areas of the unit are irregularly shaped and are 10 to 3,000 acres in size. The dominant size is about 400 acres.

Typically, the surface layer of the Rensselaer soil is very dark gray loam about 13 inches thick. The subsoil is dark gray, mottled, firm clay loam about 15 inches thick. The upper part of the substratum is dark grayish brown loam that has strata of sandy loam, loamy sand, and sand. The lower part to a depth of 60 inches is gray loam till. In some areas the till is within a depth of 40 inches or below a depth of 60 inches. In other areas the substratum is not stratified and is loam, silt loam, or silty clay loam till. In some places the subsoil has less clay. In other places limestone bedrock is within a depth of 60 inches. In some areas the surface layer has more sand. In a few areas the substratum is stratified throughout.

Typically, the surface layer of the Wolcott soil is black clay loam about 11 inches thick. The subsurface layer is about 6 inches of very dark gray clay loam. The subsoil is olive gray, mottled, friable loam about 16 inches thick. The substratum to a depth of 60 inches is light olive brown, mottled loam till. In some areas the subsoil has a dominantly brown layer. In a few places the content of clay is higher in the subsoil, the substratum, or both. In some areas limestone bedrock is within a depth of 60 inches. In a few areas the upper part of the substratum is stratified.

Included with these soils in mapping are small areas of the somewhat poorly drained Darroch and Odell soils in the slightly higher positions on the landscape. Also included are a few areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 10 percent of the map unit.

The available water capacity in the Rensselaer and Wolcott soils is high. Permeability is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas of these soils are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, these soils are well suited to corn, soybeans, and small grain. Wetness and ponding are the main management concerns. A drainage system lowers the water table and allows the soils to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep drainage tile in the Rensselaer soil from filling with sediment, a finely meshed filter should be used to cover the tile. Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soils are well suited to fall plowing and fall chiseling, to a till-plant cropping system, and to a ridge-plant cropping system in which the ridges follow the direction of natural drainage.

If drained, these soils are well suited to grasses and legumes for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soils are too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

These soils are well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, these soils are generally unsuitable as sites for dwellings and septic tank absorption fields. They are severely limited as sites for local roads because of the ponding, low strength, and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material minimizes the damage caused by low strength and frost action.

The land capability classification is IIw. The woodland ordination symbol assigned to the Rensselaer soil is 5W. No woodland ordination symbol is assigned to the Wolcott soil.

RxB—Rockton fine sandy loam, 1 to 3 percent slopes. This moderately deep, nearly level and gently sloping, well drained soil is on slightly convex rises on ground moraines and outwash plains. Areas are irregularly shaped and are 10 to 120 acres in size. The dominant size is about 30 acres.

Typically, the surface soil is very dark grayish brown fine sandy loam about 15 inches thick. The subsoil is about 21 inches thick. It is dark yellowish brown, firm loam in the upper part and brown, firm sandy clay loam in the lower part. Limestone bedrock is at a depth of about 36 inches. In some places it is below a depth of 40 inches or within a depth of 20 inches. In other places the lower part of the subsoil has gray mottles. In a few areas the solum has more sand. In some areas the slope is more than 3 or less than 1 percent.

Included with this soil in mapping are small areas of the very poorly drained Faxon soils in the lower positions on the landscape and a few small areas of the excessively drained Sparta soils in the slightly higher positions. Also included are some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 5 percent of the map unit.

The available water capacity in the Rockton soil is moderate. Permeability also is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain. Erosion by water and wind is the main management concern. The depth to bedrock limits the effectiveness of many conservation practices. Erosion and runoff can be controlled by a crop rotation that includes grasses and legumes and by terraces, diversions, cover crops, green manure crops, grassed waterways, grade stabilization structures, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping systems. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is the main management concern. The growth of deep-rooted legumes is restricted by the depth to bedrock. A dense plant cover slows the runoff and helps to control erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the depth to bedrock, this soil is moderately limited as a site for dwellings without basements and severely limited as a site for dwellings with basements. The bedrock hinders the construction of basements. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of the depth to bedrock and frost action, this soil is moderately limited as a site for local roads and streets. The depth to bedrock should be considered when the roads and streets are designed. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of the depth to bedrock, this soil is severely limited as a site for septic tank absorption fields. Mounding with suitable fill material increases the depth to bedrock.

The land capability classification is IIe. No woodland ordination symbol is assigned.

SmA—Simonin loamy sand, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is on slightly convex rises on outwash plains. Areas are elongated or irregular in shape and are 3 to 60 acres in size. The dominant size is about 15 acres.

Typically, the surface layer is very dark grayish brown loamy sand about 10 inches thick. The subsurface layer is about 4 inches of dark brown loamy sand. The subsoil is about 26 inches thick. The upper part is dark brown, friable sand; the next part is yellowish brown, mottled, friable fine sandy loam; and the lower part is olive brown, mottled, firm silty clay. The substratum to a depth of 60 inches is dark grayish brown clay. In some areas it has less clay and more sand. In other areas the surface layer is lighter colored or is less than 10 inches thick. In a few places the lower part of the subsoil and the substratum are stratified. In some places the sandy material is less than 25 or more than 28 inches thick. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Iroquois and Montgomery soils in the lower positions on the landscape. Also included are the somewhat poorly drained Papineau and Strole soils in the slightly lower positions. Included soils make up about 10 percent of the map unit.

The available water capacity in the Simonin soil is low. Permeability is rapid in the upper sandy layers and slow in the lower part of the subsoil and in the substratum. Runoff is very slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 2.5 to 4.0 feet from fall to spring.

Most areas are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain. Droughtiness and wind erosion are the main management concerns. Cover crops, green manure crops, and crop residue management conserve moisture and increase the organic matter content. Irrigation can reduce seasonal moisture stress and can increase productivity. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by critical area planting, cover crops, green manure crops, irrigation systems, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to till-plant and no-till cropping systems. Subsurface drains should be installed in areas where hillside seepage occurs. To keep the subsurface drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. A dense plant cover conserves soil moisture and helps to control wind erosion. Irrigation helps to overcome the droughtiness and helps to control wind erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is suitable as a site for dwellings without basements. Because of the shrink-swell potential, it is severely limited as a site for dwellings with basements. Using adequately reinforced steel in concrete foundations, excavating layers that have a high shrink-swell potential and backfilling with sand or gravel, building the structures on reinforced concrete slabs, and installing expansion joints help to prevent the damage caused by shrinking and swelling. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of frost action, this soil is moderately limited as a site for local roads and streets. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of the wetness, the slow permeability in the substratum, and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field lowers the water table. Mounding with better suited material increases the depth to the water table and the capacity of the field to absorb and filter the effluent.

The land capability classification is IIs. No woodland ordination symbol is assigned.

So—Sloan silt loam, frequently flooded, undrained. This deep, nearly level, very poorly drained soil is on long, narrow flood plains. It is frequently flooded for long periods between late fall and spring. Areas extend for miles along the major ditches and streams. They are 20 to 800 acres in size. The dominant size is about 300 acres.

Typically, the surface layer is very dark gray silt loam about 6 inches thick. The subsurface layer is about 9 inches of very dark gray clay loam. The subsoil is dark gray and gray, mottled, firm clay loam about 25 inches thick. The substratum to a depth of 60 inches is gray fine sandy loam that has thin strata of silt loam, loam, sand, and loamy sand. In places the solum or substratum has less clay. In a few areas the content of organic carbon regularly decreases with increasing depth. In some areas the substratum is sand.

The available water capacity is high. Permeability is moderate. Runoff is very slow. The organic matter content is high in the surface layer. The water table is at or near the surface from late fall through spring.

Most areas of this soil are used as unimproved pasture or as woodland. The pastured areas support water-tolerant grasses. The wooded areas support water-tolerant trees, such as eastern cottonwood, pin oak, sycamore, and willow.

This soil is generally unsuited to cultivated crops. The frequent flooding and the wetness are the main management concerns. Also, the use of farm equipment is limited.

This soil is well suited to wetland wildlife habitat. It is frequently flooded by backwater from the adjacent streams and drainageways. It supports aquatic and semiaquatic vegetation, such as cattails, rushes, sedges, waterlilies, pondweed, duckweed, spatterdock cowlilies, and water-tolerant trees and shrubs. These plants provide cover, nesting sites, and food for many aquatic animals, including ducks, geese, and other birds. They also provide food and cover for deer, foxes, raccoons, and muskrats.

This soil is well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvesting methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the flooding and the wetness, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the flooding, the wetness, and low strength. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by flooding and wetness. Providing coarse grained subgrade or base material minimizes the damage caused by low strength.

The land capability classification is Vw. The woodland ordination symbol is 5W.

SpB—Sparta sand, 2 to 6 percent slopes. This deep, gently sloping, excessively drained soil is on ridges on recessional moraines and outwash plains (fig. 8). Areas are irregularly shaped and are 5 to 35 acres in size. The dominant size is about 15 acres.

Typically, the surface layer is very dark grayish brown sand about 10 inches thick. The subsurface layer is very dark grayish brown fine sand about 7 inches thick. The upper part of the subsoil is dark brown, yellowish brown, light yellowish brown, and brownish yellow, loose sand and fine sand. The lower part to a depth of 80 inches is pale brown, very friable loamy sand. In some areas the lower part of the profile contains more clay. In a few areas the surface layer is lighter colored. In some places the lower part of the subsoil has textural bands. In other places gray mottles are in the lower part of the profile. In a few places the soil has a substratum of loam or sandy loam till. In some areas the soil is more acid throughout. In other areas the slope is less than 2 or more than 6 percent.

The available water capacity is low. Permeability is rapid. Runoff is slow. The organic matter content is low in the surface layer. This layer is loose and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for hay and pasture.

Figure 8.—An area of Sparta sand, 2 to 6 percent slopes, on a ridge inhabited by a colony of bank swallows.

Unless the hazards of drought and wind erosion are reduced, this soil is poorly suited to cultivated crops and specialty crops. It is fairly well suited to cultivated crops, such as corn, soybeans, and small grain, and to specialty crops, such as Christmas trees, if it is irrigated and is protected by a system of conservation tillage that leaves crop residue on the surface. The soil is well suited to a no-till cropping system. Cover crops, green manure crops, and crop residue management conserve moisture and increase the organic matter content. Irrigation systems reduce seasonal moisture stress and increase productivity. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by green manure crops, irrigation systems, and conservation tillage.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Wind erosion and droughtiness are the main management concerns. A dense plant cover helps to control wind erosion, slows runoff, and conserves soil moisture. Irrigation helps to overcome droughtiness and helps to control wind erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings and for local roads and streets. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of shallow ground water. Mounding with better suited material increases the filtering capacity of the absorption field.

The land capability classification is IVs. The woodland ordination symbol is 4S.

SsB—Sparta loamy sand, loamy substratum, 1 to 3 percent slopes. This deep, nearly level and gently sloping, well drained soil is on slightly convex rises and ridges on recessional moraines and outwash plains. Areas are irregularly shaped and are 5 to 70 acres in size. The dominant size is about 25 acres.

Typically, the surface layer is very dark gray loamy sand about 10 inches thick. The subsurface layer is about 4 inches of very dark grayish brown loamy sand. The subsoil is about 41 inches thick. It is dark brown, very friable loamy sand in the upper part; yellowish brown, loose fine sand in the next part; and dark brown, friable fine sandy loam in the lower part. The substratum to a depth of 60 inches is brown gravelly fine sandy loam. In some areas the loamy material is within a depth of 40 inches. In other areas the surface layer has a higher content of fine sand. In some places the lower part of the subsoil and the substratum have less clay or have gray mottles. In other places the subsoil and substratum have more clay. In a few areas the soil has more sand throughout. In some areas the substratum is sand and gravel. In other areas the surface layer is lighter colored. In some places limestone bedrock is within a depth of 60 inches. In other places the slope is more than 3 or less than 1 percent.

Included with this soil in mapping are small areas of the moderately deep Rockton soils in the slightly lower positions on the landscape. These soils make up about 4 percent of the map unit.

The available water capacity in the Sparta soil is low. Permeability is rapid in the upper part of the solum and moderate in the lower part and in the substratum. Runoff is very slow. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. Because of droughtiness and the hazard of wind erosion, this soil is only fairly well suited to cultivated crops, such as corn, soybeans, and small grain, and to specialty crops. Cover crops, green manure crops, and crop residue management conserve moisture and increase the organic matter content. Irrigation systems reduce seasonal moisture stress and increase productivity. Wind erosion can be controlled by a crop rotation that includes grasses and legumes and by green manure crops, irrigation systems, and a conservation tillage system that leaves all or part of the crop residue on the surface. The soil is well suited to a no-till cropping system.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and is well suited to pasture. It is best suited to deep-rooted, drought-tolerant species. Droughtiness and wind erosion are the main management concerns. A dense plant cover helps to control wind erosion and conserves soil moisture. Irrigation helps to overcome the droughtiness and helps to control wind erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is poorly suited to trees. Seedling mortality and plant competition are the main management concerns. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings and for local roads and streets. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over areas where establishing vegetation may be difficult.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of shallow ground water. Mounding with better suited material increases the filtering capacity of the absorption field.

The land capability classification is IIIs. The woodland ordination symbol is 2S.

St—Strole clay loam. This deep, nearly level, somewhat poorly drained soil is on slightly convex rises on lake plains. Areas are irregularly shaped and are 5 to 200 acres in size. The dominant size is about 80 acres.

Typically, the surface soil is very dark gray clay loam about 13 inches thick. The subsoil is about 16 inches thick. It is mottled and firm. The upper part is olive brown and light olive brown clay, and the lower part is light olive brown silty clay. The substratum to a depth of 60 inches is olive gray, mottled clay. In places the upper part of the solum has less clay. In some areas the dark surface soil is thinner. In other areas the soil has a lighter colored surface soil. In a few places the surface soil contains more sand and silt. In some areas the subsoil is silty clay loam.

Included with this soil in mapping are small areas of the very poorly drained Iroquois and Montgomery soils in the lower positions on the landscape and the moderately well drained Lucas and Simonin soils in the higher positions. Included soils make up about 10 percent of the map unit.

The available water capacity in the Strole soil is moderate. Permeability is slow. Runoff also is slow. The organic matter content is moderate in the surface layer. This layer is firm. If the soil is tilled when wet, large clods form. The clods become hard as they dry. They make seedbed preparation difficult. The water table is at a depth of 1 to 2 feet during winter and spring.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main management concern. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soil is well suited to fall chiseling and to a ridge-plant cropping system.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and ladino clover, for hay and pasture. The wetness is the main management concern. It hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the wetness and the shrink-swell potential, this soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. Using adequately reinforced steel in concrete foundations, excavating layers that have a high shrink-swell potential and backfilling with sand or gravel, building the structures on reinforced concrete slabs, and installing expansion joints help to prevent the damage caused by shrinking and swelling. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of the shrink-swell potential, low strength, and frost action, this soil is severely limited as a site for local roads and streets. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action. Providing coarse grained subgrade or base material minimizes the damage caused by low strength, by shrinking and swelling, and by frost action.

Because of the wetness and the slow permeability, this soil is severely limited as a site for septic tank absorption fields. Installing interceptor drains around the absorption field lowers the water table. Mounding with better suited material and increasing the size of the absorption field help to compensate for the restricted permeability.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Sx—Suman loam, frequently flooded. This deep, nearly level, very poorly drained soil is in broad depressions on the first bottoms of flood plains. It is frequently flooded for long periods during late fall, winter, and spring. Areas are irregularly shaped and are 80 to 3,500 acres in size. The dominant size is about 2,500 acres.

Typically, the surface layer is black loam about 10 inches thick. The subsurface layer is about 6 inches of black, mottled clay loam. The subsoil is dark gray, mottled, firm clay loam about 12 inches thick. The substratum to a depth of 60 inches is grayish brown and pale brown, mottled sand. In some areas the solum contains more sand. In a few areas the soil contains more silt and clay throughout. In a few places the content of gravel is more than 15 percent in the subsoil and substratum. In some areas the substratum is more alkaline.

The available water is moderate. Permeability is moderately slow in the solum and rapid in the substratum. Runoff is very slow. The water table is at or near the surface from late fall through spring. Some areas are ponded for brief periods. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas of this soil are drained and are used for cultivated crops. A few are used as woodland or as wetland wildlife habitat.

If drained and protected from flooding, this soil is fairly well suited to corn and soybeans. Wetness and flooding are the main management concerns. Fall-planted small grain is subject to severe damage during prolonged periods of flooding. Planting short-season varieties of adapted crops in late spring minimizes this damage. Some areas can be protected by dikes and levees. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. To keep drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Because cutbanks are unstable, caution is needed if heavy equipment is operated near open ditches. Drained areas are frequently droughty during the summer. Controlled drainage and subsurface irrigation minimize the effects of droughtiness.

Measures that help to control wind erosion are needed in cultivated areas. Examples are crop rotations that include grasses and legumes, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. Cover crops, green manure crops, and crop residue management help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. The soil is well suited to a ridge-plant cropping system in which the ridges follow the direction of natural drainage or streamflow.

If drained, this soil is well suited to grasses and legumes for hay and pasture. The wetness and the flooding are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand both the seasonal high water table and the summer droughtiness should be selected for planting. Irrigation helps to control wind erosion and helps to overcome the droughtiness. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover helps to control wind erosion.

This soil is well suited to trees. The equipment limitation, seeding mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the flooding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the flooding, the wetness, and low strength. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by flooding and wetness. Providing coarse grained subgrade or base material minimizes the damage caused by low strength.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Wb—Warners fine sandy loam. This deep, nearly level, very poorly drained soil is in depressions on outwash plains. It is frequently ponded for long periods by runoff from the surrounding soils. Areas are elongated or irregular in shape and are 5 to 300 acres in size. The dominant size is about 20 acres.

Typically, the surface soil is very dark gray fine sandy loam about 14 inches thick. The substratum to a depth of 60 inches is yellowish brown, light yellowish brown, pale brown, light gray, and gray marl. In some areas the soil has an organic surface layer.

The available water capacity is high. Permeability is moderate in the solum. Runoff is very slow or ponded. The water table is near or above the surface from late fall through spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

If drained, this soil is fairly well suited to cultivated crops. Wetness and ponding are the main management concerns. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches and surface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains.

Measures that help to control wind erosion are needed in cultivated areas. Examples are crop rotations that include grasses and legumes, critical area planting, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to fall plowing, fall chiseling, and till-plant and ridge-plant cropping systems. Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes for hay and pasture. The ponding and the wetness are the main management concerns. The wetness hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover helps to control wind erosion.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by cutting, spraying, or girdling. Overstocking helps to compensate for seedling mortality, but thinning may be needed later. Planting containerized stock and applying harvest methods that leave some mature trees to provide shade and protection for seedlings reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material also minimizes the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

We—Watseka loamy fine sand. This deep, nearly level, somewhat poorly drained soil is on slightly convex rises on outwash plains. Areas are irregularly shaped and are 3 to 30 acres in size. The dominant size is about 10 acres.

Typically, the surface layer is very dark gray loamy fine sand about 10 inches thick. The subsoil is very friable fine sand about 20 inches thick. The upper part is grayish brown, and the lower part is pale brown and light brownish gray and is mottled. The substratum to a depth of 60 inches is grayish brown and gray, mottled fine sand. In some areas the surface layer is lighter colored. In a few places the soil is strongly acid or very strongly acid throughout. In some areas it does not have gray mottles in the upper part.

The available water capacity is low. Permeability is rapid. Runoff is very slow. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 1 to 3 feet in late winter and in spring.

Most areas of this soil are drained and are used for cultivated crops. A few are used for hay and pasture.

This soil is fairly well suited to cultivated crops and to specialty crops, such as asparagus and Christmas trees. Droughtiness and wind erosion are the main management concerns. Cover crops, green manure crops, and crop residue management conserve soil moisture and help to maintain the organic matter content. Measures that help to control wind erosion are needed. Examples are crop rotations that include grasses and legumes, critical area planting, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to a till-plant cropping system. Irrigation systems reduce moisture stress during the summer and increase productivity.

Controlling the water table with open ditches, subsurface drainage tile, water-retention structures, and subsurface irrigation minimizes the droughtiness.

Wetness in late fall and early spring is a concern in managing cultivated areas. It can be reduced by open ditches, surface drains, and subsurface drains. A drainage system lowers the water table in early spring and allows the soil to warm up earlier in the spring. To keep subsurface drainage tile from filling with sediment, a finely meshed filter should be used to cover the tile. Excessive drainage by a subsurface drainage system can cause droughtiness.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Wind erosion, droughtiness in summer, and wetness in late fall and early spring are the main management concerns. The grasses and legumes that can withstand both the high water table and the summer droughtiness should be selected for planting. Water-management practices, such as irrigation and drainage, are necessary. Irrigation helps to control wind erosion and helps to overcome the droughtiness. A dense plant cover conserves soil moisture and helps to control wind erosion. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

Because of the wetness, this soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations can cave in unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

This soil is moderately limited as a site for local roads and streets because of the wetness and frost action. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and wetness. Replacing or strengthening the upper layers of the soil with better suited base material improves the ability of the roads and streets to support vehicular traffic.

Because of the wetness and a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of shallow ground water. Interceptor drains around the absorption field lower the water table. Mounding with better suited material increases the filtering capacity of the absorption field and helps to overcome the wetness.

The land capability classification is IIIs. No woodland ordination symbol is assigned.

Wm—Watseka-Maumee loamy sands. These deep, nearly level soils are in broad depressions on outwash plains. The somewhat poorly drained Watseka soil is on the higher rises and knolls. The very poorly drained Maumee soil is in the lower areas. It is frequently ponded for brief periods by runoff from the surroundings soils. Areas are about 40 percent Watseka soil and 40 percent Maumee soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. The areas of the unit are irregularly shaped and are 15 to 500 acres in size. The dominant size is about 250 acres.

Typically, the surface layer of the Watseka soil is very dark gray loamy sand about 14 inches thick. The subsoil is grayish brown and dark grayish brown, loose sand about 25 inches thick. The substratum to a depth of 60 inches is light brownish gray sand. It is mottled in the lower part. In places the solum has more clay. In a few areas it is more acid. In some areas the lower part of the subsoil and the substratum have free carbonates. In other areas the upper part of the solum irregularly decreases in content of organic carbon with increasing depth. In some places the substratum is very fine sand. In other places accumulations and concretions of iron are in the upper part of the solum. In some areas the subsoil has a thin layer of loam or clay loam. In other areas the upper part of the subsoil is not grayish.

Typically, the surface layer of the Maumee soil is very dark gray loamy sand about 18 inches thick. The substratum to a depth of 60 inches is sand. It is dark gray in the upper part and light brownish gray and mottled in the lower part. In some places the soil is more acid. In other places the substratum has accumulations of iron. In some areas it has free carbonates. In a few areas the surface layer is thinner. In places the substratum irregularly decreases in content of organic matter with increasing depth. In a few areas it has a layer of loam or clay loam. In some areas the lower part of the substratum is fine sand.

Included with this soil in mapping are small areas of the moderately well drained Brems and somewhat poorly drained Morocco soils in the slightly higher positions on the landscape. These soils make up about 4 percent of the map unit.

The available water capacity in the Watseka and Maumee soils is low. Permeability is rapid. Runoff is very slow or ponded. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content. The water table in the Watseka soil is at a depth of 1 to 3 feet in late winter and in spring. The one in the Maumee soil is near or above the surface during winter and spring.

Most areas of these soils are drained and are used for cultivated crops. A few are used for specialty crops, woodland, hay, or pasture.

These soils are fairly well suited to corn, soybeans, and small grain and to specialty crops, such as potatoes, mint, and asparagus. Wetness, the hazard of wind erosion, and the low available water capacity are the main management concerns. Wind erosion can be controlled by crop rotations that include grasses and legumes and by critical area planting, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soils are well suited to a till-plant cropping system. Cover crops, green manure crops, and crop residue management conserve moisture and help to maintain the organic matter content. Irrigation can reduce seasonal moisture stress and can increase productivity. Droughtiness during the summer can be minimized by controlling the water table with open ditches, subsurface drains, water-retention structures, and subsurface irrigation.

A drainage system lowers the water table in early spring and allows the soils to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep the drains from filling with sediment, a finely meshed filter should be used to cover the tile lines.

If drained, these soils are well suited to grasses and legumes for hay and pasture. The low available water capacity, the wetness, and the hazard of wind erosion are the main management concerns. The grasses and legumes that can withstand both the seasonal high water table and the summer droughtiness should be selected for planting. Water-management practices, such as irrigation and drainage, are necessary. Irrigation helps to control wind erosion and helps to overcome the droughtiness. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition. A dense plant cover conserves soil moisture and helps to control wind erosion.

The Maumee soil is fairly well suited to trees. The main management concerns are the equipment limitation and the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Care should be taken to avoid damaging the surficial root system of the trees. Competing vegetation can be controlled by adequate site preparation and by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, the Maumee soil is generally unsuitable as a site for dwellings and septic tank absorption fields.

Because of the wetness, the Watseka soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations can cave in unless they are temporarily reinforced.

Because of the wetness and a poor filtering capacity, the Watseka soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of shallow ground water. Interceptor drains around the absorption field lower the water table. Mounding with better suited material increases the filtering capacity of the absorption field and helps to overcome the wetness.

The Watseka soil is moderately limited as a site for local roads because of the wetness and frost action, and the Maumee soil is severely limited because of the ponding. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action, wetness, and ponding. Replacing or strengthening the base with better suited material improves the ability of the roads to support vehicular traffic.

The land capability classification is IIIs. No woodland ordination symbol is assigned to the Watseka soil. The woodland ordination symbol assigned to the Maumee soil is 4W.

WsB2—Wawasee loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, well drained soil is on ridges and knolls on recessional moraines. Areas are irregularly shaped and are 5 to 50 acres in size. The dominant size is about 25 acres.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. It is mixed with dark yellowish brown material in the lower part. The subsoil is about 21 inches thick. The upper part is dark brown, friable loam mixed with dark yellowish brown material, and the lower part is dark yellowish brown, firm loam. The substratum to a depth of 60 inches is yellowish brown loam. In places the lower part of the solum and the substratum are stratified. In a few areas the upper part of the solum has more sand. In some areas the surface layer is thinner and darker. In a few places it is thicker and darker. In some places the subsoil is dominantly gray. In other places the substratum is within a depth of 28 inches. In some areas the slope is more than 6 or less than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Brookston soils in the lower positions on the landscape. Also included are a few severely eroded areas where the subsoil is exposed and some areas where stones as much as 1 foot in diameter are on the surface. Included soils make up about 4 percent of the map unit.

The available water capacity in the Wawasee soil is moderate. Permeability also is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled under proper moisture conditions.

Most areas of this soil are used for cultivated crops. A few are used for woodland, hay, or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion by water and wind is the main management concern. Erosion and runoff can be controlled by critical area planting, terraces, diversions, crop rotations that include grasses and legumes, water- and sediment-control basins, cover crops, green manure crops, grassed waterways, grade stabilization structures, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is suited to till-plant and no-till cropping systems. Crop residue management, cover crops, and green manure crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content. In areas where hillside seepage occurs, subsurface drains should be installed.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is the main management concern. A dense plant cover slows runoff and helps to control erosion. Overgrazing reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. It can be controlled by proper site preparation and by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

This soil is suitable as a site for dwellings. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of frost action, this soil is moderately limited as a site for local roads and streets. Crowning the roads and streets, constructing them on raised, well compacted fill material, providing adequate side ditches and culverts, and providing coarse grained subgrade or base material minimize the damage caused by frost action. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of the moderate permeability, this soil is moderately limited as a site for septic tank absorption fields. Mounding with better suited material and increasing the size of the absorption field help to compensate for the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 5A.

Wt—Whitaker fine sandy loam. This deep, nearly level, somewhat poorly drained soil is on slightly convex rises on outwash plains and recessional moraines. Areas are irregularly shaped and are 3 to 50 acres in size. The dominant size is about 20 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer is about 6 inches of pale brown loam. The subsoil is about 19 inches thick. It is mottled and firm. The upper part is grayish brown clay loam, and the lower part is grayish brown and light brownish gray sandy clay loam. The substratum to a depth of 60 inches is light brownish gray, mottled loam that has thin strata of very fine sand and sand. In some places the lower part of the solum, the substratum, or both are not stratified. In other places the surface layer is thicker and darker. In a few areas the subsoil and substratum have more sand or gravel. In places the lower part of the subsoil and the substratum are more acid.

Included with this soil in mapping are small areas of the well drained Martinsville soils in the higher positions on the landscape. These soils make up about 6 percent of the map unit.

The available water capacity in the Whitaker soil is high. Permeability is moderate. Runoff is slow. The organic matter content is low in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content. The water table is at a depth of 1 to 3 feet during winter and early spring.

Most areas of this soil are drained and are used for cultivated crops. A few are used for woodland, hay, or pasture.

If drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main management concern. A drainage system lowers the water table and allows the soil to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. To keep drains from filling with sediment, a finely meshed filter should be used to cover the drain lines.

Measures that help to control wind erosion are needed in cultivated areas. Examples are crop rotations that include grasses and legumes, critical area planting, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soil is well suited to fall chiseling and to a till-plant cropping system. Crop residue management, green manure crops, and cover crops help to maintain tilth, the rate of water infiltration, aeration, and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as bromegrass, ladino clover, and birdsfoot trefoil, for hay and pasture. The wetness is the main management concern. It hinders the growth of most legumes. The grasses and legumes that can withstand the high water table should be selected for planting. A drainage system is necessary. Overgrazing or grazing when the soil is too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. It can be controlled by proper site preparation and by spraying, cutting, or girdling. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the wetness, this soil is severely limited as a site for dwellings. Surface and subsurface drains are needed. Proper landscaping helps to control runoff. Building the houses on raised, well compacted fill material also helps to overcome the wetness. The sides of shallow excavations are unstable unless they are temporarily reinforced. Revegetating disturbed areas as soon as possible after construction helps to control erosion. Topsoil should be stockpiled and spread over critical areas where establishing vegetation may be difficult.

Because of frost action, this soil is severely limited as a site for local roads and streets. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Crowning the roads and streets, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action.

Because of the wetness, this soil is severely limited as a site for septic tank absorption fields. Mounding with suitable material and installing interceptor drains around the absorption field help to overcome this limitation.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Za—Zadog-Maumee loamy sands. These deep, nearly level, very poorly drained soils are in broad depressions on outwash plains. It is frequently ponded for brief periods by runoff from the surrounding soils. Areas are about 50 percent Zadog soil and 40 percent Maumee soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. The areas of the unit are broad and irregular in shape and are 20 to 300 acres in size. The dominant size is about 100 acres.

Typically, the surface layer of the Zadog soil is black loamy sand about 11 inches thick. The subsurface layer is about 6 inches of black fine sandy loam that has strong brown accumulations of iron. The subsoil is about 9 inches thick. The upper part is yellowish red, mottled, firm sandy clay loam in which the content of iron nodules is about 4 percent, and the lower part is grayish brown, mottled, firm sandy clay loam that has strong brown accumulations of iron. The substratum to a depth of 60 inches is pale brown, strong brown, and yellowish brown, mottled sand. In some places the solum is more acid. In other places it irregularly decreases in content of organic matter with increasing depth. In a few areas the subsoil has a layer of loam or clay loam. In some areas the surface layer is mucky loamy sand. In a few places the lower part of the subsoil and the substratum are fine sand.

Typically, the surface layer of the Maumee soil is very dark gray loamy sand about 11 inches thick. The subsurface layer is about 4 inches of very dark gray, mottled loamy sand. The upper part of the substratum is grayish brown, mottled loamy sand. The lower part to a depth of 60 inches is light brownish gray sand. In some places the soil is more acid. In other places the substratum has accumulations of iron. In some areas it has free carbonates. In a few places the surface layer is thinner. In some areas the substratum irregularly decreases in content of organic matter with increasing depth. In a few areas it has a layer of loam or clay loam. In places the lower part of the subsoil and the substratum are fine sand.

Included with these soils in mapping are small areas of the moderately well drained Brems soils, the somewhat poorly drained Morocco and Watseka soils, and the moderately well drained and well drained Oakville soils. Brems and Oakville soils are in the highest positions on the landscape. Morocco and Watseka soils are in the slightly higher positions. Included soils make up about 10 percent of the map unit.

The available water capacity is moderate in the Zadog soil and low in the Maumee soil. Permeability is moderate in the upper part of the Zadog soil and rapid in the substratum. It is rapid in the Maumee soil. Runoff is very slow or ponded on both soils. The water table is near or above the surface during winter and spring. The organic matter content is moderate in the surface layer. This layer is friable or very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of these soils are drained and are used for cultivated crops. A few are used for specialty crops, woodland, or pasture.

If drained, these soils are fairly well suited to corn, soybeans, and small grain and to a wide variety of specialty crops. Wetness, ponding, and the limited available water capacity are the main management concerns. A drainage system lowers the water table and allows the soils to warm up earlier in the spring. Open ditches, surface drains, and subsurface drains can reduce the wetness. Pumps can be used in areas where suitable drainage outlets are not available. Ponded areas generally can be drained by an open inlet pipe in conjunction with subsurface drains. To keep drain lines from filling with sediment, a finely meshed filter should be used to cover the lines. Because cutbanks are unstable, caution is needed if heavy equipment is operated near open ditches. Excessive drainage can cause droughtiness. Irrigation can reduce moisture stress in summer and can increase productivity.

Measures that help to control wind erosion are needed in cultivated areas. Examples are crop rotations that include grasses and legumes, critical area planting, cover crops, green manure crops, irrigation systems, and conservation tillage systems that leave all or part of the crop residue on the surface. The soils are well suited to a till-plant cropping system. Crop residue management, green manure crops, and cover crops help to maintain the organic matter content.

These soils are well suited to grasses and legumes for hay and pasture. The ponding and the wetness are the main management concerns. The grasses and legumes that can withstand both the high water table and the summer droughtiness should be selected for planting. Water-management practices, such as irrigation and drainage, are necessary. Irrigation helps to control wind erosion and helps to overcome the droughtiness. A dense plant cover helps to control wind erosion. Overgrazing or grazing when the soils are too wet reduces plant density and hardiness and results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, restricted use during wet periods, and timely applications of plant nutrients help to keep the pasture in good condition.

These soils are fairly well suited to trees. The main management concerns are the equipment limitation, the windthrow hazard, and plant competition. Equipment should be used only during dry periods or when the ground is frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Plant competition can be controlled by proper site preparation and by spraying, cutting, or girdling. Care should be taken to avoid damaging the surficial root system of the trees. Additional management practices include harvesting mature trees, excluding livestock, and saving desirable seed trees.

Because of the ponding, these soils are generally unsuitable as sites for dwellings and septic tank absorption fields. They are severely limited as sites for local roads because of the ponding and frost action. Crowning the roads, constructing them on raised, well compacted fill material, and providing adequate side ditches and culverts minimize the damage caused by frost action and ponding. Providing coarse grained subgrade or base material also minimizes the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

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

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

About 209,000 acres in the survey area, or nearly 60 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the southern part, mainly in associations 6 through 13, which are described under the heading "General Soil Map Units." Nearly all of this prime farmland is used for corn or soybeans.

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

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

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

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

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

Crops and Pasture

James D. Storer, district conservationist, Soil Conservation Service, helped prepare this section.

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

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

A total of 267,639 acres in the county was used for crops and pasture in 1982 (*14*). Of this total, 253,540 acres was used for harvested crops, mostly corn, soybeans, and wheat; 5,702 acres was pastured; and the 8,397 acres was other cropland. The acreage available for crops and pasture has been gradually decreasing as more and more land is used for urban development. From 1967 to 1980, about 12,900 acres was converted to urban and built-up land (*9*). Most of this development took place in the late 1960's and early 1970's.

The potential of the soils in Jasper County for increased food production is low. Food production could be increased by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate in the application of such technology.

The major concerns in managing the soils in Jasper County for crops and pasture are controlling wind erosion and water erosion; controlling flooding, wetness, and ponding; reducing droughtiness; and maintaining or improving tilth and fertility (*6*). Most of the soils in the county are affected by more than one management concern. In the northern part of the county, for example, wind erosion and wetness are concerns in areas of Maumee, Morocco, and many other soils.

Erosion is a major management concern on about two-thirds of the acreage in the county. Areas that have a slope of more than 2 percent generally are susceptible to gully, rill, and sheet erosion. Water erosion results in the pollution of streams by sediment, plant nutrients, and farm chemicals. Because of this pollution, costly stream reclamation and water purification projects are needed. Controlling erosion minimizes the pollution of streams and improves the quality of water for municipal use, for recreation, and for fish and wildlife. Soils that have a sandy or organic surface layer are susceptible to wind erosion unless the surface is protected by crop residue or by plants. Many soils are susceptible to both wind erosion and water erosion.

No-till farming or another system of conservation tillage that leaves all or part of the crop residue on the surface helps to control erosion on cropland (fig. 9). Conservation tillage systems are being applied on an increasing acreage in Jasper County. They can be applied on most of the soils in the county. Terraces, diversions, contour farming, critical area planting, cover crops, green manure crops, and a cropping sequence that includes grasses and legumes also help to control erosion.

Water- and sediment-control basins help to control erosion in areas where surface water concentrates. They are very effective in reducing the susceptibility to rill and gully erosion. They are most effective on deep, well

Figure 9.—No-till corn in an area of Nesius fine sand, 1 to 3 percent slopes.

Figure 10.—Wind erosion in an unprotected area of Maumee, Morocco, and Watseka soils.

drained soils that are highly susceptible to erosion. Wawasee soils are an example. These basins reduce soil loss and the associated loss of fertilizer elements; help to prevent the damage to crops and watercourses caused by eroding sediment; help to eliminate the need for grassed waterways, which take productive land out of row crop production; and reduce the amount of pesticides entering watercourses. Soils that have bedrock within a depth of 40 inches, such as Faxon soils, are less well suited to these basins than other soils.

Wind erosion is a hazard on Morocco and other sandy soils and on Houghton and other organic soils (fig. 10). It occurs when the wind dislodges soil particles. The distance that the soil particles travel depends on the wind velocity and the size, density, and shape of the soil particles. Most of the windblown particles are 0.1 to 0.5 millimeter in size. Wind erosion removes silt, clay, and organic particles, leaving coarse sand and less fertile material. During late spring and early summer, wind erosion severely damages young plants and seedlings. Specialty crops are especially susceptible to this damage.

Maintaining a protective plant cover, leaving crop residue on the surface, or leaving the surface rough through proper tillage methods minimizes wind erosion. Cover crops and conservation tillage also help to control wind erosion.

Wetness is the major problem on about 78 percent of the cropland in the county. Most areas of the very poorly drained soils in depressions, such as Maumee, Rensselaer, and Zadog soils, are adequately drained. A few areas of these soils, however, cannot be drained economically because drainage outlets would have to be deepened and would have to be extended for great distances. Many of these depressional areas are ponded for brief periods in the spring. The ponding commonly retards crop growth or kills the crop. Unless drained, somewhat poorly drained soils are so wet that crops are damaged during most years. Examples are Andres, Aubbeenaubbee, Morocco, Strole, and Whitaker soils.

Although they are well drained, such soils as Parr and Wawasee tend to dry out slowly after rains. Small areas of wetter soils in swales, in depressions, and along drainageways are commonly included with these well drained soils in mapping. A drainage system is needed in these included areas.

Craigmile, Gilford, Morocco, Suman, and Zadog soils have textures of loamy sand and sand below a depth of about 30 inches. To keep drainage tile from filling with these sandy sediments, a finely meshed filter should be used to cover the tile. After the tile is installed in these soils, placing part of the surface layer or some organic material directly over the tile and its protective covering helps to keep sand from clogging the tile openings and the protective covering. Excessive drainage by subsurface drainage systems can cause droughtiness. Water-management practices, such as drainage, irrigation, or a combination of the two, are necessary.

Special drainage systems are needed to control the water table in organic soils, such as Adrian, Houghton, and Muskego soils (fig. 11). Keeping the water table at the level required by the crops during the growing season and raising it to the surface during the rest of the year minimize oxidation and subsidence of the organic material and reduce the susceptibility to wind erosion. Oxidation and subsidence occur when pore spaces are filled with air. Subsidence and the unstable soil material can cause tile to settle and move out of alignment. In some areas water inlets to the tile plug up quickly as a result of chemical and biological reactions within the soil. In organic soils continuous lines of tile seem to stay in place better than individual, small sections. Tile lines with large holes are less likely to plug up than those with small holes.

Some organic soils are affected by special drainage problems. For example, subsurface drainage is generally not feasible in Edwards soils, which formed in muck over marl. Muskego soils formed in muck over coprogenous earth. If the coprogenous earth dries out, it is extremely difficult to rewet. Also, if it is exposed and allowed to dry out, it becomes cloddy and a very poor growing medium for plants. Adrian soils, which formed in muck over sand, can be overdrained. Excessive drainage increases the amount of oxidation in the organic material.

Flooding is a major management concern along the Iroquois and Kankakee Rivers. Craigmile, Prochaska, Sloan, and Suman soils are frequently flooded for several days in early spring and late fall. Dikes and levees protect most areas adjacent to the Kankakee River. Fall-planted small grain is subject to severe damage during prolonged periods of flooding. Flood damage can be reduced by planting short-season varieties of adapted crops. Late planting minimizes the crop damage or loss caused by flooding in the spring.

Droughtiness is a problem on about 16 percent of the cropland in the county. Most of the droughty soils are in the northern half of the county. Soil moisture can be conserved by crop residue management, a system of conservation tillage that leaves a protective amount of crop residue on the surface, and cover crops or green manure crops. In areas of Craigmile, Morocco, Prochaska, and Watseka soils, a combination of drainage measures and irrigation is needed. One such combination consists of open ditches and water-control structures.

An irrigation system minimizes the effect of droughtiness and frost. It also reduces moisture stress during the summer and increases productivity. Irrigation is gaining widespread use on many of the droughty soils in the county. On soils having an available water capacity of 5 inches or less within a depth of 40 inches, irrigation can be expected to improve yields in at least 3 or 4 years out of every 5. The increase in yields on soils that have a dominant texture of sand, loamy sand, loam, sandy loam, or silt loam may be high. Yields may also be increased on some of the sandy loams, loams, clay loams, and sandy clay loams that are underlain by sand and gravel.

Tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular, are porous, and have a sufficient content of organic matter. In soils that have a surface layer of clay loam, silty clay loam, silty clay, or clay, tilth is improved by the freeze-thaw action in the soils during the winter. If the soil is worked at too high a moisture content, the weight of farm equipment can cause compaction and can destroy tilth.

Some of the soils used for crops in the county have a dark surface layer of loam or sandy loam that is moderate in content of organic matter. Generally, the structure of these soils is moderate or weak, and a crust forms on the surface during periods of heavy rainfall. The crust becomes hard and impervious to water when it dries. As a result, it reduces the rate of water infiltration and increases the runoff rate. Leaving crop residue on the surface and regularly adding manure and other organic material improve soil structure and minimize crusting.

The dark Brookston, Montgomery, and Rensselaer soils have a high content of clay. Tilth is a problem because these soils often stay wet until late spring. If

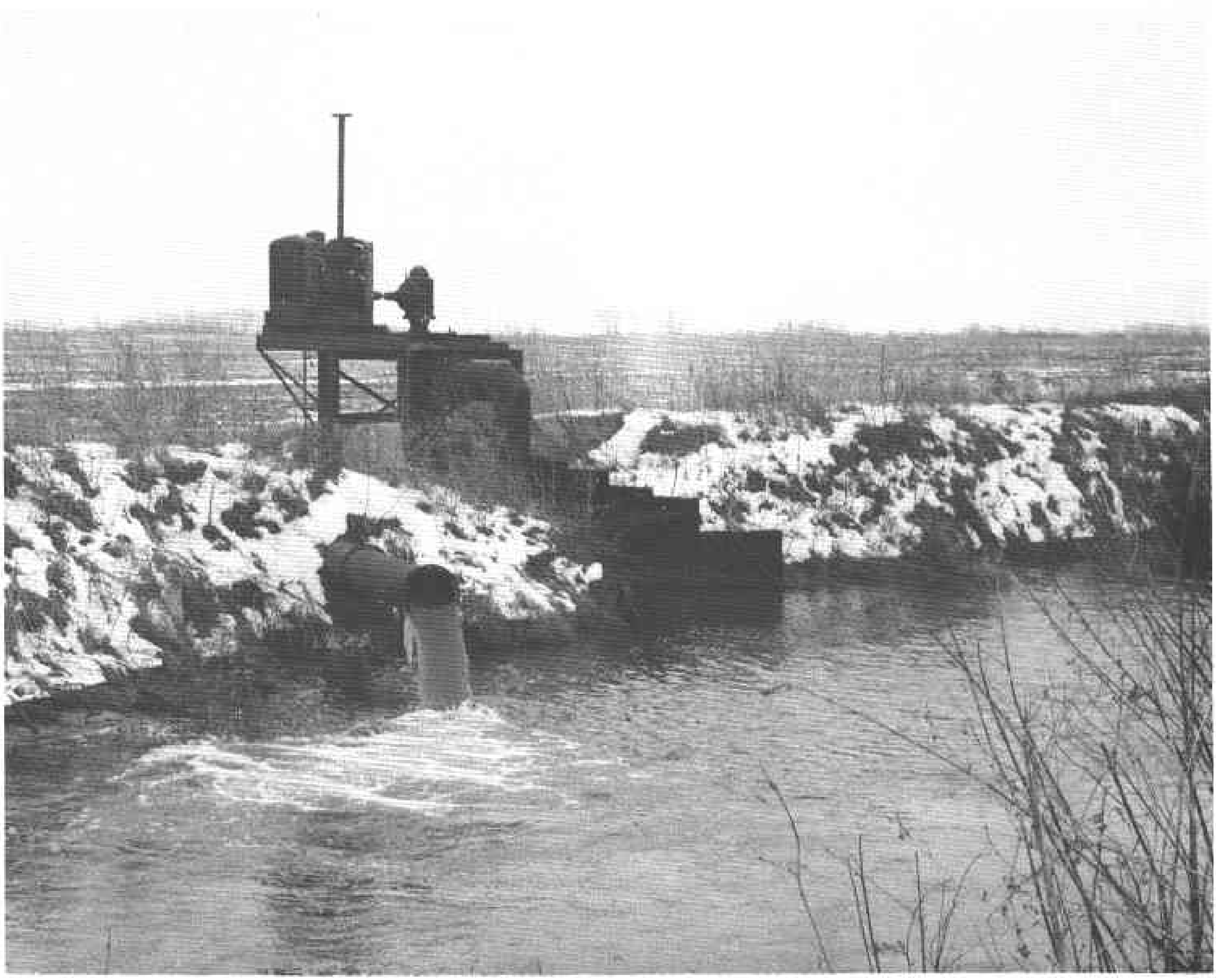

Figure 11.—A combination of an open ditch, a subsurface drain, and a pump in an area of Ackerman and Houghton mucks. The gate to the right of the pipe is opened when the area in the background is irrigated during the growing season.

plowed when wet, the soils tend to be very cloddy. As a result of the cloddiness, preparing a good seedbed is difficult.

Fertility can be improved or maintained by applications of lime and fertilizer. On all soils additions of lime and fertilizer should be based on the needs of the crop, on the expected level of yields, and on the results of soil tests. Soil testing should be done periodically because the available supply of any particular element can change. Tissue tests of plants at critical periods of development show the nutrient status of the crop and indicate which food elements should be replenished. Information about soil tests and plant tissue tests can be obtained at the local office of the Cooperative Extension Service.

Field crops that are of major significance in Jasper County are corn and soybeans. Seed corn and soybeans for seed are important crops in the southern part of the county. Wheat and oats are the chief close-growing crops, but they are of minor extent in the county. The field crops that are suited to the soils and climate of the county include many that are not now commonly grown. Buckwheat, rye, sorghum, and sunflowers could be grown. Brome, fescue, redtop, and bluegrass could be grown for hay or seed.

Permanent pasture is a minor land use in most of the county. A permanent cover of grasses and legumes slows runoff and helps to control both water erosion and wind erosion.

Many coarse textured soils, such as Nesius and Oakville, are fairly well suited to grasses and legumes for hay or pasture. Runoff and erosion by water and wind are the main hazards on these soils. Because of insufficient moisture, the soils become droughty during the summer. They are best suited to deep-rooted, drought-tolerant forage species. The best suited grasses are smooth bromegrass, red fescue, tall fescue, sudangrass, and switchgrass, and the least well suited are Kentucky bluegrass, field brome, ryegrass, and timothy. The best suited legumes are sweet clover, alfalfa, and lespedeza, and the least well suited are crimson clover, ladino clover, red clover, and white clover.

In areas of somewhat poorly drained to very poorly drained soils that have a low available water capacity, both drainage measures and irrigation systems are needed. Watseka soils are an example. The best suited grasses and legumes are those that can withstand both the high water table between late fall and early spring and the extremely droughty conditions during the summer. They include reed canarygrass, tall fescue, redtop, sudangrass, switchgrass, and birdsfoot trefoil.

Wetness is a limitation in areas of Rensselaer, Wolcott, and other somewhat poorly drained, poorly drained, or very poorly drained soils. A drainage system is needed. Water-tolerant grasses and legumes, which can withstand the high water table between late fall and early spring should be selected for planting. The best suited grasses are reed canarygrass and redtop, and the least well suited are Kentucky bluegrass, field brome, smooth bromegrass, red fescue, orchardgrass, ryegrass, sudangrass, switchgrass, and timothy. The best suited legumes are ladino clover, white clover, and birdsfoot trefoil, and the least well suited are alfalfa, crimson clover, red clover, and sweet clover.

In the moderately deep Faxon and Rockton soils, the depth to bedrock limits the rooting depth of some legumes. The best suited grasses are reed canarygrass and redtop, and the best suited legumes are ladino clover, white clover, and birdsfoot trefoil.

Erosion and runoff are problems on soils that are gently sloping and are moderately well drained or well drained, such as Corwin and Wawasee soils. These soils are suited to grasses and legumes. Generally, the grasses included in seeding mixtures are Kentucky bluegrass, field brome, smooth bromegrass, tall fescue, orchardgrass, and timothy, and the legumes included in these mixtures are alfalfa, red clover, ladino clover, alsike clover, and birdsfoot trefoil.

Specialty crops are of commercial importance in the county. They are grown throughout the county. They include Christmas trees, mint, and a variety of fruits and vegetables. Apples, blueberries, and watermelons are the main kinds of fruit. The most commonly grown vegetables include asparagus, cabbage (fig. 12), cauliflower, onions, potatoes, pumpkins, and turnip greens. The Christmas trees generally are grown on sandy, well drained soils on ridges. Most of the fruits, vegetables, and mint are grown on sandy and organic soils that have been drained. These soils are in the northern and southeastern parts of the county.

Yields Per Acre

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

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the

Figure 12.—Cabbage in an area of Watseka-Maumee loamy sands.

way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Michael D. Warner, forester, Soil Conservation Service, helped prepare this section.

In 1982, a total of 15,839 acres in Jasper County, or about 4.5 percent of the total acreage, was woodland. Most of this acreage is privately owned. Public ownership is primarily in the Jasper-Pulaski State Game Preserve.

Hardwood forests once covered many areas of the county. In recent years, however, many of the areas suitable for cultivation have been cleared. Most of the remaining woodland is in scattered areas throughout the northern half of the county and in areas of droughty sands. Bur oak, black oak, white oak, blackjack oak, sassafras, and a few scattered hickories commonly grow on the sandy soils on ridges. In many areas pin oak grows at the base of knolls. The wetter, lower lying areas support stands of pin, bur, blackjack, swamp white, black, white, and red oaks; hickory; white and black ash; American elm; silver maple; river birch; sandbar and black willow; cottonwood; quaking aspen; hackberry; and sycamore.

Many areas in the county have good potential for woodland. The droughty sands have excellent potential for Christmas trees (fig. 13). They are well suited to Scotch pine. Plant competition is minimal on these soils.

If managed properly, woodland can have commercial value as a source of timber or firewood, even on marginal land. Economic returns can be increased by improved management in most established woodlots. This management includes removal of mature trees and undesirable species; protection from grazing and fire; control of disease, insects, and plant competition; and timely use of heavy equipment. The Soil Conservation Service, the Indiana Department of Natural Resources, and the Cooperative Extension Service can help to determine specific management needs.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness

Figure 13.—Christmas trees on Brems loamy sand, 1 to 3 percent slopes, in the foreground and on Oakville fine sand, 2 to 6 percent slopes, in the background.

restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage (fig. 14). The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given

Figure 14.—A windthrown tree in an area of Morocco loamy sand.

species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Many soils in Jasper County are subject to wind erosion. This erosion occurs mainly on sandy and mucky soils. It reduces the productivity of these soils. The wind removes the finer soil particles more easily than the coarser, less fertile material. Specialty crops and emerging corn and soybean plants are often damaged by the windblown soil particles. Windbreaks can minimize this damage. They also can increase productivity by conserving moisture and nutrients, reducing the evaporation rate, and preventing the firing of crops by hot winds. Windbreaks and environmental plantings around homes and farmsteads conserve fuel and reduce the cost of home heating and cooling.

Windbreaks should be dense from the ground level to the treetops if they are to be effective. Generally, one to eight rows of trees and shrubs are planted, depending largely on the kind of protection needed and the space available for planting. The tree species commonly suitable for planting include red pine, white pine, Norway spruce, and American arborvitae. The suitable shrubs commonly include hazelnut, autumn-olive, multiflora rose, lilac, Tatarian honeysuckle, gray dogwood, redosier dogwood, and highbush cranberry.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Most of the recreational areas in Jasper County are owned by private individuals, cities, and towns. These areas provide opportunities for horseback riding, snowmobiling, hunting, fishing, camping, hiking, canoeing, bicycling, bird-watching, golfing, and many other activities.

The Jasper-Pulaski State Game Preserve is the only state-owned recreational area in the county. It provides opportunities for many outdoor activities. Sandhill cranes use the area for feeding and resting during their migrations. They attract a large number of bird-watchers each spring and fall. A state tree nursery is in this area.

Many areas of the county have good potential for recreational development. The Kankakee River and many of the wooded knolls can be developed for a variety of recreational uses. The Iroquois River and the wooded areas southeast of Rensselaer also provide many possibilities for recreational development.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

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

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

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

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

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

Wildlife Habitat

James D. McCall, biologist, Soil Conservation Service, helped prepare this section.

Boar, buffalo, deer, elk, and predators, such as cougar, wildcats, and wolves, once roamed the prairies of Jasper County. The species that no longer inhabit the county were not particularly adaptable to the changes that occurred after the county was settled. Wildlife management was not considered when these changes were made. A well planned, well managed system of agriculture can provide food and shelter for wildlife. Habitat can be improved by increasing and diversifying food supplies and by providing water, cover, and travel lanes.

A few farms in Jasper County provide both cover and food for wildlife. Many farms are used almost entirely for row crops. On these farms, food for wildlife is abundant but cover is scarce. Some areas used as pasture or woodland furnish ample cover but insufficient food. Cropland, pasture, and woodland can all provide food and cover. In areas of cropland, cover can be provided by fence rows, windbreaks, perennial field borders, grassed waterways, and vegetated ditchbanks. Borders along woodland and pasture can be planted to seed- and fruit-bearing species.

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

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

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

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

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

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

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

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds (fig. 15).

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

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

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

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

Edge habitat consists of areas where major land uses or cover types adjoin. A good example is the border between dense woodland and a field of no-till corn. Although not rated in the table, edge habitat is of primary importance to animals from the smallest songbirds to white-tailed deer. Most of the animals that inhabit openland or woodland also frequent edge habitat, and desirable edge areas are consistently used by 10 times as many wildlife as are the centers of large areas of woodland or cropland.

Engineering

Max L. Evans, state conservation engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or

Figure 15.—A pond in an area of Zadog-Maumee loamy sands. Canadian geese use the pond as a rest area during their fall migration.

for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

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

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

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

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

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

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil (fig. 16). How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks

Figure 16.—An area of Zadog-Maumee loamy sands drained by a subsurface drainage system and an open ditch.

are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 17). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

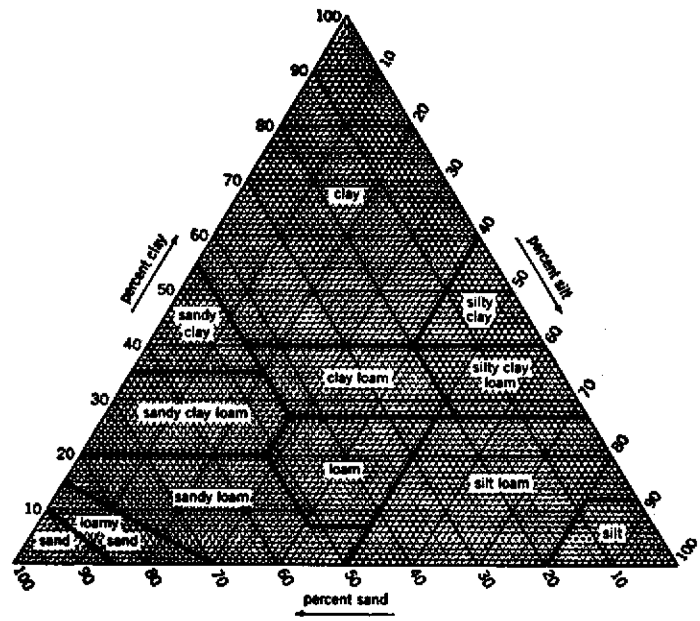

Figure 17.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18. An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*13*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquolls (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*12*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*13*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ackerman Series

The Ackerman series consists of deep, very poorly drained soils on outwash plains and moraines. These soils formed in organic deposits and in the underlying coprogenous earth and sand. Permeability is slow in the coprogenous earth and rapid in the underlying sand. Slopes are 0 to 1 percent.

Ackerman soils are similar to Adrian, Edwards, and Muskego soils and are adjacent to Adrian, Houghton, and Muskego soils. Adrian, Edwards, and Houghton soils do not have layers of coprogenous earth. They are in positions on the landscape similar to those of the

Ackerman soils. Muskego soils have coprogenous earth below a depth of 16 inches and do not have sandy material within a depth of 51 inches.

Typical pedon of Ackerman muck, drained, in a cultivated field; 1,100 feet west and 1,800 feet south of the northeast corner of sec. 30, T. 28 N., R. 5 W.

Op—0 to 10 inches; sapric material, black (10YR 2/1) broken face and rubbed, very dark gray (10YR 3/1) dry; about 2 percent fiber, less than 1 percent rubbed; weak fine subangular blocky structure; very friable; common medium and fine roots; primarily herbaceous fiber; about 12 percent mineral material; neutral; abrupt smooth boundary.

Cg1—10 to 23 inches; very dark grayish brown (2.5Y 3/2) coprogenous earth; moderate medium platy structure; slightly plastic; common fine and very fine roots; thin lenses of grayish brown (10YR 5/2) stripped sand grains between some plates; few white (10YR 8/1) carbonaceous shells; few black (10YR 2/1) organic linings in old root channels; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—23 to 27 inches; dark gray (5Y 4/1) coprogenous earth; many coarse prominent dark grayish brown (2.5Y 4/2) mottles; massive; slightly plastic; few fine and very fine roots; few white (10YR 8/1) carbonaceous shells; few black (10YR 2/1) organic linings in old root channels; strong effervescence; moderately alkaline; clear wavy boundary.

2Cg3—27 to 32 inches; dark gray (N 4/0) sand; common coarse prominent dark grayish brown (2.5Y 4/2) mottles; single grain; loose; few fine and very fine roots; few black (10YR 2/1) organic linings in old root channels; thin strata of dark gray (5Y 4/1) coprogenous earth 0.25 inch thick; strong effervescence; moderately alkaline; clear wavy boundary.

2Cg4—32 to 36 inches; dark grayish brown (2.5Y 4/2) sand; many coarse prominent dark gray (N 4/0) mottles; single grain; loose; few reddish brown (2.5YR 4/4) iron accumulations; strong effervescence; moderately alkaline; clear wavy boundary.

2C1—36 to 50 inches; light olive brown (2.5Y 5/4) sand; single grain; loose; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—50 to 55 inches; grayish brown (2.5Y 5/2) sand; single grain; loose; strong effervescence; moderately alkaline; clear wavy boundary.

2C3—55 to 60 inches; gray (5Y 5/1) sand; single grain; loose; strong effervescence; moderately alkaline.

The sapric material is 6 to 14 inches thick. The coprogenous earth is 10 to 20 inches thick. The depth to sand is 20 to 30 inches. The organic material is primarily herbaceous.

The surface tier has hue of 10YR, value of 2, and chroma of 1 or is black (N 2/0). The C horizon has hue of 10YR, 5Y, or 2.5Y, value of 3 to 5, and chroma of 1 or 2. The 2C horizon has hue of 10YR, 5Y, 2.5Y, value of 4 or 5, and chroma of 1 to 4 or is dark gray (N 4/0). In some pedons it has strata of coprogenous earth.

Adrian Series

The Adrian series consists of deep, very poorly drained soils on moraines and outwash plains. These soils formed in organic deposits over sand. Permeability is moderately slow to moderately rapid in the organic material and rapid in the underlying sand. Slopes are 0 to 1 percent.

Adrian soils are similar to Ackerman, Edwards, Houghton, and Muskego soils and are adjacent to Ackerman, Houghton, and Muskego soils. The adjacent soils are in positions on the landscape similar to those of the Adrian soils. Ackerman and Muskego soils have coprogenous earth in the subsurface tier. Edwards soils formed in muck 16 to 50 inches deep over marl. Houghton soils formed in more than 51 inches of muck.

Typical pedon of Adrian muck, drained, in a cultivated field; 300 feet south and 2,440 feet west of the northeast corner of sec. 16, T. 30 N., R. 5 W.

Op—0 to 10 inches; sapric material, black (N 2/0) broken face and rubbed, black (10YR 2/1) dry; about 2 percent fiber, less than 1 percent rubbed; weak fine granular structure; very friable; few fine and very fine roots; primarily herbaceous fiber; neutral; abrupt smooth boundary.

Oa1—10 to 20 inches; sapric material, very dark gray (5YR 3/1) broken face, black (5YR 2/1) rubbed; about 25 percent fiber, 2 percent rubbed; weak coarse subangular blocky structure; friable; few very fine roots; primarily herbaceous fiber; neutral; clear wavy boundary.

Oa2—20 to 24 inches; sapric material, very dark gray (10YR 3/1) broken face and rubbed; about 8 percent fiber, less than 1 percent rubbed; weak coarse subangular blocky structure; friable; few very fine roots; primarily herbaceous fiber; about 30 percent mineral material; neutral; clear wavy boundary.

2C1—24 to 34 inches; pale brown (10YR 6/3) sand; single grain; loose; slight effervescence; mildly alkaline; gradual wavy boundary.

2C2—34 to 60 inches; gray (10YR 6/1) sand; single grain; loose; strongly effervescence; moderately alkaline.

The organic material is 20 to 30 inches thick. It typically is neutral but ranges from strongly acid to mildly alkaline. The organic fibers are primarily herbaceous. The subsurface and bottom tiers have hue of 10YR or

5YR, value of 2 or 3, and chroma of 1 or 2 or are black (N 2/0). The 2C horizon has value of 5 or 6 and chroma of 1 to 3. It is typically neutral to moderately alkaline but ranges from medium acid to moderately alkaline.

Andres Series

The Andres series consists of deep, somewhat poorly drained soils on ground moraines. These soils formed in loamy and silty sediments over silty till. Permeability is moderate in the solum and moderately slow in the substratum. Slopes range from 0 to 2 percent.

Andres soils are similar to the Darroch soils that have a till substratum and to Odell soils. They are adjacent to Corwin and Reddick soils. Darroch soils are stratified in the substratum. Odell soils have a loamy substratum. Corwin soils do not have grayish mottles in the upper part of the subsoil. They are in the higher areas. Reddick soils have a grayish subsoil. They are in the lower areas.

Typical pedon of Andres loam, 0 to 2 percent slopes, in a cultivated field; 170 feet north and 2,475 feet west of the southeast corner of sec. 32, T. 27 N., R. 7 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; common fine roots; few pebbles; slightly acid; abrupt smooth boundary.

Bt1—11 to 18 inches; dark brown (10YR 4/3) clay loam; few fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common very fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 2 percent gravel; medium acid; clear wavy boundary.

Bt2—18 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; many fine distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; common very fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

BC—26 to 34 inches; pale brown (10YR 6/3) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous gray (5Y 5/1) clay films on faces of peds; about 5 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

2C—34 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct gray (N 6/0) mottles; massive; firm; about 2 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 36 inches thick. The depth to carbonates is 24 to 40 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or loam. It is medium acid to neutral. The Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is silty clay loam or clay loam. It is medium acid to neutral in the upper part and neutral to moderately alkaline in the lower part. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline.

Aubbeenaubbee Series

The Aubbeenaubbee series consists of deep, somewhat poorly drained, moderately permeable soils on recessional moraines. These soils formed in loamy sediments and in the underlying loamy till. Slopes range from 1 to 3 percent.

Aubbeenaubbee soils are similar to Markton soils and are adjacent to Markton and Metea soils and to the Rensselaer soils that have a till substratum. Markton and Metea soils have more sand in the upper part of the solum than the Aubbeenaubbee soils. Markton soils are in positions on the landscape similar to those of the Aubbeenaubbee soils. Metea soils are brown throughout. They are in the higher areas. Rensselaer soils have a grayish subsoil that is stratified in the lower part. They are in the lower areas.

Typical pedon of Aubbeenaubbee fine sandy loam, in a cultivated area of Markton-Aubbeenaubbee complex, 1 to 3 percent slopes; 150 feet west and 900 feet south of the northeast corner of sec. 36, T. 30 N., R. 6 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; many fine and very fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.

E—10 to 15 inches; brown (10YR 5/3) fine sandy loam; few fine faint dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; friable; common very fine roots; about 3 percent gravel; neutral; clear wavy boundary.

Bt1—15 to 20 inches; dark brown (10YR 4/3) sandy clay loam; common fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

2Bt2—20 to 28 inches; brown (10YR 5/3) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

2BC—28 to 33 inches; light brownish gray (10YR 6/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; neutral; clear smooth boundary.

2C—33 to 60 inches; brown (10YR 5/3) loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few discontinuous light gray (10YR 7/1) coatings of carbonate on internal planes; about 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 40 inches thick. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is sandy loam or fine sandy loam. It is medium acid to neutral. The Bt horizon has value of 4 or 5 and chroma of 2 or 3. It is strongly acid to neutral. The 2Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is loam or clay loam. It is medium acid to neutral. The 2C horizon has hue of 10YR or 2.5Y and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Ayr Series

The Ayr series consists of deep, well drained soils on recessional moraines. These soils formed in sandy sediments and in the underlying loam till. Permeability is rapid in the sandy upper part of the solum and moderate in the lower part and in the substratum. Slopes range from 1 to 4 percent.

Ayr soils are similar to Markton, Metea, Parr, and Sparta soils and are adjacent to Parr and Sparta soils. Markton soils have grayish mottles in the lower part of the subsoil. Metea soils have a surface layer that is lighter colored than that of the Ayr soils. Parr and Sparta soils are in positions on the landscape similar to those of the Ayr soils. Parr soils have more clay in the upper part of the solum than the Ayr soils. Sparta soils are sandy throughout.

Typical pedon of Ayr loamy fine sand, 1 to 4 percent slopes, in a cultivated field; 2,500 feet west and 130 feet north of the southeast corner of sec. 16, T. 29 N., R. 7 W.

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common medium and fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

A—9 to 13 inches; very dark brown (10YR 2/2) loamy sand, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; few fine and medium roots; about 1 percent gravel; neutral; clear wavy boundary.

AB—13 to 17 inches; dark brown (10YR 3/3) sand, grayish brown (10YR 5/2) dry; single grain; loose; few medium roots; about 1 percent gravel; neutral; clear wavy boundary.

BA—17 to 26 inches; brown (10YR 4/3) sand; single grain; loose; few fine roots; neutral; clear wavy boundary.

Bt1—26 to 33 inches; yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure; very friable; few fine roots; thin patchy dark brown (7.5YR 4/4) clay bridges between sand grains; about 1 percent gravel; neutral; clear wavy boundary.

2Bt2—33 to 37 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; firm; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

2C—37 to 60 inches; brown (10YR 5/3) loam; massive; friable; common discontinuous light gray (10YR 6/1) coatings of carbonate on internal planes; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 40 inches thick. The sandy material is 21 to 35 inches thick.

The A and Bt horizons are slightly acid or neutral. The A horizon has value of 2 or 3 and chroma of 1 to 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loamy sand or sand. The 2Bt horizon has value of 4 or 5. It is slightly acid to mildly alkaline. The 2C horizon is mildly alkaline or moderately alkaline.

Brems Series

The Brems series consists of deep, moderately well drained, rapidly permeable soils on outwash plains. These soils formed in sandy sediments. Slopes range from 1 to 3 percent.

Brems soils are similar to Morocco and Nesius soils and to the moderately wet Oakville soils. They are adjacent to Maumee and Zadog soils. Morocco soils have a dominantly grayish subsoil. Nesius and Oakville soils have a dominantly brownish subsoil. Nesius soils are not leached so deeply as the Brems soils, have a thicker dark surface layer, and do not have so much very fine sand throughout. Maumee and Zadog soils have a thick, dark surface layer. They are in the lower areas. Zadog soils have a grayish subsoil.

Typical pedon of Brems loamy sand, 1 to 3 percent slopes, in an uncultivated field; 100 feet west and 120 feet north of the southeast corner of sec. 37, T. 31 N., R. 7 W.

A—0 to 6 inches; dark brown (10YR 3/3) loamy sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

Bw1—6 to 20 inches; dark yellowish brown (10YR 4/6) sand; weak medium granular structure; very friable; few very fine roots; common dark brown (10YR 3/3) organic stains lining old root channels; strongly acid; clear wavy boundary.

Bw2—20 to 31 inches; yellowish brown (10YR 5/4) sand; common fine prominent yellowish red (5YR

5/8) mottles; single grain; loose; strongly acid; gradual wavy boundary.

Bw3—31 to 40 inches; pale brown (10YR 6/3) sand; common medium distinct light brownish gray (10YR 6/2) and many medium distinct brownish yellow (10YR 6/6) mottles; single grain; loose; strongly acid; clear wavy boundary.

C—40 to 60 inches; yellowish brown (10YR 5/6) sand; common medium prominent light brownish gray (10YR 6/2) mottles; single grain; loose; strongly acid.

The solum is 38 to 63 inches thick. It is sand, fine sand, or loamy sand.

The A horizon has value of 3 or 4 and chroma of 2 or 3. When dry, it has value of 6 or more. In uncultivated areas it is 2 to 6 inches thick. It is strongly acid to slightly acid. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is very strongly acid to medium acid. The C horizon has value 5 to 7 and chroma of 2 to 6. It is sand or fine sand. It is strongly acid to slightly acid.

Brookston Series

The Brookston series consists of deep, very poorly drained, moderately permeable soils on recessional moraines. These soils formed in loamy sediments and in the underlying loam till. Slopes are 0 to 1 percent.

Brookston soils are similar to Reddick and Wolcott soils and to the Rensselaer soils that have a till substratum. They are adjacent to Octagon, Parr, and Wawasee soils. Reddick and Wolcott soils have less clay in the subsoil than the Brookston soils. Also, Reddick soils have a higher content of clay in the substratum. Rensselaer soils do not have till within a depth of 40 inches. Octagon, Parr, and Wawasee soils are brownish throughout. They are in the higher areas. Wawasee soils have a surface layer that is lighter colored than that of the Brookston soils.

Typical pedon of Brookston loam, in a cultivated field; 1,000 feet west and 1,300 feet north of the southeast corner of sec. 11, T. 29 N., R. 7 W.

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

AB—10 to 13 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; firm; few fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Btg1—13 to 19 inches; dark gray (10YR 4/1) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; medium continuous gray (N 5/0) clay films on faces of peds; very dark gray (10YR 3/1) organic stains lining old root channels; about 1 percent gravel; neutral; gradual wavy boundary.

Btg2—19 to 30 inches; gray (5Y 6/1) clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; thin discontinuous gray (N 5/0) clay films on faces of peds; about 1 percent gravel; neutral; gradual wavy boundary.

BC—30 to 40 inches; olive brown (2.5Y 4/4) loam; common medium prominent gray (N 6/0) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; about 2 percent gravel; neutral; gradual wavy boundary.

C—40 to 60 inches; brown (10YR 5/3) loam; common coarse prominent strong brown (7.5YR 5/6) and many medium prominent gray (N 6/0) mottles; massive; firm; about 2 percent gravel; slight effervescence; mildly alkaline.

The solum is 35 to 45 inches thick. It is slightly acid or neutral.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam or clay loam. The Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. The Cg horizon has chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Chelsea Series

The Chelsea series consists of deep, excessively drained, rapidly permeable soils on outwash plains. These soils formed in water-laid sandy deposits that have been reworked by the wind. Slopes range from 2 to 6 percent.

Chelsea soils are similar to Oakville, Ormas, and Ormas Variant soils and are adjacent to Gilford soils. Oakville and Ormas Variant soils do not have textural bands in the subsoil. Ormas and Ormas Variant soils have gravel in the substratum. Gilford soils have a dominantly grayish subsoil. They are in the lower areas.

Typical pedon of Chelsea sand, 2 to 6 percent slopes, in an uncultivated field; 1,100 feet east and 2,600 feet north of the southwest corner of sec. 5, T. 28 N., R. 6 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) sand, pale brown (10YR 6/3) dry; single grain; loose; many fine roots; slightly acid; clear smooth boundary.

E1—4 to 7 inches; yellowish brown (10YR 5/4) sand; single grain; loose; common very fine roots; neutral; clear smooth boundary.

E2—7 to 20 inches; yellowish brown (10YR 5/4) sand; single grain; loose; neutral; clear wavy boundary.

E3—20 to 30 inches; yellowish brown (10YR 5/6) sand; single grain; loose; neutral; clear wavy boundary.

E4—30 to 40 inches; yellowish brown (10YR 5/6) sand; single grain; loose; neutral; clear wavy boundary.

E&B—40 to 80 inches; yellowish brown (10YR 5/4) sand (E); single grain; loose; bands of dark brown (7.5YR 4/4) loamy sand (B) that are 0.5 to 1.0 inch thick and have a cumulative thickness of 4 inches within a depth of 60 inches; massive; very friable; neutral.

The solum is 60 to 80 inches thick. The A and E horizons are medium acid to neutral. The A horizon has value of 3 or 4 and chroma of 1 or 2. It is sand, fine sand, or loamy fine sand. The E horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand or fine sand. The textural bands in the E&B horizon have hue of 10YR or 7.5YR. They are loamy sand or sandy loam.

Corwin Series

The Corwin series consists of deep, moderately well drained, moderately permeable soils on recessional moraines and ground moraines. These soils formed in loamy and silty sediments and in the underlying loam till. Slopes range from 1 to 3 percent.

Corwin soils are similar to Grovecity, Metamora, and Parr soils and are adjacent to Andres and Reddick soils. Grovecity soils have more sand in the substratum than the Corwin soils. The subsoil in Metamora soils has grayish mottles and has less clay in the upper part than that of the Corwin soils. Parr soils are dominantly brownish throughout. They are in the higher areas. Andres soils have a dominantly brownish layer in the upper part of the subsoil and have grayish mottles in that layer. They are in the slightly lower areas. Reddick soils have a grayish subsoil. They are on the lowest part of the landscape.

Typical pedon of Corwin loam, moderately permeable, 1 to 3 percent slopes, in a cultivated field; 400 feet east and 250 feet north of the southwest corner of sec. 27, T. 27 N., R. 7 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam, gray (10YR 5/1) dry; weak medium granular structure; friable; common very fine roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

A—9 to 13 inches; very dark brown (10YR 2/2) loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; common very fine roots; about 1 percent gravel; medium acid; clear wavy boundary.

Bt1—13 to 17 inches; dark brown (10YR 4/3) loam; moderate medium subangular blocky structure; firm; few very fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 2 percent gravel; medium acid; clear wavy boundary.

Bt2—17 to 23 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few very fine roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; medium acid; clear wavy boundary.

Bt3—23 to 28 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt4—28 to 35 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

2BC—35 to 40 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

2C—40 to 60 inches; yellowish brown (10YR 5/4) loam; common medium distinct gray (10YR 6/1) mottles; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 40 inches thick. The A horizon has value of 2 or 3 and chroma of 1 to 3. It is loam or silt loam. It is medium acid to neutral. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is loam, clay loam, or silty clay loam in the upper part and loam or clay loam in the lower part. It is strongly acid to slightly acid in the upper part and slightly acid or neutral in the lower part. The 2C horizon has value of 4 or 5 and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Craigmile Series

The Craigmile series consists of deep, very poorly drained soils on the second bottoms of flood plains. These soils formed in loamy alluvium over sandy deposits. Permeability is moderately rapid in the loamy material and rapid in the sandy material. Slopes are 0 to 1 percent.

The Craigmile soils in this county have a higher content of fine and coarse sand in the upper loamy material than is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Craigmile soils are similar to Prochaska, Sloan, and Suman soils and are adjacent to Prochaska and Suman soils. Prochaska soils have more sand throughout than the Craigmile soils. They are in positions on the landscape similar to those of the Craigmile soils. Sloan soils have more silt and clay throughout than the Craigmile soils. Suman soils have more clay in the solum than the Craigmile soils. They are in the slightly lower areas.

Typical pedon of Craigmile sandy loam, frequently flooded, in a cultivated field; 2,500 feet east and 100 feet north of the southwest corner of sec. 34, T. 33 N., R. 6 W.

Ap—0 to 10 inches; black (10YR 2/1) sandy loam, gray (10YR 5/1) dry; weak fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

A—10 to 14 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; very friable; common fine roots; slightly acid; clear wavy boundary.

Cg1—14 to 28 inches; dark gray (10YR 4/1) sandy loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very friable; few very fine roots; common discontinuous black (10YR 2/1) organic streaks; few splotches of light gray (10YR 7/2) uncoated sand grains; slightly acid; clear wavy boundary.

Cg2—28 to 37 inches; dark gray (10YR 4/1) sandy loam; weak medium subangular blocky structure; friable; few very fine roots; common discontinuous black (10YR 2/1) organic streaks; few splotches of light gray (10YR 7/2) uncoated sand grains; neutral; clear wavy boundary.

2Cg3—37 to 50 inches; grayish brown (10YR 5/2) sand; common medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; neutral; gradual wavy boundary.

2C—50 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; neutral.

The loamy material is 30 to 40 inches thick. The A horizon is 10 to 16 inches thick. It has value of 2 or 3 and chroma of 1 or 2. It is medium acid to neutral. The Cg horizon has value of 4 or 5 and chroma of 1 or 2. It is fine sandy loam or sandy loam. It is slightly acid or neutral. The 2C horizon is loamy sand or sand. It is neutral or mildly alkaline.

Darroch Series

The Darroch series consists of deep, somewhat poorly drained, moderately permeable soils on outwash plains and ground moraines. These soils formed in stratified, loamy and silty sediments. Slopes are 0 to 1 percent.

Darroch soils are similar to Andres, Odell, Papineau, and Whitaker soils and are adjacent to Rensselaer and Wolcott soils. Andres and Odell soils have till within a depth of 60 inches. Papineau soils have more clay in the lower part of the solum and in the substratum than the Darroch soils. Whitaker soils have a surface layer that is lighter colored than that of the Darroch soils. Rensselaer and Wolcott soils have a grayish subsoil. They are in the lower areas.

Typical pedon of Darroch loam, in a cultivated field; 700 feet south and 1,600 feet east of the northwest corner of sec. 24, T. 28 N., R. 7 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; common medium and fine roots; neutral; abrupt smooth boundary.

BA—10 to 13 inches; dark grayish brown (10YR 4/2) loam; moderate medium subangular blocky structure; firm; common fine roots; few very dark grayish brown (10YR 3/2) organic stains in pores and old root channels; slightly acid; clear wavy boundary.

Bt1—13 to 20 inches; brown (10YR 5/3) clay loam; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine and very fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—20 to 34 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate coarse subangular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few light gray (10YR 7/1) silt coatings on vertical faces of peds; neutral; clear wavy boundary.

C—34 to 60 inches; dark yellowish brown (10YR 4/4) very fine sand that has strata of silt loam; massive; firm; strong effervescence; moderately alkaline.

The solum is 26 to 36 inches thick. The A horizon has value of 2 or 3 and chroma of 1 to 3. It is loam or silt loam. It is medium acid to neutral. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is loam or clay loam in the upper part and loam, sandy clay loam, or clay loam in the lower part. It is medium acid or slightly acid in the upper part and slightly acid or neutral in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is very fine sand or fine sand that has strata of silt loam or fine sandy loam. It is mildly alkaline or moderately alkaline. A till substratum phase is mapped in the county.

Edwards Series

The Edwards series consists of deep, very poorly drained soils on ground moraines and outwash plains. These soils formed in organic material over marl. Permeability is moderately rapid to moderately slow in the organic material. Slopes are 0 to 1 percent.

Edwards soils are similar to Ackerman, Adrian, Houghton, Muskego, and Warners soils and are adjacent to Warners soils. Ackerman, Adrian, and Houghton soils do not have layers of marl. Muskego soils have coprogenous earth in the subsurface and bottom tiers. Warners soils do not have an organic surface soil. They are in positions on the landscape similar to those of the Edwards soils.

Typical pedon of Edwards muck, drained, in a cultivated field; 900 feet east and 1,000 feet south of the northwest corner of sec. 25, T. 32 N., R. 6 W.

Op—0 to 10 inches; sapric material, black (10YR 2/1) broken face and rubbed, black (10YR 2/1) dry; about 2 percent fiber, less than 1 percent rubbed; weak fine granular structure; very friable; many very fine roots; primarily herbaceous fiber; neutral; abrupt smooth boundary.

Oa1—10 to 14 inches; sapric material, black (N 2/0) broken face, black (10YR 2/1) rubbed; about 3 percent fiber, less than 1 percent rubbed; weak coarse subangular blocky structure; very friable; common very fine roots; primarily herbaceous fiber; neutral; clear wavy boundary.

Oa2—14 to 20 inches; sapric material, dark reddish brown (5YR 2/2) broken face, dark reddish brown (5YR 3/2) rubbed; about 10 percent fiber, 3 percent rubbed; weak coarse subangular blocky structure; very friable; few very fine roots; primarily herbaceous fiber; neutral; clear wavy boundary.

C1—20 to 30 inches; grayish brown (10YR 5/2) marl; massive; friable; few strong brown (7.5YR 5/8) stains surrounding old root channels; strong effervescence; moderately alkaline; clear smooth boundary.

C2—30 to 40 inches; gray (10YR 5/1) marl; massive; friable; few strong brown (7.5YR 5/8) stains surrounding old root channels; strong effervescence; moderately alkaline; clear smooth boundary.

C3—40 to 50 inches; gray (5Y 5/1) marl; massive; friable; few strong brown (7.5YR 5/8) stains surrounding old root channels; strong effervescence; moderately alkaline; clear smooth boundary.

C4—50 to 60 inches; gray (5Y 5/1) marl; massive; friable; strong effervescence; moderately alkaline.

The organic material is 20 to 30 inches thick. The organic fibers are primarily herbaceous.

The surface tier is black (N 2/0) in some pedons. It is medium acid to mildly alkaline. The subsurface and bottom tiers have hue of 10YR or 5YR, value of 2 or 3, and chroma of 1 or 2 or are black (N 2/0). They are mildly alkaline or moderately alkaline. The C horizon has hue of 10YR or 5Y, value of 5 or 6, and chroma of 1 or 2.

Faxon Series

The Faxon series consists of moderately deep, very poorly drained, moderately permeable soils on outwash plains and ground moraines. These soils formed in loamy sediments over limestone bedrock. Slopes are 0 to 1 percent.

Faxon soils are similar to Iroquois soils and are adjacent to Grovecity and Rockton soils. Grovecity and Iroquois soils do not have consolidated limestone bedrock within a depth of 60 inches. Grovecity and Rockton soils have a dominantly brownish subsoil. They are in the higher areas.

Typical pedon of Faxon loam, in a cultivated field; 1,700 feet east and 900 feet south of the northwest corner of sec. 35, T. 29 N., R. 6 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine and very fine roots; about 1 percent gravel; medium acid; abrupt smooth boundary.

Btg1—10 to 14 inches; dark grayish brown (2.5Y 4/2) loam; common fine faint olive brown (2.5Y 4/4) mottles; moderate medium subangular blocky structure; firm; common fine and very fine roots; few very dark gray (10YR 3/1) organic stains in pores; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

Btg2—14 to 25 inches; gray (10YR 5/1) sandy clay loam; common fine prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

Btg3—25 to 33 inches; gray (10YR 5/1) sandy clay loam; many coarse distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; few very fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 1 percent gravel; neutral; gradual wavy boundary.

BC—33 to 36 inches; gray (5Y 5/1) fine sandy loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; about 1 percent gravel; neutral; abrupt wavy boundary.

R—36 inches; consolidated limestone bedrock.

The solum is 30 to 36 inches thick. The depth to limestone bedrock is 32 to 40 inches.

The Ap horizon has value of 2 or 3. It is medium acid to mildly alkaline. The Btg horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is loam, clay loam, or sandy clay loam. The BC horizon is fine sandy loam or sandy loam.

Gilford Series

The Gilford series consists of deep, very poorly drained, moderately rapidly permeable soils on outwash plains. These soils formed in loamy sediments over sandy deposits. Slopes are 0 to 1 percent.

Gilford soils are similar to Mussey soils and are adjacent to Chelsea, Morocco, and Mussey soils. Mussey soils have more clay in the subsoil than the Gilford soils. They are in positions on the landscape similar to those of the Gilford soils. Chelsea soils have textural bands in the subsoil and are brownish throughout. They are in the higher areas. Morocco soils have a dominantly brownish layer in the subsoil and have less clay in the solum than the Gilford soils. They are in the slightly higher areas.

Typical pedon of Gilford fine sandy loam, in a cultivated field; 900 feet north and 300 feet west of the southeast corner of sec. 36, T. 28 N., R. 7 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; very friable; common very fine roots; slightly acid; abrupt smooth boundary.

A—10 to 15 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bg—15 to 28 inches; grayish brown (10YR 5/2) fine sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin patchy very dark gray (10YR 3/1) organic coatings in old root channels; neutral; gradual wavy boundary.

2Cg1—28 to 40 inches; light gray (10YR 7/2) fine sand; common medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; neutral; gradual wavy boundary.

2Cg2—40 to 50 inches; brown (10YR 5/3) fine sand; common coarse distinct gray (10YR 6/1) mottles; single grain; loose; slight effervescence; mildly alkaline; gradual wavy boundary.

2Cg3—50 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 23 to 38 inches thick. It is medium acid to neutral. It is fine sandy loam or sandy loam.

The A horizon has chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The 2C horizon has value of 5 to 7 and chroma of 1 to 3. It is neutral to moderately alkaline.

Grovecity Series

The Grovecity series consists of deep, somewhat poorly drained, moderately rapidly permeable soils on ground moraines and outwash plains. These soils formed in loamy sediments and in the underlying loamy till. Slopes range from 1 to 3 percent.

Grovecity soils are similar to Corwin, Martinsville, and Rockton soils and are adjacent to Faxon and Rockton soils. Corwin soils have less sand in the substratum than the Grovecity soils. Martinsville soils have a surface layer that is lighter colored than that of the Grovecity soils. Rockton soils have limestone bedrock within a depth of 40 inches. They are in the slightly lower areas. Faxon soils have a grayish subsoil. They are in the lower areas.

Typical pedon of Grovecity fine sandy loam, 1 to 3 percent slopes, in a cultivated field; 200 feet east and 1,500 feet north of the southwest corner of sec. 26, T. 29 N., R. 6 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine and very fine roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

A—10 to 16 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak medium subangular blocky structure; friable; common fine and few very fine roots; about 1 percent gravel; slightly acid; clear wavy boundary.

Bt1—16 to 21 inches; brown (10YR 4/3) sandy loam; moderate medium subangular blocky structure; firm; common fine and few very fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; few very dark gray (10YR 3/1) organic stains on faces of peds; about 6 percent gravel; neutral; clear wavy boundary.

Bt2—21 to 32 inches; dark yellowish brown (10YR 4/4) coarse sandy loam; few fine distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure; friable; common fine and very fine roots; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; about 12 percent gravel; neutral; clear wavy boundary.

2C1—32 to 40 inches; yellowish brown (10YR 5/4) fine sandy loam; common fine distinct yellowish brown (10YR 5/8) mottles; massive; friable; few light gray (10YR 7/1) coatings of carbonate on internal planes; about 7 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—40 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; common fine distinct yellowish brown (10YR 5/8) mottles; massive; friable; few light gray

(10YR 7/1) coatings of carbonate on internal planes; about 8 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 36 inches thick. The A horizon is loam or fine sandy loam. It is slightly acid or neutral. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is fine sandy loam, sandy loam, or coarse sandy clay loam. It is slightly acid to mildly alkaline.

Houghton Series

The Houghton series consists of deep, very poorly drained, moderately rapidly permeable to moderately slowly permeable soils on outwash plains, flood plains, and moraines. These soils formed in thick deposits of organic material. Slopes range from 0 to 2 percent.

Houghton soils are similar to Adrian, Edwards, and Muskego soils and are adjacent to Ackerman, Adrian, Muskego, Ormas, and Ormas Variant soils. Ackerman, Adrian, Edwards, and Muskego soils are in positions on the landscape similar to those of the Houghton soils. Ackerman soils have less than 16 inches of organic material. Adrian soils formed in muck 16 to 50 inches deep over sand. Edwards soils formed in muck 16 to 50 inches deep over marl. Muskego soils have coprogenous earth in the subsurface and bottom tiers. Ormas and Ormas Variant soils do not have organic deposits. They are in the higher areas.

Typical pedon of Houghton muck, drained, in a cultivated field; 1,440 feet east and 2,300 feet north of the southwest corner of sec. 16, T. 30 N., R. 5 W.

Op—0 to 12 inches; sapric material, black (N 2/0) broken face and rubbed, black (10YR 2/1) dry; about 2 percent fiber, less than 1 percent rubbed; weak fine granular structure; very friable; few fine roots; primarily herbaceous fiber; neutral; abrupt smooth boundary.

Oa1—12 to 16 inches; sapric material, very dark gray (5YR 3/1) broken face, dark reddish brown (5YR 2.5/2) rubbed; about 25 percent fiber, 3 percent rubbed; moderate coarse subangular blocky structure; friable; few very fine roots; primarily herbaceous fiber; neutral; clear wavy boundary.

Oa2—16 to 27 inches; sapric material, dark reddish brown (5YR 3/3) broken face, dark reddish brown (5YR 3/2) rubbed; about 45 percent fiber, 8 percent rubbed; weak coarse subangular blocky structure; friable; primarily herbaceous fiber; medium acid; clear wavy boundary.

Oa3—27 to 47 inches; sapric material, dark reddish brown (5YR 3/3) broken face, dark reddish brown (5YR 3/2) rubbed; about 65 percent fiber, 12 percent rubbed; massive; friable; primarily herbaceous fiber; slightly acid; clear wavy boundary.

Oa4—47 to 66 inches; sapric material, dark reddish brown (5YR 3/3) broken face, dark reddish brown (5YR 3/2) rubbed; about 35 percent fiber, 10 percent rubbed; massive; friable; primarily herbaceous fiber; slightly acid.

The organic material is more than 51 inches thick. It is primarily herbaceous. It has hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 1 to 3 or is black (N 2/0). It ranges from medium acid to mildly alkaline.

Iroquois Series

The Iroquois series consists of deep, very poorly drained soils on outwash plains. These soils formed in loamy outwash over clayey lacustrine sediments. Permeability is moderate in the solum and very slow in the substratum. Slopes are 0 to 1 percent.

Iroquois soils are similar to Faxon, Montgomery, and Rensselaer soils and are adjacent to Papineau, Simonin, and Strole soils. Faxon soils have more sand in the substratum than the Iroquois soils and have limestone bedrock within a depth of 40 inches. Montgomery and Strole soils have more clay in the upper part of the solum than the Iroquois soils. Papineau and Strole soils have a dominantly brownish layer in the upper part of the subsoil. They are in the slightly higher areas. Rensselaer soils have more sand in the substratum than the Iroquois soils and are stratified in the lower part of the solum and in the substratum. Simonin soils are dominantly brownish and have more sand in the subsoil than the Iroquois soils. They are in the higher areas.

Typical pedon of Iroquois fine sandy loam, in a cultivated field; 100 feet north and 2,000 feet east of the southwest corner of sec. 12, T. 28 N., R. 7 W.

Ap—0 to 11 inches; very dark brown (10YR 2/2) fine sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common medium roots; medium acid; abrupt smooth boundary.

AB—11 to 16 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; common medium prominent light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; common very dark gray (10YR 3/1) organic stains on faces of peds; medium acid; clear wavy boundary.

Btg1—16 to 21 inches; dark grayish brown (2.5Y 4/2) sandy clay loam; many medium faint light olive brown (2.5Y 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; few very dark gray (10YR 3/1) organic stains on faces of peds; about 1 percent gravel; medium acid; clear wavy boundary.

Btg2—21 to 27 inches; gray (10YR 5/1) sandy clay loam; many medium prominent light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 1 percent gravel; medium acid; clear wavy boundary.

Btg3—27 to 31 inches; gray (5Y 6/1) clay loam; many medium prominent light olive brown (2.5Y 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous gray (5Y 5/1) clay films on faces of peds; neutral; clear wavy boundary.

2Cg—31 to 60 inches; gray (N 6/0) silty clay; many medium distinct light olive brown (2.5Y 5/4) mottles; massive; firm; strong effervescence; moderately alkaline.

The solum is 24 to 38 inches thick. It is medium acid to neutral.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is fine sandy loam or sandy loam. The Bt horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam or sandy clay loam. The 2C horizon has hue of 10YR, value of 6, and chroma of 1 or 2, or it is gray (N 6/0). It is clay or silty clay. It is mildly alkaline or moderately alkaline.

Lucas Series

The Lucas series consists of deep, moderately well drained soils on lake plains and recessional moraines. These soils formed in silty and clayey sediments. Permeability is slow in the solum and slow or very slow in the substratum. Slopes range from 2 to 6 percent.

Lucas soils are adjacent to Montgomery and Strole soils. Montgomery soils have a grayish subsoil. They are in the lower areas. Strole soils have a dominantly grayish subsoil. They are in the slightly lower areas.

Typical pedon of Lucas silty clay loam, 2 to 6 percent slopes, eroded, in a cultivated field; 400 feet north and 1,600 feet west of the southeast corner of sec. 14, T. 30 N., R. 5 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, light gray (10YR 7/2) dry; mixed with dark brown (10YR 4/3) material in the lower part; moderate very fine subangular blocky structure; firm; few very fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

Bt1—8 to 11 inches; dark brown (10YR 4/3) clay; moderate fine angular blocky structure; firm; few very fine roots; thin discontinuous brown (10YR 5/3) clay films on faces of peds; about 1 percent gravel; neutral; clear smooth boundary.

Bt2—11 to 24 inches; yellowish brown (10YR 5/4) clay; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; thin discontinuous brown (10YR 5/3) clay films on faces of peds; about 1 percent gravel; neutral; gradual wavy boundary.

C1—24 to 40 inches; brown (10YR 5/3) silty clay; few medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; thin continuous gray (5Y 5/1) clay films on internal planes; common light gray (10YR 7/1) coatings of carbonate on internal planes; about 1 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—40 to 60 inches; brown (10YR 5/3) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; thick continuous gray (5Y 5/1) clay films on internal planes; common light gray (10YR 7/1) coatings of carbonate on internal planes; about 1 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 34 inches thick. The Ap horizon has chroma of 2 or 3. It is silt loam or silty clay loam. It is strongly acid to neutral. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is clay or silty clay. It is slightly acid to neutral in the upper part and neutral or mildly alkaline in the lower part. The C horizon is clay, silty clay, or silty clay loam. It is mildly alkaline or moderately alkaline.

Markton Series

The Markton series consists of deep, somewhat poorly drained soils on recessional moraines. These soils formed in sandy sediments and in the underlying loamy till. Permeability is rapid in the upper part of the solum and moderate in the lower part and in the substratum. Slopes range from 1 to 3 percent.

Markton soils are similar to Aubbeenaubbee, Ayr, Metea, and Simonin soils and are adjacent to Aubbeenaubbee soils. Aubbeenaubbee soils have less sand in the upper part of the solum than the Markton soils. They are in positions on the landscape similar to those of the Markton soils. Ayr and Metea soils do not have grayish mottles in the lower part of the subsoil. Simonin soils have a thick, dark surface layer. They do not have glacial till in the substratum.

Typical pedon of Markton sand, in a cultivated area of Markton-Aubbeenaubbee complex, 1 to 3 percent slopes; 200 feet south and 1,050 feet west of the northeast corner of sec. 5, T. 29 N., R. 7 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine roots; about 2 percent gravel; slightly acid; abrupt smooth boundary.

Bw1—10 to 18 inches; brown (10YR 5/3) sand; single grain; loose; many fine and very fine roots; about 1 percent gravel; medium acid; clear wavy boundary.

Bw2—18 to 27 inches; yellowish brown (10YR 5/4) sand; few fine faint grayish brown (10YR 5/2) mottles; single grain; loose; common fine and very fine roots; about 1 percent gravel; slightly acid; clear wavy boundary.
2Bt—27 to 34 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous brown (10YR 4/3) clay films on faces of peds; about 4 percent gravel; neutral; clear wavy boundary.
2BC—34 to 38 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; common light gray (10YR 7/2) coatings of carbonate on internal planes; about 5 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.
2C—38 to 60 inches; brown (10YR 5/3) loam; massive; friable; few light gray (10YR 7/2) coatings of carbonate on internal planes; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 40 inches thick. The sandy deposits are 20 to 40 inches thick.

The Ap and Bw horizons are sand or loamy sand. They are medium acid to neutral. The Ap horizon has value of 3 or 4 and chroma of 1 to 3. The Bw horizon has value of 4 or 5 and chroma of 3 to 6. The 2Bt horizon has value of 4 to 6 and chroma of 1 to 6. It is sandy loam or loam. It is slightly acid or neutral. The 2C horizon has value of 5 or 6 and chroma of 1 to 4. It is mildly alkaline or moderately alkaline.

Martinsville Series

The Martinsville series consists of deep, well drained, moderately permeable soils on outwash plains and recessional moraines. These soils formed in loamy sediments and in the underlying silty and sandy deposits. Slopes range from 2 to 6 percent.

Martinsville soils are adjacent to Ormas, Ormas Variant, and Whitaker soils. Ormas and Ormas Variant soils have more sand throughout than the Martinsville soils and have gravel in the substratum. They are in positions on the landscape similar to those of the Martinsville soils. Whitaker soils have a dominantly grayish subsoil. They are in the slightly lower areas.

Typical pedon of Martinsville fine sandy loam, 2 to 6 percent slopes, in a cultivated field; 2,200 feet west and 200 feet south of the northeast corner of sec. 35, T. 30 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; common medium and fine roots; about 2 percent gravel; medium acid; abrupt smooth boundary.
Bt1—8 to 12 inches; brown (10YR 5/3) loam; weak thick platy structure parting to moderate fine subangular blocky; friable; common medium and fine roots; about 1 percent gravel; medium acid; clear wavy boundary.
Bt2—12 to 21 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; few fine roots; medium discontinuous dark brown (10YR 4/3) clay films on faces of peds; about 6 percent gravel; medium acid; clear wavy boundary.
Bt3—21 to 30 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; few fine roots; medium discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; about 2 percent gravel; slightly acid; gradual wavy boundary.
Bt4—30 to 35 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; firm; medium continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.
BC—35 to 41 inches; yellowish brown (10YR 5/6) silt loam; weak coarse subangular blocky structure; firm; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.
2C—41 to 60 inches; yellowish brown (10YR 5/4) silt loam that has thin strata of fine sand; massive; friable; common light gray (10YR 7/2) carbonates; about 2 percent gravel; strong effervescence; mildly alkaline.

The solum is 40 to 50 inches thick. The Ap horizon has chroma of 2 or 3. It is sandy loam or fine sandy loam. It is medium acid to neutral. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or clay loam. It is strongly acid to slightly acid. The 2C horizon has value of 5 or 6 and chroma of 3 to 6. It is sandy loam or silt loam that has strata of sand, fine sand, very fine sand, or loamy sand. It typically is mildly alkaline or moderately alkaline but ranges from medium acid to moderately alkaline.

Maumee Series

The Maumee series consists of deep, very poorly drained, rapidly permeable soils in broad depressions on outwash plains. These soils formed in sandy sediments. Slopes are 0 to 1 percent.

Maumee soils are similar to Newton and Zadog soils and are adjacent to Brems, Morocco, Watseka, and Zadog soils. Newton soils are more acid in the solum than the Maumee soils. Zadog soils have accumulations of iron in the solum. They are in positions on the landscape similar to those of the Maumee soils. Brems soils have a dominantly brownish subsoil. They are in the higher areas. Morocco and Watseka soils are in the slightly higher areas. They have a dominantly brownish horizon in the upper part of the subsoil. Also, Watseka soils have a dark surface layer that is thinner than that of the Maumee soils.

Typical pedon of Maumee loamy sand, in a cultivated area of Zadog-Maumee loamy sands; 800 feet south and 1,900 feet west of the northeast corner of sec. 13, T. 32 N., R. 6 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; common medium and fine roots; medium acid; abrupt smooth boundary.

A—11 to 15 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; common medium distinct grayish brown (10YR 5/2) mottles; weak fine granular structure; very friable; few fine roots; discontinuous black (10YR 2/1) organic streaks; medium acid; clear wavy boundary.

Cg1—15 to 33 inches; grayish brown (10YR 5/2) loamy sand; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; very friable; few fine roots; discontinuous very dark gray (10YR 3/1) organic streaks; slightly acid; clear wavy boundary.

Cg2—33 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; slightly acid.

The A horizon has value of 2 or 3 and chroma of 1 or 2 or is black (N 2/0). It is sand, loamy sand, or loamy fine sand. It is medium acid to neutral. The Cg horizon has value of 4 to 6 and chroma of 1 to 3. It is sand or loamy sand. It is slightly acid to moderately alkaline.

Metamora Series

The Metamora series consists of deep, somewhat poorly drained, moderately permeable soils on recessional moraines. These soils formed in loamy sediments and in the underlying loam till. Slopes range from 0 to 4 percent.

The Metamora soils in this county have grayish mottles at a lower depth than is definitive for the series. Also, Metamora fine sandy loam, moderately permeable, 0 to 1 percent slopes, contains less clay in the subsoil and has a thick, dark surface layer. These differences, however, do not alter the usefulness or behavior of the soils.

Metamora soils are similar to Corwin and Wawasee soils and are adjacent to Octagon soils. Corwin soils have a dark surface layer that is thicker than that of the Metamora soils. Octagon and Wawasee soils have a brownish subsoil. Wawasee soils have a surface layer that is lighter colored than that of the Metamora soils. Octagon soils are in the slightly higher areas.

Typical pedon of Metamora fine sandy loam, moderately permeable, 1 to 4 percent slopes, in a cultivated field; 1,800 feet east and 1,900 feet south of the northwest corner of sec. 23, T. 30 N., R. 5 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; common medium and fine roots; about 1 percent gravel; strongly acid; abrupt smooth boundary.

Bt1—8 to 14 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; firm; common medium and fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; common very dark gray (10YR 3/1) organic stains on faces of peds; about 2 percent gravel; strongly acid; clear wavy boundary.

Bt2—14 to 22 inches; yellowish brown (10YR 5/4) loam; common fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common medium and fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel; strongly acid; clear wavy boundary.

Bt3—22 to 29 inches; brown (10YR 5/3) loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; about 2 percent gravel; medium acid; gradual wavy boundary.

2BC—29 to 36 inches; light brownish gray (10YR 6/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; about 7 percent gravel; neutral; gradual wavy boundary.

2C—36 to 60 inches; brown (10YR 5/3) loam; massive; friable; few light gray (10YR 7/1) coatings of carbonates on internal planes; about 6 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 32 to 37 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is fine sandy loam or sandy loam. It is strongly acid to slightly acid. The Bt horizon has chroma of 3 or 4. It is loam or clay loam. It is strongly acid to slightly acid in the upper part and medium acid to neutral in the lower part. The C horizon has value of 5 or 6 and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Metea Series

The Metea series consists of deep, well drained soils on recessional moraines. These soils formed in sandy sediments and the underlying loamy till. Permeability is rapid in the upper part of the solum and moderate in the lower part and in the substratum. Slopes range from 2 to 6 percent.

Metea soils are similar to Ayr and Markton soils and are adjacent to Aubbeenaubbee and Wawasee soils. Ayr and Markton soils have a dark surface layer. Markton soils have grayish mottles in the lower part of the subsoil. Aubbeenaubbee soils have a dominantly grayish subsoil. They are in the lower areas. Wawasee soils have more clay in the upper part of the solum than the Metea soils. They are in positions on the landscape similar to those of the Metea soils.

Typical pedon of Metea loamy sand, moderately permeable, 2 to 6 percent slopes, in a cultivated field; 1,600 feet south and 150 feet east of the northwest corner of sec. 4, T. 29 N., R. 6 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) loamy sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many medium and fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

E1—8 to 12 inches; brown (10YR 5/3) loamy sand; weak coarse subangular blocky structure; very friable; common medium and fine roots; about 1 percent gravel; neutral; clear wavy boundary.

E2—12 to 16 inches; yellowish brown (10YR 5/4) loamy sand; weak medium subangular blocky structure; very friable; few fine roots; about 1 percent gravel; strongly acid; clear wavy boundary.

E3—16 to 28 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few fine roots; about 1 percent gravel; neutral; gradual wavy boundary.

2Bt—28 to 38 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; medium continuous dark brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

2C—38 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; few light gray (10YR 7/2) coatings of carbonate on internal planes; about 9 percent gravel; strong effervescence; mildly alkaline.

The solum is 38 to 47 inches thick. The sandy material is 24 to 30 inches thick.

The Ap and E horizons are sand or loamy sand. The Ap horizon has chroma of 2 or 3. The E horizon has value of 4 or 5 and chroma of 3 or 4. It is strongly acid or medium acid in the upper part and slightly acid or neutral in the lower part. The 2Bt horizon has value of 4 or 5. It is clay loam or sandy clay loam. It is medium acid to neutral. The 2C horizon is mildly alkaline or moderately alkaline.

Montgomery Series

The Montgomery series consists of deep, very poorly drained, slowly permeable soils on lake plains. These soils formed in stratified, silty lacustrine sediments. Slopes are 0 to 1 percent.

Montgomery soils are similar to Iroquois and Reddick soils and are adjacent to Lucas, Papineau, Simonin, and Strole soils. Iroquois and Reddick soils have more sand in the solum than the Montgomery soils. Reddick soils formed in glacial till. Lucas and Simonin soils have a dominantly brownish subsoil. They are in the higher areas. Papineau and Strole soils have a dominantly brownish horizon in the upper part of the subsoil. They are in the slightly higher areas.

Typical pedon of Montgomery silty clay loam, in a cultivated field; 1,500 feet west and 1,250 feet north of the southeast corner of sec. 17, T. 28 N., R. 7 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; firm; common fine roots; neutral; abrupt smooth boundary.

Bg1—10 to 15 inches; dark gray (2.5Y 4/1) silty clay loam; common fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; neutral; clear wavy boundary.

Bg2—15 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many medium distinct light olive brown (2.5Y 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; about 1 percent gravel; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—22 to 60 inches; gray (5Y 6/1) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; massive; firm; a 2-inch stratum of clay loam containing carbonaceous shells is at a depth of about 33 inches; strong effervescence; moderately alkaline.

The solum is 22 to 36 inches thick. It is slightly acid to mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bg and Cg horizons are silty clay loam or silty clay. The Bg horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The C horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is mildly alkaline or moderately alkaline.

Morocco Series

The Morocco series consists of deep, somewhat poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy sediments. Slopes range from 0 to 2 percent.

Morocco soils are similar to Brems and Watseka soils and are adjacent to Gilford, Maumee, Newton, and

Zadog soils. Brems soils have a dominantly brownish subsoil and have grayish mottles in the lower part of the solum. Watseka soils have a thick, dark surface layer. Gilford, Maumee, Newton, and Zadog soils are in the lower areas. They have a grayish subsoil. Also, Zadog soils have accumulations of iron in the solum.

Typical pedon of Morocco loamy sand, in a cultivated field; 270 feet north and 950 feet west of the southeast corner of sec. 7, T. 31 N., R. 7 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine and very fine roots; strongly acid; abrupt smooth boundary.

E—9 to 14 inches; light yellowish brown (10YR 6/4) loamy fine sand; common medium distinct light gray (10YR 7/2) and few fine prominent strong brown (7.5YR 5/8) mottles; single grain; loose; few very fine roots; very strongly acid; clear wavy boundary.

Bw—14 to 22 inches; very pale brown (10YR 7/3) fine sand; common fine faint light gray (10YR 7/2) and common medium distinct brownish yellow (10YR 6/8) mottles; single grain; loose; few very fine roots; very strongly acid; clear wavy boundary.

Bg—22 to 35 inches; light gray (10YR 7/2) fine sand; many coarse prominent yellowish red (5YR 5/8) mottles; single grain; loose; few very fine roots; very strongly acid; gradual wavy boundary.

C—35 to 60 inches; very pale brown (10YR 7/4) fine sand; common medium distinct light gray (10YR 7/2) mottles; single grain; loose; common brownish yellow (10YR 6/8) iron stains; strongly acid.

The solum is 24 to 44 inches thick. The Ap horizon has value of 3 or 4 and chroma of 1 or 2. It is strongly acid to slightly acid. Pedons in uncultivated areas have an A horizon. This horizon is 3 to 5 inches thick. It has value of 3 or 4 and chroma of 1 to 3. It is loamy sand, loamy fine sand, or fine sand. It is strongly acid to medium acid. The E, B, and C horizons are very strongly acid to medium acid. The E horizon, if it occurs, has value of 4 to 6 and chroma of 3 or 4. It is sand, fine sand, loamy sand, or loamy fine sand. The B and C horizons are sand or fine sand. The B horizon has value of 5 to 7 and chroma of 2 to 6. The C horizon has value of 6 or 7 and chroma of 2 to 4.

Muskego Series

The Muskego series consists of deep, very poorly drained soils on outwash plains and moraines. These soils formed in organic deposits and in the underlying coprogenous earth. Permeability is moderately rapid or moderate in the organic material and slow in the coprogenous earth. Slopes are 0 to 1 percent.

Muskego soils are similar to Ackerman, Adrian, Edwards, and Houghton soils and are adjacent to Ackerman, Adrian, and Houghton soils. The adjacent soils are in positions on the landscape similar to those of the Muskego soils. Ackerman soils have less than 14 inches of organic material above the coprogenous earth and have sandy material within a depth of 51 inches. Adrian, Edwards, and Houghton soils do not have coprogenous earth in the subsurface or bottom tiers.

Typical pedon of Muskego muck, drained, in a cultivated field; 1,000 feet west and 600 feet north of the southeast corner of sec. 20, T. 30 N., R. 7 W.

Op—0 to 10 inches; sapric material, black (N 2/0) broken face and rubbed, black (10YR 2/1) dry; about 5 percent fiber, less than 1 percent rubbed; moderate medium granular structure; very friable; common medium roots; primarily herbaceous fiber; medium acid; abrupt smooth boundary.

Oa1—10 to 14 inches; sapric material, black (N 2/0) broken face and rubbed; about 3 percent fiber, less than 1 percent rubbed; moderate medium subangular blocky structure; very friable; few fine roots; primarily herbaceous fiber; neutral; clear wavy boundary.

Oa2—14 to 18 inches; sapric material, dark brown (7.5YR 3/2) broken face, very dark brown (7.5YR 2/2) rubbed; about 5 percent fiber, less than 1 percent rubbed; moderate medium subangular blocky structure; very friable; primarily herbaceous fiber; slightly acid; clear wavy boundary.

C1—18 to 30 inches; grayish brown (2.5Y 5/2) coprogenous earth; massive; slightly plastic; common medium prominent yellowish brown (10YR 5/6) iron stains in old root channels; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—30 to 60 inches; gray (5Y 5/1) coprogenous earth; massive; slightly plastic; strata of sand that are about 0.25 inch thick and have a combined thickness of less than 2 inches; strong effervescence; moderately alkaline.

The depth to coprogenous earth is 18 to 30 inches. The organic material is primarily herbaceous. It is medium acid to neutral.

The surface tier is black (N 2/0 or 10YR 2/1). The subsurface tier has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3 or is black (N 2/0). The C horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is neutral to moderately alkaline.

Mussey Series

The Mussey series consists of deep, very poorly drained soils on outwash plains. These soils formed in loamy sediments over sand. Permeability is moderate in the solum and rapid in the substratum. Slopes are 0 to 1 percent.

Mussey soils are similar to Gilford soils and are adjacent to those soils. Gilford soils have less clay in the subsoil than the Mussey soils. They are in positions on the landscape similar to those of the Mussey soils.

Typical pedon of Mussey mucky sandy loam, in a cultivated field; 1,400 feet east and 1,900 feet north of the southwest corner of sec. 5, T. 30 N., R. 6 W.

Ap—0 to 10 inches; black (10YR 2/1) mucky sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common fine and very fine roots; slightly acid; abrupt smooth boundary.

Btg—10 to 13 inches; dark grayish brown (10YR 4/2) clay loam; few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; many fine and very fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; common discontinuous black (10YR 2/1) organic stains on faces of peds; very dark gray (10YR 3/1) linings in old root channels; slightly acid; clear wavy boundary.

2C1—13 to 19 inches; grayish brown (10YR 5/2) sand; common medium distinct dark yellowish brown (10YR 4/4) mottles; single grain; loose; few fine and very fine roots; very dark gray (10YR 3/1) linings in old root channels; neutral; gradual wavy boundary.

2C2—19 to 23 inches; brown (10YR 5/3) sand; few fine faint gray (10YR 5/1) mottles; single grain; loose; neutral; gradual wavy boundary.

2C3—23 to 30 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 2 percent gravel; neutral; gradual wavy boundary.

2C4—30 to 47 inches; brown (10YR 5/3) sand; single grain; loose; about 2 percent gravel; neutral; gradual wavy boundary.

3C5—47 to 60 inches; dark brown (10YR 4/3) gravelly sand; single grain; loose; about 20 percent gravel; neutral.

The solum is 12 to 20 inches thick. It is slightly acid to mildly alkaline.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is mucky sandy loam or mucky fine sandy loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is clay loam or loam. The C horizon has value of 5 or 6 and chroma of 1 to 4. It is sand or gravelly sand. It is neutral or mildly alkaline.

Nesius Series

The Nesius series consists of deep, moderately well drained, rapidly permeable soils on lake plains and outwash plains. These soils formed in sandy eolian deposits. Slopes range from 1 to 3 percent.

Nesius soils are similar to Brems, Oakville, Sparta, and Watseka soils and are adjacent to Watseka soils. Brems and Oakville soils have a light colored surface layer. Oakville soils do not have grayish mottles in the lower part of the subsoil. Sparta soils have a solum that is thicker than that of the Nesius soils and are brownish throughout. Watseka soils have a dominantly grayish subsoil. They are in the slightly lower areas.

Typical pedon of Nesius fine sand, 1 to 3 percent slopes, in a cultivated field; 2,150 feet east and 2,550 feet south of the northwest corner of sec. 9, T. 28 N., R. 7 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine and very fine roots; neutral; abrupt smooth boundary.

A—7 to 18 inches; dark brown (10YR 3/3) fine sand, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; common fine and very fine roots; neutral; abrupt smooth boundary.

Bw1—18 to 25 inches; dark yellowish brown (10YR 3/4) fine sand; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very friable; few very fine roots; neutral; clear wavy boundary.

Bw2—25 to 31 inches; brown (10YR 4/3) fine sand; many medium distinct dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; very friable; neutral; clear wavy boundary.

Bw3—31 to 37 inches; yellowish brown (10YR 5/6) fine sand; many medium distinct yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very friable; neutral; clear wavy boundary.

Bw4—37 to 44 inches; strong brown (7.5YR 5/6) fine sand; many medium distinct brown (7.5YR 5/4) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; neutral; clear wavy boundary.

Bw5—44 to 51 inches; dark yellowish brown (10YR 4/6) fine sand; many medium faint dark yellowish brown (10YR 4/4) and common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; neutral; clear wavy boundary.

Cg—51 to 60 inches; grayish brown (10YR 5/2) fine sand; many coarse distinct yellowish brown (10YR 5/4) mottles; single grain; loose; neutral.

The solum is 40 to 60 inches thick. The A horizon has value of 2 or 3 and chroma of 1 to 3. The B horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. The C horizon has value of 5 or 6 and chroma of 2 to 6. It is fine sand or sand.

Newton Series

The Newton series consists of deep, very poorly drained, rapidly permeable soils on outwash plains.

These soils formed in sandy sediments. Slopes are 0 to 1 percent.

Newton soils are similar to Maumee and Zadog soils and are adjacent to Morocco and Oakville soils. Maumee and Zadog soils are less acid throughout than the Newton soils. Also, Zadog soils have accumulations of iron in the solum. Morocco soils have a dominantly brownish layer in the upper part of the subsoil. They are in the slightly higher areas. Oakville soils are brownish throughout. They are on the highest part of the landscape.

Typical pedon of Newton loamy fine sand, undrained, in a wooded area; 700 feet west and 150 feet south of the northeast corner of sec. 2, T. 31 N., R. 5 W.

A1—0 to 6 inches; very dark gray (10YR 3/1) loamy fine sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine and very fine roots; few streaks of light gray (10YR 7/2) uncoated sand grains; very strongly acid; clear smooth boundary.

A2—6 to 10 inches; very dark gray (10YR 3/1) loamy fine sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine and very fine roots; common streaks of light gray (10YR 7/2) uncoated sand grains; very strongly acid; clear smooth boundary.

AC—10 to 15 inches; light brownish gray (10YR 6/2) loamy fine sand; few fine distinct dark gray (10YR 4/1) mottles; weak coarse subangular blocky structure; very friable; common fine and very fine roots; many very dark gray (10YR 3/1) organic streaks; very strongly acid; clear smooth boundary.

Cg1—15 to 25 inches; light brownish gray (10YR 6/2) fine sand; single grain; loose; few very fine roots; very strongly acid; clear smooth boundary.

Cg2—25 to 33 inches; light brownish gray (2.5Y 6/2) fine sand; single grain; loose; strongly acid; clear smooth boundary.

Cg3—33 to 60 inches; light brownish gray (10YR 6/2) fine sand; single grain; loose; strongly acid.

Reaction is very strongly acid to medium acid throughout the profile. The A horizon has chroma of 1 or 2. It is sand or loamy fine sand. The C horizon has hue of 10YR or 2.5Y and value of 4 to 6. It is sand, fine sand, or loamy fine sand.

Oakville Series

The Oakville series consists of deep, well drained and moderately well drained, rapidly permeable soils on outwash plains. These soils formed in sandy sediments. Slopes range from 1 to 15 percent.

Oakville soils are similar to Brems, Chelsea, Nesius, and Sparta soils and are adjacent to Newton and Zadog soils. Brems soils have grayish mottles in the lower part of the subsoil. Chelsea soils have textural bands in the subsoil. Nesius, Sparta, and Zadog soils have a dark surface layer that is thicker than that of the Oakville soils. Newton and Zadog soils are in the lower areas. They have a grayish subsoil.

Typical pedon of Oakville fine sand, 2 to 6 percent slopes, in a wooded area; 100 feet south and 1,800 feet east of the northwest corner of sec. 17, T. 31 N., R. 7 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; many fine and few medium roots; neutral; abrupt smooth boundary.

BA—4 to 9 inches; dark brown (10YR 4/3) fine sand; single grain; loose; many fine and few medium roots; slightly acid; clear wavy boundary.

Bw1—9 to 15 inches; dark yellowish brown (10YR 4/4) fine sand; single grain; loose; many fine roots; neutral; clear wavy boundary.

Bw2—15 to 34 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; many fine roots; neutral; clear wavy boundary.

C—34 to 60 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; common very fine roots; neutral.

The solum is 20 to 40 inches thick. Reaction is medium acid to neutral throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is sand, loamy sand, or fine sand. Some pedons have an Ap horizon. This horizon has value of 3 or 4 and chroma of 2. It is sand, loamy sand, or loamy fine sand. The B and C horizons are sand or fine sand. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The C horizon has value of 5 to 7 and chroma of 2 to 6. A moderately wet phase is mapped in the county.

Octagon Series

The Octagon series consists of deep, well drained, moderately permeable soils on recessional moraines. These soils formed in loamy sediments and in the underlying loamy till. Slopes range from 6 to 12 percent.

Octagon soils are similar to Parr and Wawasee soils and are adjacent to Brookston, Metamora, and Wawasee soils. Parr soils have a dark surface layer that is thicker than that of the Octagon soils. Wawasee soils have a surface layer that is lighter colored than that of the Octagon soils. They are in positions on the landscape similar to those of the Octagon soils. Brookston soils have a grayish subsoil. They are in the lower areas. Metamora soils have grayish mottles in the lower part of the subsoil. They are in the slightly lower areas.

Typical pedon of Octagon fine sandy loam, 6 to 12 percent slopes, eroded, in a cultivated field; 400 feet east and 1,600 feet south of the northwest corner of sec. 8, T. 29 N., R. 6 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sandy loam, dark grayish brown (10YR 4/2) dry; mixed with dark brown (10YR 4/3) material in the lower part; moderate medium granular structure; friable; common medium roots; about 2 percent gravel; slightly acid; abrupt smooth boundary.

BA—8 to 13 inches; dark brown (10YR 4/3) fine sandy loam; moderate medium subangular blocky structure; friable; few fine roots; patchy very dark gray (10YR 3/1) organic stains on faces of peds; about 5 percent gravel; medium acid; clear wavy boundary.

2Bt1—13 to 18 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; few fine roots; thin patchy dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; medium acid; clear wavy boundary.

2Bt2—18 to 30 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; slightly acid; clear wavy boundary.

2BC—30 to 36 inches; yellowish brown (10YR 5/4) loam; weak coarse subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 3 percent gravel; slight effervescence; mildly alkaline; gradual wavy boundary.

2C—36 to 60 inches; brown (10YR 5/3) loam; massive; friable; few discontinuous white (10YR 8/1) coatings of carbonate on internal planes; about 5 percent gravel; strong effervescence; mildly alkaline.

The solum is 24 to 40 inches thick. The Ap horizon has chroma of 1 or 2. It is fine sandy loam or sandy loam. It is medium acid to neutral. The 2Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam. It is medium acid or slightly acid in the upper part and slightly acid or neutral in the lower part. The 2C horizon has chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Odell Series

The Odell series consists of deep, somewhat poorly drained, moderately permeable soils on ground moraines. These soils formed in loamy sediments and in the underlying loam till. Slopes range from 0 to 2 percent.

Odell soils are similar to Andres and Darroch soils and are adjacent to Darroch and Wolcott soils. Andres soils have a substratum of silty glacial till. Darroch soils generally are stratified throughout the substratum. The Darroch soils that have a till substratum are stratified in the lower part of the subsoil and in the upper part of the substratum. They have loam till within a depth of 60 inches. They are in positions on the landscape similar to those of the Odell soils. Wolcott soils have a grayish subsoil. They are in the lower areas.

Typical pedon of Odell loam, in a cultivated area of Darroch, till substratum-Odell complex; 100 feet west and 2,500 feet south of the northeast corner of sec. 28, T. 27 N., R. 6 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; few fine and very fine roots; slightly acid; abrupt smooth boundary.

Bt1—10 to 20 inches; dark brown (10YR 4/3) clay loam; common fine faint dark gray (10YR 4/1) mottles; moderate medium subangular blocky structure; firm; few fine and very fine roots; discontinuous very dark grayish brown (10YR 3/2) organic stains in pores and old root channels; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; slightly acid; gradual wavy boundary.

Bt2—20 to 32 inches; brown (10YR 5/3) clay loam; common medium distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; common black (10YR 2/1) concretions of iron and manganese oxide; about 3 percent gravel; neutral; clear wavy boundary.

C1—32 to 46 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; about 3 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

C2—46 to 60 inches; brown (10YR 5/3) loam; massive; friable; many light gray (10YR 7/1) coatings of carbonate on internal planes; about 5 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates are 27 to 35 inches. Reaction is medium acid to neutral in the solum and mildly alkaline or moderately alkaline in the C horizon. The content of coarse fragments is 0 to 5 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 or 4.

Ormas Series

The Ormas series consists of deep, well drained soils on outwash plains. These soils formed in sandy and loamy sediments over sand and gravel. Permeability is rapid and moderately rapid in the solum and very rapid in the substratum. Slopes range from 2 to 6 percent.

Ormas soils are similar to Chelsea and Ormas Variant soils and are adjacent to Houghton and Martinsville soils.

Chelsea soils have less gravel in the lower part of the solum and in the substratum than the Ormas soils. Ormas Variant soils have more sand throughout than the Ormas soils. Houghton soils formed in more than 51 inches of muck. They are in the lower areas. Martinsville soils have more clay in the subsoil than the Ormas soils. They are in positions on the landscape similar to those of the Ormas soils.

Typical pedon of Ormas loamy fine sand, 2 to 6 percent slopes, in a cultivated field; 1,700 feet west and 150 feet south of the northeast corner of sec. 31, T. 30 N., R. 6 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

A—8 to 12 inches; brown (10YR 4/3) loamy fine sand; weak coarse subangular blocky structure; very friable; common fine roots; very strongly acid; clear wavy boundary.

E1—12 to 19 inches; yellowish brown (10YR 5/4) loamy fine sand; weak coarse subangular blocky structure; very friable; few fine roots; very strongly acid; clear wavy boundary.

E2—19 to 37 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; few very fine roots; medium acid; clear wavy boundary.

2Bt1—37 to 46 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; thin discontinuous brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; medium acid; gradual wavy boundary.

2Bt2—46 to 50 inches; dark brown (7.5YR 4/4) gravelly fine sandy loam; moderate medium subangular blocky structure; friable; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 16 percent gravel; neutral; clear wavy boundary.

3C—50 to 60 inches; brown (10YR 5/3) very gravelly coarse sand; single grain; loose; about 47 percent gravel; strong effervescence; moderately alkaline.

The solum is 48 to 50 inches thick. The A horizon has value of 3 to 5. It is loamy fine sand or loamy sand. It is very strongly acid to neutral. The E horizon has chroma of 3 or 4. It is loamy fine sand, loamy sand, or sand. It is medium acid or slightly acid. The 2Bt horizon has hue of 10YR or 7.5YR and value of 4 or 5. It is sandy clay loam, gravelly sandy clay loam, or gravelly fine sandy loam. It is strongly acid to neutral. The 3C horizon has chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Ormas Variant

The Ormas Variant consists of deep, well drained, rapidly permeable soils on outwash plains. These soils formed in sandy sediments over gravelly and sandy material. Slopes range from 2 to 6 percent.

Ormas Variant soils are similar to Chelsea and Ormas soils and are adjacent to Houghton and Martinsville soils. Chelsea soils have textural bands in the lower part of the solum. Houghton soils formed in more than 51 inches of muck. They are in the lower areas. Martinsville and Ormas soils have more clay in the solum than the Ormas Variant soils. Martinsville soils are in positions on the landscape similar to those of the Ormas Variant soils.

Typical pedon of Ormas Variant loamy sand, 2 to 6 percent slopes, in a cultivated field; 600 feet west and 1,100 feet north of the southeast corner of sec. 5, T. 28 N., R. 6 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine roots; about 1 percent gravel; strongly acid; abrupt smooth boundary.

E1—8 to 14 inches; dark brown (10YR 4/3) sand; single grain; loose; few fine roots; common very dark grayish brown (10YR 3/2) organic stains in pores and old root channels; about 2 percent gravel; medium acid; clear smooth boundary.

E2—14 to 24 inches; dark brown (10YR 4/3) sand; single grain; loose; few very fine roots; about 3 percent gravel; slightly acid; clear smooth boundary.

Bt—24 to 33 inches; dark brown (7.5YR 4/4) loamy coarse sand; weak coarse subangular blocky structure; very friable; few very fine roots; few patchy dark yellowish brown (10YR 3/4) clay bridges between sand grains; about 10 percent gravel; neutral; diffuse irregular boundary.

2C1—33 to 42 inches; dark yellowish brown (10YR 4/4) coarse sand; single grain; loose; about 13 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—42 to 52 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; about 15 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

2C3—52 to 60 inches; dark yellowish brown (10YR 4/4) coarse sand; single grain; loose; about 13 percent gravel; strong effervescence; moderately alkaline.

The solum is 33 to 38 inches thick. The A horizon is loamy sand or sand. It is strongly acid to slightly acid. The E and Bt horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. They are loamy sand, sand, or loamy coarse sand. The E horizon is strongly acid to slightly acid, and the Bt horizon is strongly acid to neutral. The 2C horizon has value of 4 or 5. It is gravelly coarse sand, coarse sand, gravelly sand, or sand. It is neutral to moderately alkaline.

Papineau Series

The Papineau series consists of deep, somewhat poorly drained soils on outwash plains. These soils formed in loamy outwash and in the underlying silty and clayey lacustrine sediments. Permeability is moderate in the upper part of the solum and slow in the lower part and in the substratum. Slopes are 0 to 1 percent.

The Papineau soils in this county are taxadjuncts to the series because they do not have a sufficient difference in clay content between the loamy outwash and the underlying clayey sediments to meet the criteria for contrasting textures. This difference, however, does not alter the usefulness or behavior of the soils.

Papineau soils are similar to Darroch and Strole soils and are adjacent to Iroquois, Montgomery, and Simonin soils. Darroch soils have less clay in the lower part of the solum and in the substratum than the Papineau soils. Strole soils have more clay in the upper part of the solum than the Papineau soils. Iroquois and Montgomery soils have a grayish subsoil. They are in the lower areas. Simonin soils have a dominantly brownish subsoil and have less clay in the upper part of the subsoil than the Papineau soils. They are in the slightly higher areas.

Typical pedon of Papineau sandy loam, in a cultivated field; 100 feet west and 1,600 feet north of the southeast corner of sec. 11, T. 28 N., R. 7 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine and very fine roots; very strongly acid; abrupt smooth boundary.

AB—10 to 14 inches; very dark gray (10YR 3/1) sandy clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; friable; common very fine roots; strongly acid; clear wavy boundary.

Btg1—14 to 24 inches; grayish brown (10YR 5/2) sandy clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; common very dark gray (10YR 3/1) organic stains on internal planes; medium acid; clear wavy boundary.

2Btg2—24 to 28 inches; grayish brown (2.5Y 5/2) silty clay; common medium distinct olive brown (2.5Y 4/4) mottles; moderate medium prismatic structure; firm; few very fine roots; thin continuous gray (10YR 5/1) clay films on faces of peds; neutral; clear wavy boundary.

2Btg3—28 to 32 inches; grayish brown (2.5Y 5/2) silty clay; common medium distinct olive brown (2.5Y 4/4) mottles; weak medium prismatic structure; firm; thin discontinuous gray (10YR 5/1) clay films on faces of peds; neutral; clear wavy boundary.

2Cg—32 to 60 inches; gray (N 6/0) silty clay; common coarse distinct olive brown (2.5Y 4/4) mottles; massive; firm; few white (10YR 8/1) coatings of carbonate on internal planes; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The depth to the underlying fine textured material is 18 to 30 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is sandy loam or sandy clay loam. It is very strongly acid to neutral. The Bt and 2Bt horizons have hue of 10YR, 5Y, or 2.5Y, value of 4 or 5, and chroma of 2 to 4. The Bt horizon is sandy clay loam, clay loam, or loam. It is medium acid to neutral. The 2Bt horizon is neutral or mildly alkaline. The 2Bt and 2C horizons are silty clay or clay. The 2C horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is mildly alkaline or moderately alkaline.

Parr Series

The Parr series consists of deep, well drained, moderately permeable soils on recessional moraines. These soils formed in loamy sediments and in underlying loamy till. Slopes range from 2 to 6 percent.

Parr soils are similar to Ayr, Corwin, Octagon, and Wawasee soils and are adjacent to Ayr and Brookston soils. Ayr soils have more sand in the upper part of the solum than the Parr soils. They are in positions on the landscape similar to those of the Parr soils. Corwin soils have grayish mottles in the lower part of the subsoil. Octagon soils have a thin, dark surface layer. Wawasee soils have a surface layer that is lighter colored than that of the Parr soils. Brookston soils have a grayish subsoil. They are in the lower areas.

Typical pedon of Parr fine sandy loam, in a cultivated area of Parr-Ayr complex, 2 to 6 percent slopes; 2,240 feet west and 400 feet south of the northeast corner of sec. 13, T. 29 N., R. 7 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine and very fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.

BA—10 to 14 inches; brown (10YR 4/3) fine sandy loam; moderate fine subangular blocky structure; firm; many fine roots; common very dark gray (10YR 3/1) organic stains in old root channels; about 4 percent gravel; slightly acid; clear smooth boundary.

2Bt1—14 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common very fine roots; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; about 1 percent gravel; slightly acid; gradual wavy boundary.

2Bt2—26 to 31 inches; yellowish brown (10YR 5/4) sandy clay loam; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2C—31 to 60 inches; brown (10YR 5/3) loam; massive; friable; few light gray (10YR 7/1) coatings of carbonate on internal planes; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 25 to 35 inches thick. The Ap horizon has chroma of 1 or 2. It is loam or fine sandy loam. It is medium acid to neutral. The 2Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is sandy clay loam, loam, or clay loam. It is medium acid or slightly acid in the upper part, and slightly acid or neutral in the lower part. The 2C horizon has chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Prochaska Series

The Prochaska series consists of deep, very poorly drained, rapidly permeable soils on the second bottoms of flood plains. These soils formed in sandy alluvium. Slopes are 0 to 1 percent.

Prochaska soils are similar to Craigmile and Suman soils and are adjacent to those soils. Craigmile and Suman soils have more clay in the upper part than the Prochaska soils. Craigmile soils are in the positions on the landscape similar to those of the Prochaska soils. Suman soils are in the slightly lower areas.

Typical pedon of Prochaska loamy sand, frequently flooded, in a cultivated field; 1,100 feet east and 200 feet north of the southwest corner of sec. 35, T. 33 N., R. 7 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many fine and very fine roots; medium acid; abrupt smooth boundary.

A—10 to 14 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; few fine distinct dark gray (10YR 4/1) mottles; weak medium subangular blocky structure; very friable; common fine and very fine roots; common discontinuous black (10YR 2/1) organic streaks; few splotches of light gray (10YR 7/2) uncoated sand grains; medium acid; clear wavy boundary.

Bg1—14 to 24 inches; dark grayish brown (10YR 4/2) loamy sand; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; common fine and very fine roots; common discontinuous very dark gray (10YR 3/1) organic streaks; slightly acid; gradual wavy boundary.

Bg2—24 to 33 inches; dark gray (10YR 4/1) loamy sand; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; few fine roots; common discontinuous very dark gray (10YR 3/1) organic streaks; slightly acid; clear wavy boundary.

BCg—33 to 36 inches; gray (10YR 5/1) loamy sand; common medium faint light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; few discontinuous very dark gray (10YR 3/1) organic streaks; neutral; clear wavy boundary.

Cg—36 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; slight effervescence; mildly alkaline.

The solum is 30 to 36 inches thick. The A horizon has value of 2 or 3 and chroma of 1 or 2 or is black (N 2/0). It is sand, loamy sand, or loamy fine sand. It is strongly acid to neutral. The Bg horizon has value of 4 to 6 and chroma of 1 or 2. It is sand or loamy sand and is medium acid to neutral. The C horizon has value of 5 to 7 and chroma of 1 to 3. It is medium acid to mildly alkaline.

Reddick Series

The Reddick series consists of deep, poorly drained soils on ground moraines. These soils formed in silty and loamy sediments over silty till. Permeability is moderate in the solum and slow or very slow in the substratum. Slopes are 0 to 1 percent.

Reddick soils are similar to Brookston, Montgomery, and Wolcott soils and are adjacent to Andres and Corwin soils. Brookston soils have more clay in the upper part of the subsoil than the Reddick soils and have a substratum of loam till. Montgomery soils have more clay throughout than the Reddick soils and formed in lacustrine sediments. Wolcott soils have less clay in the substratum than the Reddick soils. Andres soils have a dominantly brownish layer in the subsoil. They are in the slightly higher areas. Corwin soils have a dominantly brownish subsoil. They are in the higher areas.

Typical pedon of Reddick silty clay loam, in a cultivated field; 1,700 feet west and 475 feet north of the southeast corner of sec. 32, T. 27 N., R. 7 W.

Ap—0 to 11 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; firm; common fine and very fine roots; about 1 percent gravel; medium acid; abrupt smooth boundary.

AB—11 to 17 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; firm; common very fine roots; about 2 percent gravel; slightly acid; clear wavy boundary.

Bg1—17 to 23 inches; dark gray (10YR 4/1) clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; common very dark gray (10YR 3/1) organic stains on faces of peds; about 4 percent gravel; neutral; clear wavy boundary.

Bg2—23 to 32 inches; olive gray (5Y 5/2) clay loam; common coarse prominent olive brown (2.5Y 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; thin discontinuous dark gray (N 4/0) silt coatings on faces of peds; few very dark gray (10YR 3/1) organic stains on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

Bg3—32 to 42 inches; gray (5Y 5/1) clay loam; common medium prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few very fine roots; thin discontinuous dark gray (10YR 4/1) silt coatings on faces of peds; about 2 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

2BCg—42 to 50 inches; gray (5Y 5/1) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; about 8 percent gravel; strong effervescence; mildly alkaline; clear wavy boundary.

2Cg—50 to 60 inches; gray (N 6/0) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; massive; firm; about 2 percent gravel; strong effervescence; moderately alkaline.

The solum is 42 to 55 inches thick. It is silty clay loam or clay loam.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or is black (N 2/0). The B horizon has hue of 10YR or 5Y, value of 4 to 6, and chroma of 1 or 2 or is gray (N 6/0). The 2C horizon has hue of 10YR or 5Y, value of 4 or 5, and chroma of 1 to 4 or is gray (N 6/0). It is mildly alkaline or moderately alkaline.

Rensselaer Series

The Rensselaer series consists of deep, very poorly drained, moderately permeable soils on outwash plains and recessional moraines. These soils formed in stratified, loamy and silty sediments. Slopes are 0 to 1 percent.

Rensselaer soils are similar to Brookston, Iroquois, Reddick, and Wolcott soils and are adjacent to Aubbeenaubbee, Darroch, and Wolcott soils. Brookston, Reddick, and Wolcott soils have till within a depth of 60 inches. Iroquois soils have more clay in the lower part of the solum and in the substratum than the Rensselaer soils. Aubbeenaubbee and Darroch soils have a dominantly brownish layer in the upper part of the subsoil. They are in the slightly higher areas. Wolcott soils have less clay in the subsoil than the Rensselaer soils. They are in positions on the landscape similar to those of the Rensselaer soils.

Typical pedon of Rensselaer loam, in a cultivated field; 400 feet west and 1,100 feet south of the northeast corner of sec. 26, T. 28 N., R. 7 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine and very fine roots; medium acid; abrupt smooth boundary.

AB—10 to 15 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; common fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; common fine and very fine roots; slightly acid; clear wavy boundary.

Btg1—15 to 20 inches; dark gray (10YR 4/1) loam; common fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; slightly acid; clear smooth boundary.

Btg2—20 to 25 inches; grayish brown (2.5Y 5/2) loam; common medium distinct light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous gray (10YR 5/1) clay films on faces of peds; slightly acid; clear wavy boundary.

Btg3—25 to 37 inches; gray (10YR 5/1) loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; slight effervescence; mildly alkaline; gradual wavy boundary.

2BCg—37 to 42 inches; gray (10YR 6/1) silt loam; common coarse distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; firm; slight effervescence; mildly alkaline; clear wavy boundary.

2Cg1—42 to 50 inches; gray (10YR 6/1) silt loam that has thin strata of fine sand; common medium distinct strong brown (7.5YR 5/8) mottles; massive; friable; strong effervescence; moderately alkaline; clear wavy boundary.

2Cg2—50 to 60 inches; gray (5Y 5/1) silt loam that has thin strata of fine sand and very fine sand; common coarse prominent strong brown (7.5YR 5/8) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum is 40 to 50 inches thick. The A horizon has value of 2 or 3. It is loam or fine sandy loam. It is medium acid to neutral. The Btg horizon has hue of 10YR, 5YR, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is loam, clay loam, or sandy clay loam. It is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. The 2Cg horizon has hue of 10YR or 5Y, value of 5 or 6, and chroma of 1 or 2. It is mildly alkaline or moderately alkaline and contains free carbonates. Till substratum phases are mapped in the county.

Rockton Series

The Rockton series consists of moderately deep, well drained, moderately permeable soils on ground moraines and outwash plains. These soils formed in loamy sediments over limestone bedrock. Slopes range from 1 to 3 percent.

Rockton soils are adjacent to Faxon, Grovecity, and Sparta soils. Grovecity soils do not have limestone bedrock within a depth of 40 inches. They are in the slightly lower areas. Faxon soils have a grayish subsoil. They are in the lower areas. Sparta soils do not have limestone bedrock within a depth of 60 inches. They are in the slightly higher areas.

Typical pedon of Rockton fine sandy loam, 1 to 3 percent slopes, in a cultivated field; 2,450 feet west and 1,400 feet north of the southeast corner of sec. 23, T. 29 N., R. 6 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine and very fine roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

A—10 to 15 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; friable; common fine and very fine roots; about 1 percent gravel; slightly acid; clear smooth boundary.

Bt1—15 to 28 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; few very fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; about 2 percent gravel; medium acid; gradual wavy boundary.

Bt2—28 to 36 inches; brown (10YR 4/3) sandy clay loam; moderate medium subangular blocky structure; firm; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; about 2 percent gravel; slightly acid; abrupt wavy boundary.

R—36 inches; consolidated limestone bedrock.

The solum is 20 to 40 inches thick. The A horizon has chroma of 1 or 2. It is fine sandy loam or loam. It is medium acid or slightly acid. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is loam, sandy clay loam, or clay loam. It is medium acid or slightly acid in the upper part and slightly acid or neutral in the lower part.

Simonin Series

The Simonin consists of deep, moderately well drained soils on outwash plains. These soils formed in sandy and loamy outwash and in the underlying lacustrine sediments. Permeability is rapid in the sandy material and slow in the lower part of the solum and in the substratum. Slopes range from 0 to 2 percent.

Simonin soils are similar to Markton soils and are adjacent to Iroquois, Montgomery, Papineau, and Strole soils. Markton soils have a substratum of loam till. Iroquois and Montgomery soils have a grayish subsoil and are in the lower areas. Papineau and Strole soils have more clay in the upper part of the solum than the Simonin soils. They are in the slightly lower areas.

Typical pedon of Simonin loamy sand, 0 to 2 percent slopes, in a cultivated field; 120 feet west and 500 feet north of the southeast corner of sec. 1, T. 28 N., R. 7 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

A—10 to 14 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; weak medium subangular blocky structure; very friable; common fine roots; very dark grayish brown (10YR 3/2) organic stains on faces of peds; slightly acid; clear wavy boundary.

BA—14 to 26 inches; dark brown (10YR 4/3) sand; common medium distinct pale brown (10YR 6/3) and strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure parting to moderate medium granular; friable; few very fine roots; slightly acid; clear wavy boundary.

Bt1—26 to 34 inches; yellowish brown (10YR 5/4) fine sandy loam; common medium distinct light brownish gray (10YR 6/2) and many medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; thin continuous dark brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.

2Bt2—34 to 40 inches; olive brown (2.5Y 4/4) silty clay; common medium prominent yellowish brown (10YR 5/8) mottles; moderate coarse prismatic structure; firm; thin continuous gray (N 6/0) clay films on faces of peds; neutral; gradual wavy boundary.

2C—40 to 60 inches; dark grayish brown (2.5Y 4/2) clay; massive; very firm; common gray (10YR 6/1) coatings of carbonate on internal planes; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The sandy material is 25 to 28 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 to 3. When dry, it has value of 5 or less. It is loamy sand or loamy fine sand. It is slightly acid or neutral. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is fine sandy loam or sandy loam. It is medium acid or slightly acid. The 2Bt and 2C horizons are silty clay or clay. The 2Bt horizon has hue of 10YR or 2.5Y, value of

4 or 5, and chroma of 3 or 4. It is slightly acid or neutral. The 2C horizon has value of 4 or 5 and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Sloan Series

The Sloan series consists of deep, very poorly drained, moderately permeable soils on flood plains. These soils formed in silty and loamy alluvium. Slopes are 0 to 1 percent.

Sloan soils are similar to Craigmile and Suman soils. Craigmile soils have less clay in the solum than the Sloan soils. Suman soils have a sandy substratum.

Typical pedon of Sloan silt loam, frequently flooded, undrained, in a wooded area; 220 feet east and 380 feet south of the northwest corner of sec. 2, T. 28 N., R. 6 W.

A—0 to 6 inches; very dark gray (N 3/0) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; common medium and fine roots; neutral; clear smooth boundary.

AB—6 to 15 inches; very dark gray (10YR 3/1) clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; firm; common medium and fine roots; common reddish brown (5YR 5/3) stains in old root channels; neutral; gradual wavy boundary.

Bg1—15 to 24 inches; dark gray (10YR 4/1) clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common reddish brown (5YR 5/3) stains in old root channels; neutral; clear wavy boundary.

Bg2—24 to 40 inches; gray (10YR 5/1) clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; many brown (10YR 5/3) stains in old root channels; neutral; clear wavy boundary.

2Cg—40 to 60 inches; gray (10YR 5/1) fine sandy loam that has thin strata of silt loam, sand, loamy sand, and loam; many fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; common black (N 2/0) iron and manganese stains; slight effervescence; mildly alkaline.

The solum is 37 to 44 inches thick. The A horizon has hue of 10YR or 2.5Y, value of 3, and chroma of 1 or is very dark gray (N 3/0). It is silt loam, loam, clay loam, or silty clay loam. It is slightly acid to mildly alkaline. The Bg horizon has value of 4 or 5. It is loam or clay loam. It is slightly acid to moderately alkaline. The 2Cg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or is gray (N 5/0). It is fine sandy loam or sandy loam that has strata of sand, fine sand, loamy sand, loam, or silt loam. It is neutral to moderately alkaline.

Sparta Series

The Sparta series consists of deep, excessively drained, rapidly permeable soils on recessional moraines and outwash plains. These soils formed in sandy sediments. Permeability is generally rapid. In the loamy substratum phases, however, it is moderate in the substratum. Slopes range from 2 to 6 percent.

Sparta soils are similar to Ayr, Nesius, and Oakville soils and are adjacent to Ayr and Rockton soils. Ayr soils have more clay in the lower part of the solum and in the substratum than the Sparta soils. They are in positions on the landscape similar to those of the Sparta soils. Nesius soils have grayish mottles in the substratum. Oakville soils have a surface layer that is lighter colored than that of the Sparta soils. Rockton soils have limestone bedrock within a depth of 40 inches. They are in the lower areas.

Typical pedon of Sparta sand, 2 to 6 percent slopes, in a cultivated field; 150 feet north and 2,600 feet east of the southwest corner of sec. 6, T. 29 N., R. 6 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very loose; many medium and fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

A—10 to 17 inches; very dark grayish brown (10YR 3/2) fine sand, grayish brown (10YR 5/2) dry; single grain; loose; common medium and fine roots; neutral; clear wavy boundary.

BA—17 to 36 inches; dark brown (10YR 4/3) fine sand; single grain; loose; common medium and fine roots; neutral; gradual wavy boundary.

Bw1—36 to 48 inches; yellowish brown (10YR 5/6) sand; single grain; loose; few medium and fine roots; neutral; gradual wavy boundary.

Bw2—48 to 60 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; few fine roots; neutral; gradual wavy boundary.

Bw3—60 to 76 inches; brownish yellow (10YR 6/6) fine sand; single grain; loose; neutral; gradual wavy boundary.

Bw4—76 to 80 inches; pale brown (10YR 6/3) loamy sand; massive; very friable; neutral.

The solum is 42 to 80 inches thick. It is sand, fine sand, or loamy sand.

The A horizon is strongly acid to neutral. The Bw horizon has value of 4 to 6 and chroma of 3 to 6. Some pedons have a C horizon. This horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is sand or fine sand. A loamy substratum phase is mapped in the county.

Strole Series

The Strole series consists of deep, somewhat poorly drained, slowly permeable soils on lake plains. These soils formed in stratified, silty and clayey lacustrine sediments. Slopes are 0 to 1 percent.

Strole soils are similar to Papineau soils and are adjacent to Iroquois, Lucas, Montgomery, and Simonin soils. Iroquois and Papineau soils have less clay in the upper part of the solum than the Strole soils. Iroquois and Montgomery soils have a grayish subsoil. They are in the lower areas. Lucas and Simonin soils are in the higher areas. They have a dominantly brownish subsoil. Also, Simonin soils have less clay in the upper part of the solum than the Strole soils.

Typical pedon of Strole clay loam, in a cultivated field; 800 feet west and 2,450 feet south of the northeast corner of sec. 8, T. 28 N., R. 7 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; firm; many medium and fine roots; slightly acid; abrupt smooth boundary.

A—10 to 13 inches; very dark gray (10YR 3/1) clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; firm; common medium and fine roots; slightly acid; clear wavy boundary.

Btg1—13 to 17 inches; olive brown (2.5Y 4/4) clay; common fine distinct dark grayish brown (2.5Y 4/2) mottles; moderate medium angular blocky structure; firm; common fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; discontinuous very dark gray (10YR 3/1) organic stains on faces of peds; slightly acid; clear wavy boundary.

Btg2—17 to 22 inches; light olive brown (2.5Y 5/4) clay; common medium distinct gray (5Y 5/1) mottles; moderate medium prismatic structure; firm; few very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; discontinuous very dark grayish brown (10YR 3/2) organic stains on faces of peds; slight effervescence; mildly alkaline; gradual wavy boundary.

BC—22 to 29 inches; light olive brown (2.5Y 5/4) silty clay; common medium distinct gray (5Y 5/1) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; few very fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; strong effervescence; mildly alkaline; gradual wavy boundary.

Cg—29 to 60 inches; olive gray (5Y 5/2) clay; common medium distinct light olive brown (2.5Y 5/4) mottles; massive; very firm; common white (10YR 8/1) coatings of carbonate on internal planes; about 1 percent gravel; strong effervescence; moderately alkaline.

The solum is 25 to 36 inches thick. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or clay loam. It is medium acid to neutral. The Btg and Cg horizons are clay or silty clay. The Btg horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is medium acid to neutral in the upper part and neutral or mildly alkaline in the lower part. The Cg horizon has hue of 5Y or 2.5Y, value of 5 or 6, and chroma of 1 to 3. It is mildly alkaline or moderately alkaline.

Suman Series

The Suman series consists of deep, very poorly drained soils on the first bottoms of flood plains. These soils formed in silty and loamy alluvium over sandy deposits. Permeability is moderately slow in the solum and rapid in the substratum. Slopes are 0 to 1 percent.

Suman soils are similar to Craigmile, Prochaska, and Sloan soils and are adjacent to Craigmile and Prochaska soils. Craigmile and Prochaska soils have less clay in the solum than the Suman soils. They are in the slightly higher areas. Sloan soils have more silt and clay throughout than the Suman soils.

Typical pedon of Suman loam, frequently flooded, in a cultivated field; 1,800 feet east and 900 feet south of the northwest corner of sec. 32, T. 33 N., R. 6 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common medium and fine roots; neutral; abrupt smooth boundary.

A—10 to 16 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; few fine distinct dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm; common fine and very fine roots; common medium reddish brown (2.5YR 4/4) iron and manganese stains on peds and lining old root channels; discontinuous streaks of light gray (10YR 7/2) uncoated sand grains; neutral; clear wavy boundary.

Bg—16 to 28 inches; dark gray (10YR 4/1) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few very fine roots; common medium reddish brown (2.5YR 4/4) iron and manganese stains on peds and lining old root channels; discontinuous streaks of light gray (10YR 7/2) uncoated sand grains; discontinuous black (10YR 2/1) organic streaks; neutral; clear wavy boundary.

2Cg1—28 to 40 inches; grayish brown (10YR 5/2) sand that has a few discontinuous strata of gray (10YR 5/1) loamy sand; common medium distinct yellowish brown (10YR 5/8) mottles; single grain; loose; discontinuous very dark gray (10YR 3/1) organic streaks; neutral; gradual wavy boundary.

2Cg2—40 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; slight effervescence; mildly alkaline.

The solum is 22 to 38 inches thick. Reaction is slightly acid to mildly alkaline throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2 or is black (N 2/0). It is loam, clay loam, or silt loam. The Bg horizon has value of 4 or 5 and chroma of 1 or 2. It is loam, clay loam, silt loam, or sandy clay loam. The 2Cg horizon has value of 5 or 6 and chroma of 2 to 4. It is loamy sand, coarse sand, fine sand, or sand.

Warners Series

The Warners series consists of deep, very poorly drained soils on outwash plains. These soils formed in loamy sediments over marl. They are moderately permeable in the solum. Slopes are 0 to 1 percent.

The Warner soils in this county have more sand and less clay than is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Warners soils are similar to Edwards soils and are adjacent to those soils. Edwards soils have an organic surface soil. They are in positions on the landscape similar to those of the Warners soils.

Typical pedon of Warners fine sandy loam, in a cultivated field; 500 feet east and 500 feet north of the southwest corner of sec. 24, T. 32 N., R. 6 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak fine granular structure; friable; many fine and very fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

AC—10 to 14 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; very friable; few white (10YR 8/1) decayed shell fragments; common fine and very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

2C1—14 to 21 inches; yellowish brown (10YR 5/6) marl; massive; very friable; few very fine roots; few very dark gray (10YR 3/1) organic stains on faces of peds; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—21 to 33 inches; light yellowish brown (10YR 6/4) marl; massive; very friable; few very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

2C3—33 to 50 inches; pale brown (10YR 6/3) marl; massive; very friable; strong brown (7.5YR 5/8) material around old root channels; strong effervescence; moderately alkaline; clear wavy boundary.

2C4—50 to 55 inches; light gray (10YR 7/2) marl; massive; very friable; yellowish brown (10YR 5/4) material around old root channels; strong effervescence; moderately alkaline; clear wavy boundary.

2C5—55 to 60 inches; gray (5Y 5/1) marl; massive; very friable; yellowish brown (10YR 5/4) material around old root channels; strong effervescence; moderately alkaline.

The A horizon is 12 to 14 inches thick. It has chroma of 1 or 2. It is slightly acid to moderately alkaline. The 2C horizon has hue of 10YR or 5Y, value of 5 to 7, and chroma of 1 to 6.

Watseka Series

The Watseka series consists of deep, somewhat poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy sediments. Slopes are 0 to 1 percent.

Watseka soils are similar to Morocco and Nesius soils and are adjacent to Maumee and Nesius soils. Morocco soils have a surface layer that is lighter colored than that of the Watseka soils. Nesius soils have a dominantly brownish solum. They are in the slightly higher areas. Maumee soils have a grayish subsoil. They are in the lower areas.

Typical pedon of Watseka loamy fine sand, in a cultivated field; 1,400 feet west and 100 feet north of the southeast corner of sec. 33, T. 28 N., R. 7 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak medium granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

BA—10 to 15 inches; grayish brown (10YR 5/2) fine sand; weak medium subangular blocky structure; very friable; few fine roots; neutral; clear smooth boundary.

BE—15 to 24 inches; pale brown (10YR 6/3) fine sand; common fine distinct light gray (10YR 7/2) mottles; weak medium subangular blocky structure; very friable; few very fine roots; neutral; clear wavy boundary.

Bg—24 to 30 inches; light brownish gray (10YR 6/2) fine sand; common fine distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; slightly acid; clear wavy boundary.

Cg1—30 to 45 inches; grayish brown (10YR 5/2) fine sand; many fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; slightly acid; clear wavy boundary.

Cg2—45 to 51 inches; gray (10YR 5/1) fine sand; common fine faint grayish brown (10YR 5/2) mottles; single grain; loose; slightly acid; clear wavy boundary.

Cg3—51 to 60 inches; gray (10YR 6/1) fine sand; few fine faint light brownish gray (10YR 6/2) mottles; single grain; loose; slightly acid.

The solum is 24 to 34 inches thick. It is strongly acid to neutral.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is loamy fine sand, loamy sand, or sand. The BE and C horizons are fine sand or sand. The BE horizon has value of 4 to 6 and chroma of 2 or 3. The C horizon has value of 5 or 6 and chroma of 1 to 3. It is medium acid to neutral.

Wawasee Series

The Wawasee series consists of deep, well drained, moderately permeable soils on recessional moraines. These soils formed in loamy sediments and in the underlying loam till. Slopes range from 2 to 6 percent.

Wawasee soils are similar to Metamora, Metea, Octagon, and Parr soils and are adjacent to Brookston, Metea, and Octagon soils. Metamora and Octagon soils have a thin, dark surface layer. Also, Metamora soils have a dominantly grayish subsoil. Metea and Octagon soils are in positions on the landscape similar to those of the Wawasee soils. Metea soils have more sand in the upper part of the solum than the Wawasee soils. Parr soils have a thick, dark surface layer. Brookston soils have a grayish subsoil. They are in the lower areas.

Typical pedon of Wawasee loam, 2 to 6 percent slopes, eroded, in an idle field; 2,475 feet east and 1,600 feet north of the southwest corner of sec. 17, T. 29 N., R. 7 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; mixed with dark yellowish brown (10YR 4/4) material in the lower part; moderate medium granular structure; friable; many fine and very fine roots; about 4 percent gravel; medium acid; abrupt smooth boundary.

BA—7 to 10 inches; dark brown (10YR 4/3) loam mixed with dark yellowish brown (10YR 4/4) material; weak medium subangular blocky structure; friable; many fine and very fine roots; about 4 percent gravel; strongly acid; clear wavy boundary.

Bt1—10 to 19 inches; dark yellowish brown (10YR 4/4) loam; moderate fine subangular blocky structure; firm; few fine and very fine roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; few black (10YR 2/1) accumulations of iron and manganese oxide; strongly acid; gradual wavy boundary.

Bt2—19 to 28 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; few very fine roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; medium acid; clear wavy boundary.

2C—28 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; few light brownish gray (10YR 6/2) coatings of carbonate on internal planes; about 5 percent gravel; few red (2.5YR 4/8) accumulations of iron oxide; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates are 28 to 38 inches. The content of coarse fragments is 0 to 5 percent in the Ap horizon and 1 to 5 percent in the Bt and 2C horizons.

The Ap horizon has chroma of 2 or 3. It is fine sandy loam, loam, or sandy loam. It is medium acid to neutral. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is strongly acid to neutral. The 2C horizon has chroma of 3 or 4. It is neutral to moderately alkaline.

Whitaker Series

The Whitaker series consists of deep, somewhat poorly drained, moderately permeable soils on outwash plains and recessional moraines. These soils formed in loamy sediments over stratified, loamy and sandy deposits. Slopes range from 0 to 2 percent.

Whitaker soils are similar to Darroch soils and are adjacent to Martinsville soils. Darroch soils have a dark surface layer. Martinsville soils have a brownish subsoil. They are in the higher areas.

Typical pedon of Whitaker fine sandy loam, in a cultivated field; 200 feet south and 100 feet east of the northwest corner of sec. 26, T. 30 N., R. 6 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common medium and fine roots; about 4 percent gravel; medium acid; abrupt smooth boundary.

E—9 to 15 inches; pale brown (10YR 6/3) loam; common fine distinct yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; friable; few fine roots; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; about 1 percent gravel; very strongly acid; clear wavy boundary.

Bt1—15 to 21 inches; grayish brown (10YR 5/2) clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous gray (10YR 5/1) clay films on faces of peds; about 1 percent gravel; very strongly acid; clear wavy boundary.

Bt2—21 to 28 inches; grayish brown (10YR 5/2) sandy clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin continuous gray (10YR 5/1) clay films on faces of peds; about 9 percent gravel; very strongly acid; clear wavy boundary.

Bt3—28 to 34 inches; light brownish gray (10YR 6/2) sandy clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure; firm; few fine roots; medium continuous gray (10YR 6/1) clay films on faces of peds; about 8 percent gravel; very strongly acid; gradual wavy boundary.

C—34 to 60 inches; light brownish gray (10YR 6/2) loam that has thin strata of very fine sand and sand; many medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; about 4 percent gravel; slightly acid.

The solum is 25 to 38 inches thick. The Ap horizon is sandy loam, fine sandy loam, or loam. It is medium acid to neutral. The E horizon has value of 5 or 6. It is loam or sandy loam. It is very strongly acid to slightly acid. The Bt horizon has value of 5 or 6 and chroma of 2 to 4. It is clay loam or sandy clay loam. It is very strongly acid to neutral. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4. It is fine sandy loam or loam that has strata of silt loam, fine sand, very fine sand, sand, or loamy sand. It is slightly acid to moderately alkaline.

Wolcott Series

The Wolcott series consists of deep, very poorly drained, moderately permeable soils on ground moraines. These soils formed in loamy sediments and in the underlying loam till. Slopes range from 0 to 2 percent.

Wolcott soils are similar to Brookston, Reddick, and Rensselaer soils and are adjacent to Darroch, Odell, and Rensselaer soils. Brookston and Odell soils have more clay in the subsoil than the Wolcott soils. Darroch and Odell soils have a dominantly brownish layer in the subsoil. They are in the slightly higher areas. Darroch and Rensselaer soils are stratified above the loam till. Rensselaer soils are in positions on the landscape similar to those of the Wolcott soils. Reddick soils have more silt and clay in the substratum than the Wolcott soils.

Typical pedon of Wolcott clay loam, in a cultivated area of Rensselaer, till substratum-Wolcott complex; 2,600 feet south and 150 feet west of the northeast corner of sec. 28, T. 27 N., R. 6 W.

Ap—0 to 11 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many medium and fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

A—11 to 17 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; common medium distinct yellowish brown (10YR 5/8) and brown (10YR 4/3) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Bg—17 to 33 inches; olive gray (5Y 5/2) loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common very dark gray (10YR 3/1) stains and concretions of iron and manganese oxide; few very dark grayish brown (10YR 3/2) organic stains lining old root channels; about 6 percent gravel; neutral; clear wavy boundary.

C—33 to 60 inches; light olive brown (2.5Y 5/4) loam; many coarse distinct grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6) mottles; massive; friable; few very dark gray (10YR 3/1) iron and manganese oxide stains; about 4 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 48 inches thick. It is loam or clay loam. The content of gravel is less than 5 percent in the A horizon and 5 to 10 percent in the B horizon. Reaction is slightly acid or neutral in the A and B horizons and mildly alkaline or moderately alkaline in the C horizon.

The A horizon has value of 2 or 3. The Bg horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The C horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 to 4 or is gray (N 5/0 or 6/0). The content of coarse fragments in this horizon is 5 to 10 percent.

Zadog Series

The Zadog series consists of deep, very poorly drained soils in broad depressions on outwash plains. These soils formed in loamy and sandy sediments. Permeability is moderate in the solum and rapid in the substratum. Slopes range from 0 to 2 percent.

Zadog soils are similar to Maumee and Newton soils and are adjacent to Brems, Maumee, Morocco, and Oakville soils. The similar and adjacent soils do not have accumulations of iron in the solum. Brems soils have a dominantly brownish subsoil. They are in the higher areas. Maumee soils have more sand in the solum than the Zadog soils. They are in positions on the landscape similar to those of the Zadog soils. Morocco soils have a dominantly brownish layer in the upper part of the subsoil. They are in the slightly higher areas. Oakville soils are brownish throughout the solum. They are on the highest part of the landscape.

Typical pedon of Zadog loamy sand, in a cultivated area of Zadog-Maumee loamy sands; 150 feet west and 250 feet south of the northeast corner of sec. 27, T. 32 N., R. 6 W.

Ap—0 to 11 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; many medium and fine roots; neutral; abrupt smooth boundary.

A—11 to 17 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; common fine and very fine roots; common streaks of grayish brown (10YR 5/2) uncoated sand grains; thin streaks of very dark gray (10YR 3/1) organic material; common medium strong brown (7.5YR 5/6) iron accumulations and stains; neutral; gradual wavy boundary.

Bs—17 to 24 inches; yellowish red (5YR 5/6) sandy clay loam; few fine distinct brown (7.5YR 4/4) and dark brown (7.5YR 3/2) mottles; massive; firm; common fine and very fine roots; common thick discontinuous very dark gray (10YR 3/1) organic streaks and lenses; about 4 percent iron nodules; neutral; gradual wavy boundary.

Bg—24 to 26 inches; grayish brown (10YR 5/2) sandy clay loam; many coarse distinct yellowish brown (10YR 5/6) mottles; massive; firm; few very fine roots; few thin discontinuous very dark gray (10YR 3/1) organic streaks and coatings on faces of peds; few fine and medium strong brown (7.5YR 5/6) iron accumulations; few light gray (10YR 7/2) and very pale brown (10YR 8/3) uncoated sand grains; violent effervescence; moderately alkaline; clear wavy boundary.

C1—26 to 33 inches; pale brown (10YR 6/3) sand; many coarse prominent pinkish gray (7.5YR 6/2) and light brown (7.5YR 6/4) mottles; single grain; loose; few very fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—33 to 49 inches; strong brown (7.5YR 4/6) sand; single grain; loose; violent effervescence; moderately alkaline; gradual wavy boundary.

C3—49 to 60 inches; yellowish brown (10YR 5/4) sand; many coarse distinct grayish brown (10YR 5/2) and pale brown (10YR 6/3) mottles; single grain; loose; violent effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The A and Bs horizons are slightly acid or neutral. The A horizon has value of 2 or 3 and chroma of 1 or 2 or is black (N 2/0). The Bs horizon has value of 4 or 5 and chroma of 4 to 8. The Bs and Bg horizons are loam, fine sandy loam, or sandy clay loam. The Bg horizon has value of 4 to 6 and chroma of 1 or 2. It is neutral to moderately alkaline. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6. It is sand or loamy sand. It is mildly alkaline or moderately alkaline. In some pedons the upper part of this horizon has thin streaks or lenses of organic material, which has chroma of 1 or 2.

Formation of the Soils

This section relates the major factors of soil formation to the soils in Jasper County. It also describes the processes of soil formation.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Some time is always required for differentiation of soil horizons.

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

Parent Material

The parent materials of the soils in Jasper County are alluvium; glacial till; ice-contact, stratified drift; organic material; outwash; and lacustrine sediment.

Alluvial material was recently deposited by floodwater along present streams. This material varies in texture, depending on the speed of the water from which it was deposited. The alluvium deposited along the Iroquois River is primarily loamy, indicating a rather sluggish stream. The soils along the Kankakee River formed in coarser textured material, indicating a swift stream. Craigmile and Sloan are examples of soils that formed in alluvium.

Glacial till is unsorted, unstratified sediment laid down directly by glaciers with a minimum of water action. The glacial till in Jasper County is calcareous, friable or firm sandy loam, loam, silty clay loam, and clay loam. Brookston and Parr are examples of soils that formed in outwash and in the underlying glacial till. These soils typically are medium textured and have well developed structure.

Ice-contact, stratified drift is sorted sediment deposited directly by glaciers with considerable water action. In Jasper County it is coarse textured or moderately coarse textured. Ormas soils are an example of soils that formed in this material.

Organic material is made up of plant remains. After the glaciers withdrew from the survey area, water was left standing in depressions on end moraines and outwash plains. Grasses and sedges growing around the edges of these lakes died, and their remains accumulated in the water. Because of wetness and the cool temperature, the plant remains did not decompose quickly. Later, herbaceous plants and other water-tolerant species grew in the areas and their residue accumulated. Eventually, the lakes were filled with organic residue, which developed slowly into peat. In some areas the plant remains decomposed into muck. In other areas the material has changed little since deposition. Adrian and Houghton are examples of soils that formed in organic material.

Outwash material was deposited by running water from melting glaciers. The size of the particles that make up outwash varies, depending on the velocity of the water that carried the material. Outwash deposits in the county are stratified in some areas, generally are poorly sorted, and are coarse textured to moderately fine textured. Brems and Martinsville are examples of soils that formed in outwash material.

Lacustrine material was deposited from relatively still water. Suspended particles, such as very fine sand, silt, and clay, settled out in still, or ponded, glacial meltwater lakes. Lacustrine deposits are generally silty or clayey. Montgomery and Strole are examples of soils that formed in this material.

Relief

Relief affects the thickness of the solum, the thickness and organic matter content of the surface soil, drainage, reaction, soil temperature, and soil color.

In Jasper County, Reddick and other nearly level soils tend to have a solum that is thicker than that of the more sloping soils. The moderately sloping Octagon soils have a thinner solum because of erosion and runoff.

Warners and other soils in depressions commonly have an accumulation of organic matter. The depressions act as settling basins. They accumulate mineral material washed in from the higher surrounding areas. They also tend to accumulate organic material because they are slightly wetter and cooler than the surrounding soils.

Generally, the water table is closer to the surface in depressional soils, such as Brookston, than in sloping soils, such as Parr. Saturation alters physical and chemical reactions. Root growth is often retarded in saturated soils because of a lack of oxygen. Also, these soils warm up more slowly in spring than the surrounding soils.

The water table in somewhat poorly drained soils, such as Andres, fluctuates seasonally. During periods when the soils are not saturated, air moves into the profile and oxidation occurs. As a result, mottles generally form.

Climate

Climatic factors, especially rainfall and temperature, significantly affect soil formation. Water is necessary before soil formation can occur. It affects the plants and animals that contribute to soil formation, transports material over the surface and within the profile, and restructures soil material when it freezes. Rainfall penetrates the surface or becomes runoff. Water losses within the soil occur mainly through evaporation, transpiration, and leaching.

Extremes in weather conditions have a considerable influence on soil reaction, organic matter, and relief. They can significantly alter the soils in a short period. An intense rainstorm, for example, can result in severe erosion or the formation of gullies. Also, a droughty, very hot summer can greatly retard plant growth and thus reduce the amount of organic matter added to the soil.

Plant and Animal Life

Organisms have played a vital role in the formation of soils in Jasper County. The kind of organic material in the soil depends on the kinds of plants and animals that have been in or on the soil. For example, Martinsville and other soils that formed dominantly under forest vegetation generally have less organic matter than Corwin and other soils that formed dominantly under grasses.

The chief contributions of plant and animal life to soil formation are the addition of organic matter to the soil and the transformation of litter into humus. The remains of plants and animals accumulated on the surface, decayed, and eventually became organic matter in the soil. Bacteria and other micro-organisms helped to break down the organic matter into plant nutrients. Decayed plant roots and earthworms provided channels for the downward movement of air and water.

Time

Time determines the degree of profile development. The influence of time may be altered by landscape characteristics. For example, erosion or deposition can significantly reduce the impact of time on soil formation.

The length of time that soil-forming factors have affected a soil are reflected in the stage of profile development. The terms young, mature, and old are applied to the stages of profile development. Wawasee and Brookston soils are considered mature because of their advanced development. Old soils are not significant in the county as relatively stable conditions have prevailed for only about 12,000 to 15,000 years.

The factors affecting the rate of soil formation include the intensity of weathering and the physical and chemical changes in the soil material. Landforms are constantly changing as surfaces are truncated or buried. As the land surface is modified, the age of the soil is affected.

Processes of Soil Formation

Several processes have been involved in the formation of the soils in Jasper County. These processes are the accumulation of organic matter; the dissolution, transfer, and removal of calcium carbonates and bases; the liberation and translocation of silicate clay minerals; and the reduction and transfer of iron. In most soils more than one of these processes have helped to differentiate horizons.

Some organic matter has accumulated in the surface layer of all the soils in the county. The organic matter content of some soils is low, but that of others is high. Generally, the soils that have the most organic matter, such as Gilford and Rensselaer soils, have a thick, dark surface soil.

Carbonates and bases have been leached from the upper horizons of nearly all the soils in the county. Leaching probably preceded the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, leaching is indicated by the absence of carbonates and by an acid reaction. Leaching of wet soils is slow because of a high water table or the slow movement of water through the profile.

Silicate clays accumulate in pores and other voids and form films on the surfaces along which water moves. The leaching of bases and the translocation of silicate clay minerals are among the more important processes of horizon differentiation in the county. Wawasee soils are an example of soils in which translocated silicate clays in the form of clay films have accumulated in the Bt horizon.

Gleying, or the reduction and transfer of iron, has occurred in all of the very poorly drained to somewhat poorly drained soils in the county. This process has significantly affected horizon differentiation in these soils. A gray color in the subsoil indicates the reduction and removal of iron oxide. Reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower ones or completely out of the profile. Mottles indicate the segregation of iron.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious

layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, subsurface. The removal of excess ground water through buried drains installed within the soil profile. The drains collect the water and convey it to a gravity or pump outlet.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-78 at Rensselaer, Indiana)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	32.7	14.9	23.8	61	-14	14	1.83	0.79	2.71	5	6.5
February----	36.5	18.2	27.4	62	-11	28	1.63	.74	2.38	5	6.4
March-------	46.9	27.5	37.2	76	3	111	2.85	1.72	3.86	7	4.0
April-------	61.5	38.9	50.2	83	20	315	4.13	2.44	5.63	8	.8
May---------	73.1	49.0	61.1	92	29	654	3.91	2.30	5.34	8	.0
June--------	82.3	58.6	70.5	97	41	915	4.60	2.53	6.42	8	.0
July--------	85.3	62.3	73.8	98	45	1,048	3.68	1.77	5.32	6	.0
August------	83.3	59.7	71.5	96	43	977	3.54	2.01	4.88	6	.0
September---	77.2	52.1	64.7	93	32	741	3.19	1.31	4.78	6	.0
October-----	65.7	41.2	53.5	86	23	428	2.62	1.13	3.88	5	.1
November----	49.7	30.4	40.1	75	8	103	2.37	1.41	3.22	6	2.0
December----	36.6	20.8	28.6	63	-9	20	2.28	.92	3.43	6	6.2
Yearly:											
Average---	60.9	39.5	50.2	---	---	---	---	---	---	---	---
Extreme---	---	---	---	101	-19	---	---	---	---	---	---
Total-----	---	---	---	---	---	5,354	36.63	32.11	41.05	76	26.0

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-78 at Rensselaer, Indiana)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 16	May 2	May 18
2 years in 10 later than--	Apr. 11	Apr. 27	May 12
5 years in 10 later than--	Apr. 3	Apr. 17	May 1
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 19	Oct. 4	Sept. 25
2 years in 10 earlier than--	Oct. 24	Oct. 11	Sept. 30
5 years in 10 earlier than--	Nov. 2	Oct. 23	Oct. 11

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-78 at Rensselaer, Indiana)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	192	163	141
8 years in 10	199	172	148
5 years in 10	212	189	162
2 years in 10	226	205	176
1 year in 10	233	214	183

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ab	Ackerman muck, drained	1,050	0.3
As	Adrian muck, drained	1,750	0.5
AtA	Andres loam, 0 to 2 percent slopes	6,000	1.7
AyB	Ayr loamy fine sand, 1 to 4 percent slopes	1,300	0.4
BeB	Brems loamy sand, 1 to 3 percent slopes	15,941	4.4
Br	Brookston loam	4,550	1.3
ChB	Chelsea sand, 2 to 6 percent slopes	1,750	0.5
CoB	Corwin loam, moderately permeable, 1 to 3 percent slopes	4,800	1.3
Cp	Craigmile sandy loam, frequently flooded	4,850	1.4
Dc	Darroch loam	7,300	2.0
Dg	Darroch, till substratum-Odell complex	10,900	3.0
Ed	Edwards muck, drained	490	0.1
Fa	Faxon loam	1,690	0.5
Gf	Gilford fine sandy loam	16,830	4.7
GzB	Grovecity fine sandy loam, 1 to 3 percent slopes	780	0.2
Ho	Houghton muck, drained	3,750	1.0
Hp	Houghton muck, frequently flooded	1,100	0.3
Ir	Iroquois fine sandy loam	6,300	1.8
LuB2	Lucas silty clay loam, 2 to 6 percent slopes, eroded	275	0.1
MaB	Markton-Aubbeenaubbee complex, 1 to 3 percent slopes	6,400	1.8
McB	Martinsville fine sandy loam, 2 to 6 percent slopes	1,450	0.4
MeA	Metamora fine sandy loam, moderately permeable, 0 to 1 percent slopes	851	0.2
MeB	Metamora fine sandy loam, moderately permeable, 1 to 4 percent slopes	950	0.3
MkB	Metea loamy sand, moderately permeable, 2 to 6 percent slopes	2,250	0.6
Mp	Montgomery silty clay loam	6,100	1.7
Mu	Morocco loamy sand	28,799	8.0
Mw	Muskego muck, drained	2,600	0.7
Mz	Mussey mucky sandy loam	2,450	0.7
NaB	Nesius fine sand, 1 to 3 percent slopes	3,700	1.0
Ne	Newton loamy fine sand, undrained	2,300	0.6
OaB	Oakville fine sand, 2 to 6 percent slopes	17,400	4.8
OaC	Oakville fine sand, 6 to 15 percent slopes	7,800	2.2
ObB	Oakville sand, moderately wet, 1 to 3 percent slopes	8,000	2.2
OcC2	Octagon fine sandy loam, 6 to 12 percent slopes, eroded	455	0.1
OrB	Ormas loamy fine sand, 2 to 6 percent slopes	360	0.1
OtB	Ormas Variant loamy sand, 2 to 6 percent slopes	450	0.1
Pa	Papineau sandy loam	2,350	0.7
PaB	Parr fine sandy loam, 2 to 6 percent slopes	300	0.1
PdB	Parr-Ayr complex, 2 to 6 percent slopes	4,450	1.2
Pf	Pits, quarries	110	*
Px	Prochaska loamy sand, frequently flooded	4,200	1.2
Rd	Reddick silty clay loam	6,300	1.8
Re	Rensselaer loam	14,900	4.2
Rs	Rensselaer fine sandy loam, till substratum	16,200	4.5
Rw	Rensselaer, till substratum-Wolcott complex	16,400	4.6
RxB	Rockton fine sandy loam, 1 to 3 percent slopes	2,250	0.6
SmA	Simonin loamy sand, 0 to 2 percent slopes	1,550	0.4
So	Sloan silt loam, frequently flooded, undrained	2,750	0.8
SpB	Sparta sand, 2 to 6 percent slopes	1,100	0.3
SsB	Sparta loamy sand, loamy substratum, 1 to 3 percent slopes	1,250	0.4
St	Strole clay loam	4,050	1.1
Sx	Suman loam, frequently flooded	7,500	2.1
Wb	Warners fine sandy loam	500	0.1
We	Watseka loamy fine sand	1,450	0.4
Wm	Watseka-Maumee loamy sands	37,640	10.5
WsB2	Wawasee loam, 2 to 6 percent slopes, eroded	2,150	0.6
Wt	Whitaker fine sandy loam	4,750	1.3
Za	Zadog-Maumee loamy sands	42,150	11.7
	Water areas less than 40 acres in size	1,008	0.3
	Water areas more than 40 acres in size	292	0.1
	Total	359,321	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
AtA	Andres loam, 0 to 2 percent slopes (where drained)
AyB	Ayr loamy fine sand, 1 to 4 percent slopes
Br	Brookston loam (where drained)
CoB	Corwin loam, moderately permeable, 1 to 3 percent slopes
Cp	Craigmile sandy loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
Dc	Darroch loam (where drained)
Dg	Darroch, till substratum-Odell complex (where drained)
Fa	Faxon loam (where drained)
Gf	Gilford fine sandy loam (where drained)
GzB	Grovecity fine sandy loam, 1 to 3 percent slopes (where drained)
Ir	Iroquois fine sandy loam (where drained)
LuB2	Lucas silty clay loam, 2 to 6 percent slopes, eroded
MaB	Markton-Aubbeenaubbee complex, 1 to 3 percent slopes
McB	Martinsville fine sandy loam, 2 to 6 percent slopes
MeA	Metamora fine sandy loam, moderately permeable, 0 to 1 percent slopes (where drained)
MeB	Metamora fine sandy loam, moderately permeable, 1 to 4 percent slopes (where drained)
MkB	Metea loamy sand, moderately permeable, 2 to 6 percent slopes
Mp	Montgomery silty clay loam (where drained)
Pa	Papineau sandy loam (where drained)
PaB	Parr fine sandy loam, 2 to 6 percent slopes
PdB	Parr-Ayr complex, 2 to 6 percent slopes
Rd	Reddick silty clay loam (where drained)
Re	Rensselaer loam (where drained)
Rs	Rensselaer fine sandy loam, till substratum (where drained)
Rw	Rensselaer, till substratum-Wolcott complex (where drained)
RxB	Rockton fine sandy loam, 1 to 3 percent slopes
SmA	Simonin loamy sand, 0 to 2 percent slopes
St	Strole clay loam (where drained)
Sx	Suman loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
WsB2	Wawasee loam, 2 to 6 percent slopes, eroded
Wt	Whitaker fine sandy loam (where drained)
Za	Zadog-Maumee loamy sands (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Bromegrass-alfalfa hay*	Tall fescue
		Bu	Bu	Bu	Tons	AUM**
Ab------------------------ Ackerman	IVw	75	28	30	---	5.0
As------------------------ Adrian	IVw	85	30	---	---	---
AtA----------------------- Andres	IIw	140	40	56	4.6	9.2
AyB----------------------- Ayr	IIIe	90	32	36	3.0	6.0
BeB----------------------- Brems	IVs	70	24	32	2.3	4.6
Br------------------------ Brookston	IIw	145	51	58	4.8	9.6
ChB----------------------- Chelsea	IVs	68	21	31	2.2	4.4
CoB----------------------- Corwin	IIe	120	42	54	4.0	8.0
Cp------------------------ Craigmile	IIIw	110	38	45	3.5	7.0
Dc------------------------ Darroch	IIw	140	50	56	4.6	9.2
Dg------------------------ Darroch-Odell	IIw	137	49	56	4.5	9.0
Ed------------------------ Edwards	IVw	80	28	32	---	5.2
Fa------------------------ Faxon	IIw	125	44	50	4.1	8.2
Gf------------------------ Gilford	IIw	120	42	48	4.0	8.0
GzB----------------------- Grovecity	IIe	100	35	40	3.3	6.6
Ho------------------------ Houghton	IIIw	115	34	46	---	6.8
Hp------------------------ Houghton	VIIIw	---	---	---	---	---
Ir------------------------ Iroquois	IIw	140	49	56	4.6	9.2
LuB2---------------------- Lucas	IIIe	85	30	34	2.8	5.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Bromegrass-alfalfa hay*	Tall fescue
		Bu	Bu	Bu	Tons	AUM**
MaB-----Markton-Aubbeenaubbee	IIIe	101	34	48	3.5	7.1
McB-----Martinsville	IIe	105	37	46	3.5	7.0
MeA-----Metamora	IIw	115	45	50	3.8	7.6
MeB-----Metamora	IIe	105	37	47	3.5	7.0
MkB-----Metea	IIIe	85	30	34	2.8	5.6
Mp-----Montgomery	IIIw	120	42	48	4.0	8.0
Mu-----Morocco	IVs	80	28	36	2.6	5.2
Mw-----Muskego	IVw	90	31	36	---	6.0
Mz-----Mussey	IIIw	120	42	48	4.0	8.0
NaB-----Nesius	IVs	70	25	31	2.3	4.6
Ne-----Newton	Vw	---	---	---	---	---
OaB-----Oakville	IVs	55	19	25	2.0	4.0
OaC-----Oakville	VIs	---	---	---	1.8	3.6
ObB-----Oakville	IVs	60	21	27	2.0	4.0
OcC2-----Octagon	IIIe	80	28	36	2.6	5.2
OrB-----Ormas	IIIs	70	24	31	2.3	4.6
OtB-----Ormas Variant	IVs	50	18	22	1.8	3.6
Pa-----Papineau	IIw	125	44	51	4.1	8.2
PaB-----Parr	IIe	115	40	52	3.8	7.6
PdB-----Parr-Ayr	IIe	107	38	50	3.5	7.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Bromegrass-alfalfa hay*	Tall fescue
		Bu	Bu	Bu	Tons	AUM**
Pf***. Pits						
Px Prochaska	IIIw	105	37	42	3.5	7.0
Rd Reddick	IIw	150	52	60	5.0	10.0
Re Rensselaer	IIw	155	54	62	5.1	10.2
Rs Rensselaer	IIw	140	49	56	4.6	9.2
Rw Rensselaer-Wolcott	IIw	147	52	59	4.9	9.7
RxB Rockton	IIe	100	35	45	3.3	6.6
SmA Simonin	IIs	95	33	38	3.1	6.2
So Sloan	Vw	---	---	---	---	---
SpB Sparta	IVs	60	21	27	2.0	4.0
SsB Sparta	IIIs	65	25	29	2.3	4.6
St Strole	IIw	110	38	44	3.6	7.2
Sx Suman	IIIw	125	44	49	4.1	8.2
Wb Warners	IIIw	100	30	40	3.3	6.6
We Watseka	IIIs	92	31	43	3.0	6.0
Wm Watseka-Maumee	IIIs	101	35	47	3.3	6.6
WsB2 Wawasee	IIe	100	35	45	3.2	6.4
Wt Whitaker	IIw	125	44	50	4.1	8.2
Za Zadog-Maumee	IIIw	113	40	49	3.8	7.6

* The Brookston, Craigmile, Faxon, Gilford, Iroquois, Maumee, Montgomery, Mussey, Newton, Prochaska, Reddick, Rensselaer, Sloan, Suman, Warners, Walcott, and Zadog soils are suitable for alfalfa only if they are drained.

** Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

*** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	138,051	17,130	119,371	1,550	---
III	122,880	10,680	71,500	40,700	---
IV	83,030	---	5,890	77,140	---
V	5,050	---	5,050	---	---
VI	7,800	---	---	7,800	---
VII	---	---	---	---	---
VIII	1,100	---	1,100	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Ab: Ackerman	2W	Slight	Severe	Severe	Severe	Red maple	46	30	
						Silver maple	---	---	
						White ash	---	---	
						Quaking aspen	---	---	
						Eastern cottonwood	---	---	
As: Adrian	2W	Slight	Severe	Severe	Severe	White ash	51	35	
						Red maple	51	33	
						Quaking aspen	56	56	
						Black willow	---	---	
						Silver maple	76	30	
BeB: Brems	4S	Slight	Slight	Moderate	Slight	Northern red oak	70	52	Eastern white pine, red pine, jack pine.
						Red pine	72	134	
						Eastern white pine	65	136	
						Jack pine	70	103	
Br: Brookston	5W	Slight	Severe	Severe	Moderate	Pin oak	86	68	Eastern white pine, red maple, white ash.
						White oak	75	57	
						Sweetgum	90	106	
						Northern red oak	78	60	
ChB: Chelsea	3S	Slight	Slight	Moderate	Slight	White oak	55	38	Eastern white pine, European larch, red pine, jack pine.
Cp: Craigmile	5W	Slight	Severe	Severe	Severe	Pin oak	90	72	Eastern white pine, white ash, red maple, American sycamore, pin oak.
						Red maple	72	44	
						Silver maple	95	46	
						White ash	72	69	
						American elm	70	---	
						Eastern cottonwood	100	128	
						American sycamore	90	---	
Ed: Edwards	2W	Slight	Severe	Severe	Severe	White ash	51	35	
						Red maple	51	33	
						Quaking aspen	56	56	
						Black willow	---	---	
						Silver maple	76	30	
Gf: Gilford	4W	Slight	Severe	Severe	Severe	Pin oak	70	52	Eastern white pine, European larch, white spruce, white ash.
						Eastern white pine	55	106	
						Bigtooth aspen	70	81	
						Red maple	60	38	
Ho: Houghton	2W	Slight	Severe	Severe	Severe	White ash	51	35	
						Red maple	51	33	
						Black willow	---	---	
						Quaking aspen	56	56	
						Silver maple	76	30	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
LuB2: Lucas	4C	Slight	Moderate	Severe	Severe	Northern red oak	70	52	Austrian pine, yellow-poplar, green ash, black oak, pin oak, red maple, American sycamore, eastern cottonwood.
						White ash	---	---	
						Red maple	---	---	
						White oak	---	---	
						Black cherry	---	---	
						Slippery elm	---	---	
MaB**:									
Markton	4S	Slight	Slight	Moderate	Slight	White oak	80	62	Eastern white pine, Austrian pine, red pine, black oak, white oak.
						Black oak	70	52	
						Quaking aspen	70	81	
						Eastern cottonwood	90	103	
						Red maple	50	32	
Aubbeenaubbee	4A	Slight	Slight	Slight	Slight	White oak	75	57	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore, green ash, white ash.
						Pin oak	85	67	
						Yellow-poplar	85	81	
						Sweetgum	80	79	
						Northern red oak	75	57	
McB: Martinsville	4A	Slight	Slight	Slight	Slight	White oak	80	62	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
						Yellow-poplar	98	104	
						Sweetgum	76	70	
MeA, MeB: Metamora	4A	Slight	Slight	Slight	Slight	Northern red oak	75	57	Yellow-poplar, northern red oak, red pine, eastern white pine, white ash.
						Pin oak	85	67	
						Yellow-poplar	85	81	
MkB: Metea	4A	Slight	Slight	Slight	Slight	White oak	80	62	Eastern white pine, red pine, yellow-poplar, black walnut.
						Yellow-poplar	86	82	
						Eastern white pine	75	166	
						Red pine	75	142	
Mp: Montgomery	5W	Slight	Severe	Severe	Severe	Pin oak	88	70	American sycamore, pin oak, green ash, red maple, eastern cottonwood, silver maple.
						White oak	75	57	
						Sweetgum	90	106	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns: Erosion hazard	Management concerns: Equip- ment limita- tion	Management concerns: Seedling mortal- ity	Management concerns: Wind- throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
Mu------------- Morocco	5S	Slight	Slight	Moderate	Slight	Pin oak------------	85	67	Eastern white pine, European larch, red maple, American sycamore.
						Northern red oak----	70	52	
						Eastern white pine--	65	136	
Mw------------- Muskego	2W	Slight	Severe	Severe	Severe	White ash-----------	52	37	
						Tamarack------------	50	42	
						Red maple-----------	51	33	
						Green ash-----------	---	---	
						Black willow--------	---	---	
						Quaking aspen-------	56	56	
						Silver maple--------	---	---	
Mz------------- Mussey	3W	Slight	Severe	Severe	Severe	Red maple-----------	66	41	Eastern white pine, white spruce.
						Silver maple--------	91	43	
						White ash-----------	66	60	
						American basswood---	66	41	
						Pin oak-------------	---	---	
						Swamp white oak-----	---	---	
NaB------------ Nesius	3S	Slight	Slight	Moderate	Slight	Northern pin oak----	55	38	Jack pine, eastern white pine, red pine.
						Eastern white pine--	55	106	
						Red pine------------	55	88	
						Jack pine-----------	57	80	
Ne------------- Newton	4W	Slight	Severe	Severe	Severe	Pin oak-------------	70	52	Eastern white pine, black spruce, European larch.
						Eastern white pine--	55	106	
						Eastern cottonwood--	70	58	
OaB, OaC, ObB--- Oakville	4S	Slight	Moderate	Moderate	Slight	White oak-----------	70	52	Eastern white pine, red pine, jack pine.
						Red pine------------	78	150	
						Eastern white pine--	85	196	
						Jack pine-----------	68	100	
OrB------------ Ormas	4S	Slight	Slight	Moderate	Slight	White oak-----------	70	52	Eastern white pine, red pine, yellow-poplar, black walnut, European alder.
						Yellow-poplar-------	---	---	
						Eastern white pine--	---	---	
						Red pine------------	78	150	
OtB------------ Ormas Variant	4S	Slight	Slight	Moderate	Slight	Black oak-----------	70	52	Eastern white pine, red pine, jack pine, Austrian pine, black oak.
						Northern red oak----	70	52	
						Northern pin oak----	70	52	
						White oak-----------	70	52	
						Pin oak-------------	70	52	
						Sassafras-----------	30	---	
Px------------- Prochaska	4W	Slight	Severe	Severe	Severe	Pin oak-------------	75	57	Eastern cottonwood, European larch, silver maple, red maple, quaking aspen.
						River birch---------	46	30	
						Red maple-----------	50	32	
						Quaking aspen-------	55	53	
						Silver maple--------	70	25	
						Eastern cottonwood--	85	91	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Re: Rensselaer	5W	Slight	Severe	Severe	Severe	Pin oak White oak Sweetgum Northern red oak	86 75 90 76	68 57 106 58	Eastern white pine, red maple, white ash.
Rs: Rensselaer	5W	Slight	Severe	Severe	Severe	Pin oak White oak Sweetgum Northern red oak	85 75 90 75	67 57 106 57	Eastern white pine, American sycamore, red maple, white ash, pin oak, swamp white oak, silver maple.
Rw**:									
Rensselaer	5W	Slight	Severe	Severe	Severe	Pin oak White oak Sweetgum Northern red oak	85 75 90 75	67 57 106 57	Eastern white pine, American sycamore, red maple, white ash, pin oak, swamp white oak, silver maple.
Wolcott.									
So: Sloan	5W	Slight	Severe	Severe	Severe	Pin oak Swamp white oak Red maple Green ash Eastern cottonwood	86 --- --- --- ---	68 --- --- --- ---	Red maple, green ash, eastern cottonwood, pin oak, swamp white oak, silver maple, American sycamore.
SpB: Sparta	4S	Slight	Slight	Severe	Slight	Northern red oak Eastern white pine Red pine Jack pine	70 --- --- ---	52 --- --- ---	Red pine, eastern white pine, jack pine.
SsB: Sparta	2S	Slight	Slight	Severe	Slight	Northern red oak Jack pine Red pine	47 57 ---	32 84 ---	Red pine, eastern white pine, jack pine.
Sx: Suman	5W	Slight	Severe	Severe	Severe	Pin oak Red maple Swamp white oak White ash Sweetgum	85 --- --- --- 90	67 --- --- --- 106	Eastern white pine, red maple, white ash.
Wb: Warners	4W	Slight	Severe	Severe	Severe	Eastern cottonwood American sycamore Red maple Black willow Green ash Pin oak Swamp white oak	80 --- --- --- --- --- ---	78 --- --- --- --- --- ---	American sycamore, eastern cottonwood, green ash, pin oak, red maple, silver maple, swamp white oak.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Wm**: Watseka.									
Maumee	4W	Slight	Severe	Slight	Severe	Pin oak Eastern white pine Bigtooth aspen Silver maple	70 55 70 ---	52 106 81 ---	Eastern white pine, European larch, white spruce.
WsB2 Wawasee	5A	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum Sugar maple White ash	90 98 72 --- ---	72 104 61 --- ---	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
Wt Whitaker	4A	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Sweetgum Northern red oak	70 85 85 80 75	52 67 81 79 57	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
Za**: Zadog	4W	Slight	Severe	Slight	Severe	Pin oak Quaking aspen Eastern cottonwood Silver maple	75 55 85 70	57 53 91 25	Eastern white pine, European larch, white spruce, silver maple, red maple.
Maumee	4W	Slight	Severe	Slight	Severe	Pin oak Eastern white pine Bigtooth aspen Silver maple	70 55 70 ---	52 106 81 ---	Eastern white pine, European larch, white spruce.

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ab: Ackerman	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
As: Adrian	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum.	Tall purple willow	Black willow, golden willow.	Imperial Carolina poplar.
AtA: Andres	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
AyB: Ayr	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush.	Austrian pine, northern white-cedar, eastern redcedar, osageorange.	Eastern white pine, red pine, Norway spruce.	---
BeB: Brems	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac.	Austrian pine, jack pine, red pine.	Eastern white pine	---
Br: Brookston	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
ChB: Chelsea	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac.	Austrian pine, jack pine, red pine.	Eastern white pine	---
CoB: Corwin	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Cp: Craigmile	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
Dc: Darroch	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Dg*:					
Darroch	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Odell	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, Austrian pine, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Ed: Edwards	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Fa: Faxon	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Gf: Gilford	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, northern white-cedar, Washington hawthorn, blue spruce, white fir, Austrian pine.	Eastern white pine	Pin oak.
GzB: Grovecity	---	Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, eastern redcedar, osageorange.	Eastern white pine, red pine, Norway spruce.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ho. Houghton	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Hp. Houghton					
Ir. Iroquois	Silky dogwood	Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, Washington hawthorn.	Pin oak, eastern white pine.	Carolina poplar.
LuB2. Lucas	---	Amur honeysuckle, Washington hawthorn, Amur privet, eastern redcedar, arrowwood, American cranberrybush.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
MaB*:					
Markton	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
Aubbeenaubbee	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
McB. Martinsville	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
MeA, MeB. Metamora	---	Amur privet, American cranberrybush, Amur honeysuckle, silky dogwood.	Austrian pine, blue spruce, Washington hawthorn, white fir, northern white-cedar.	Norway spruce	Eastern white pine, pin oak.
MkB. Metea	---	Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Red pine, eastern white pine, Norway spruce.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Mp Montgomery	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Mu Morocco	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Mw Muskego	Common ninebark, whitebelle honeysuckle.	Amur privet, nannyberry viburnum, silky dogwood, Amur honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Mz Mussey	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, green ash, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
NaB Nesius	Lilac, Siberian peashrub.	Washington hawthorn, eastern redcedar, Amur honeysuckle, sargent crabapple.	Eastern white pine, red pine, green ash, Austrian pine, jack pine, honeylocust.	---	---
Ne Newton	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
OaB, OaC, ObB Oakville	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
OcC2 Octagon	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
OrB: Ormas	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
OtB: Ormas Variant	Siberian peashrub	Eastern redcedar, Manchurian crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle.	Eastern white pine, Austrian pine, jack pine, red pine, honeylocust, green ash.	---	---
Pa: Papineau	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
PaB: Parr	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
PdB*:					
Parr	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Ayr	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush.	Austrian pine, northern white-cedar, eastern redcedar, osageorange.	Eastern white pine, red pine, Norway spruce.	---
Pf*. Pits					
Px: Prochaska	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
Rd: Reddick	---	Silky dogwood, American cranberrybush, Amur privet, Amur honeysuckle.	Washington hawthorn, blue spruce, northern white-cedar, Norway spruce, Austrian pine, white fir.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Re. Rensselaer	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Rs. Rensselaer	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, northern white-cedar, Washington hawthorn, Norway spruce, blue spruce.	Eastern white pine	Pin oak.
Rw*:					
Rensselaer	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, northern white-cedar, Washington hawthorn, Norway spruce, blue spruce.	Eastern white pine	Pin oak.
Wolcott	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
RxB. Rockton	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
SmA. Simonin	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac.	Austrian pine, jack pine, red pine.	Eastern white pine	---
So. Sloan	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
SpB Sparta	Siberian peashrub	Amur honeysuckle, lilac, eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive.	Red pine, jack pine, Austrian pine.	Eastern white pine	---
SsB Sparta	Siberian peashrub	Amur honeysuckle, lilac, autumn-olive, radiant crabapple, Washington hawthorn.	Red pine, jack pine, Austrian pine.	Eastern white pine	---
St Strole	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Sx Suman	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Wb Warners	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, white fir, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
We Watseka	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Wm*: Watseka	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Maumee	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
WsB2----------------- Wawasee	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
Wt------------------- Whitaker	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, Austrian pine, blue spruce, Washington hawthorn, northern white-cedar.	Norway spruce-----	Eastern white pine, pin oak.
Za*:					
Zadog----------------	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Maumee---------------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ab: Ackerman	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
As: Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
AtA: Andres	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
AyB: Ayr	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
BeB: Brems	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: too sandy.	Moderate: droughty.
Br: Brookston	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
ChB: Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
CoB: Corwin	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
Cp: Craigmile	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.
Dc: Darroch	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Dg*:					
Darroch	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Odell	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ed: Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Fa: Faxon	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Gf: Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
GzB----- Grovecity	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Ho----- Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Hp----- Houghton	Severe: flooding, wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness, flooding.	Severe: wetness, excess humus.	Severe: wetness, flooding, excess humus.
Ir----- Iroquois	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
LuB2----- Lucas	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight-----	Slight.
MaB*:					
Markton-----	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Aubbeenaubbee-----	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
McB----- Martinsville	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
MeA, MeB----- Metamora	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
MkB----- Metea	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Mp----- Montgomery	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mu----- Morocco	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
Mw----- Muskego	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Mz----- Mussey	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
NaB----- Nesius	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
Ne----- Newton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
OaB----- Oakville	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
OaC-----------------Oakville	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope.
ObB-----------------Oakville	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
OcC2----------------Octagon	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
OrB-----------------Ormas	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
OtB-----------------Ormas Variant	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Pa------------------Papineau	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
PaB-----------------Parr	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
PdB*:					
Parr-----------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Ayr------------------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Pf*. Pits					
Px------------------Prochaska	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.
Rd------------------Reddick	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Re, Rs--------------Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Rw*:					
Rensselaer-----------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Wolcott--------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
RxB-----------------Rockton	Slight----------	Slight----------	Moderate: slope, thin layer, area reclaim.	Slight----------	Moderate: thin layer, area reclaim.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SmA: Simonin	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: too sandy.	Moderate: droughty.
So: Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
SpB: Sparta	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
SsB: Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
St: Strole	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Sx: Suman	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Wb: Warners	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
We: Watseka	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
Wm*:					
Watseka	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
Maumee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
WsB2: Wawasee	Slight	Slight	Moderate: slope.	Slight	Slight.
Wt: Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Za*:					
Zadog	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Maumee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ab----------------- Ackerman	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
As----------------- Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
AtA---------------- Andres	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
AyB---------------- Ayr	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
BeB---------------- Brems	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Poor.
Br----------------- Brookston	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
ChB---------------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
CoB---------------- Corwin	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
Cp----------------- Craigmile	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Dc----------------- Darroch	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Dg*:										
Darroch-----------	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Odell-------------	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ed----------------- Edwards	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Poor	Fair	Good.
Fa----------------- Faxon	Fair	Fair	Fair	Poor	Poor	Good	Fair	Fair	Poor	Fair.
Gf----------------- Gilford	Fair	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
GzB---------------- Grovecity	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ho----------------- Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Hp----------------- Houghton	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Ir----------------- Iroquois	Fair	Poor	Poor	Poor	Poor	Good	Fair	Poor	Poor	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
LuB2: Lucas	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MaB*:										
Markton	Poor	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
Aubbeenaubbee	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
McB: Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MeA: Metamora	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Poor.
MeB: Metamora	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MkB: Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Mp: Montgomery	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Mu: Morocco	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Fair	Fair	Poor.
Mw: Muskego	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Mz: Mussey	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
NaB: Nesius	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Ne: Newton	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
OaB: Oakville	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
OaC: Oakville	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
ObB: Oakville	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
OcC2: Octagon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
OrB: Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
OtB: Ormas Variant	Very poor.	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Pa: Papineau	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
PaB: Parr	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PdB*:										
Parr	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ayr	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Pf*. Pits										
Px: Prochaska	Poor	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.
Rd: Reddick	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Re, Rs: Rensselaer	Fair	Poor	Poor	Fair	Fair	Good	Good	Fair	Fair	Good.
Rw*:										
Rensselaer	Fair	Poor	Poor	Fair	Fair	Good	Good	Fair	Fair	Good.
Wolcott	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
RxB: Rockton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
SmA: Simonin	Poor	Poor	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
So: Sloan	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
SpB, SsB: Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
St: Strole	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Sx: Suman	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wb: Warners	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
We: Watseka	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
Wm*:										
Watseka	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
Maumee	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
WsB2: Wawasee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Wt----------------- Whitaker	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Za*:										
Zadog--------------	Poor	Poor	Poor	Poor	Poor	Good	Fair	Poor	Poor	Fair.
Maumee-------------	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ab: Ackerman	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
As: Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
AtA: Andres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
AyB: Ayr	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
BeB: Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
Br: Brookston	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
ChB: Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty, too sandy.
CoB: Corwin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, low strength, wetness.	Slight.
Cp: Craigmile	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action, wetness.	Severe: flooding, wetness.
Dc: Darroch	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Dg*:						
Darroch	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Odell	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ed----------------- Edwards	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
Fa----------------- Faxon	Severe: depth to rock, ponding.	Severe: ponding.	Severe: ponding, depth to rock.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Gf----------------- Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
GzB---------------- Grovecity	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Moderate: wetness.
Ho----------------- Houghton	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
Hp----------------- Houghton	Severe: excess humus, wetness.	Severe: subsides, flooding, wetness.	Severe: subsides, flooding, wetness.	Severe: subsides, flooding, wetness.	Severe: subsides, wetness, flooding.	Severe: wetness, flooding, excess humus.
Ir----------------- Iroquois	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
LuB2--------------- Lucas	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
MaB*:						
Markton------------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
Aubbeenaubbee-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
McB---------------- Martinsville	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action.	Slight.
MeA, MeB----------- Metamora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
MkB---------------- Metea	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Mp----------------- Montgomery	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Mu: Morocco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Mw: Muskego	Severe: excess humus, ponding.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Mz: Mussey	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
NaB: Nesius	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty.
Ne: Newton	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
OaB: Oakville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
OaC: Oakville	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
ObB: Oakville	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty, too sandy.
OcC2: Octagon	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
OrB: Ormas	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
OtB: Ormas Variant	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Pa: Papineau	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
PaB: Parr	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength, frost action.	Slight.
PdB*:						
Parr	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
Ayr	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Pf*. Pits						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Px----------------- Prochaska	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.
Rd----------------- Reddick	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Re----------------- Rensselaer	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Rs----------------- Rensselaer	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Rw*:						
Rensselaer--------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Wolcott-----------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
RxB---------------- Rockton	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer, area reclaim.
SmA---------------- Simonin	Severe: cutbanks cave.	Slight----------	Severe: shrink-swell.	Slight----------	Moderate: frost action.	Moderate: droughty.
So----------------- Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
SpB---------------- Sparta	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty, too sandy.
SsB---------------- Sparta	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: droughty.
St----------------- Strole	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
Sx----------------- Suman	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
Wb----------------- Warners	Severe: ponding.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
We: Watseka	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Wm*:						
Watseka	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Maumee	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
WsB2: Wawasee	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Wt: Whitaker	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Za*:						
Zadog	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Maumee	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ab-------------------Ackerman	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
As-------------------Adrian	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, too sandy, seepage.
AtA------------------Andres	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
AyB------------------Ayr	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
BeB------------------Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Br-------------------Brookston	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
ChB------------------Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
CoB------------------Corwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Cp-------------------Craigmile	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Dc-------------------Darroch	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: wetness.
Dg*:					
Darroch------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Odell--------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ed-------------------Edwards	Severe: subsides, ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Fa-----------------Faxon	Severe: thin layer, seepage, ponding.	Severe: depth to rock, seepage, ponding.	Severe: depth to rock, seepage, ponding.	Severe: ponding.	Poor: area reclaim, ponding, thin layer.
Gf-----------------Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
GzB----------------Grovecity	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness.
Ho-----------------Houghton	Severe: subsides, ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Hp-----------------Houghton	Severe: subsides, flooding, wetness.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness, excess humus.
Ir-----------------Iroquois	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
LuB2---------------Lucas	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey, hard to pack.
MaB*:					
Markton------------	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
Aubbeenaubbee------	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
McB----------------Martinsville	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
MeA, MeB-----------Metamora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
MkB----------------Metea	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Mp-----------------Montgomery	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mu: Morocco	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
Mw: Muskego	Severe: ponding, subsides, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: hard to pack, ponding.
Mz: Mussey	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy.
NaB: Nesius	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy.
Ne: Newton	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
OaB: Oakville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
OaC: Oakville	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
ObB: Oakville	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
OcC2: Octagon	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
OrB: Ormas	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
OtB: Ormas Variant	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Pa: Papineau	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
PaB: Parr	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PdB*:					
Parr	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Ayr	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Pf*. Pits					
Px Prochaska	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Rd Reddick	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: too clayey, ponding.
Re, Rs Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Rw*:					
Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Wolcott	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
RxB Rockton	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
SmA Simonin	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack.
So Sloan	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
SpB Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
SsB Sparta	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
St Strole	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Sx: Suman	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness, seepage, too sandy.
Wb: Warners	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
We: Watseka	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, seepage, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
Wm*:					
Watseka	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, seepage, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
Maumee	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
WsB2: Wawasee	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Wt: Whitaker	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
Za*:					
Zadog	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Maumee	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ab------------------- Ackerman	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: excess humus, wetness.
As------------------- Adrian	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: wetness, excess humus.
AtA------------------ Andres	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
AyB------------------ Ayr	Good----------------	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
BeB------------------ Brems	Fair: wetness.	Probable------------	Improbable: too sandy.	Poor: too sandy.
Br------------------- Brookston	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
ChB------------------ Chelsea	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
CoB------------------ Corwin	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Cp------------------- Craigmile	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: wetness.
Dc------------------- Darroch	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Dg*:				
Darroch--------------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Odell----------------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ed------------------- Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
Fa------------------- Faxon	Poor: area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
Gf------------------- Gilford	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: wetness.
GzB------------------ Grovecity	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ho: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
Hp: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Ir: Iroquois	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
LuB2: Lucas	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MaB*:				
Markton	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Aubbeenaubbee	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
McB: Martinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MeA, MeB: Metamora	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MkB: Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Mp: Montgomery	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Mu: Morocco	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Mw: Muskego	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Mz: Mussey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, area reclaim, wetness.
NaB: Nesius	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Ne: Newton	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
OaB, OaC, ObB: Oakville	Good	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OcC2 Octagon	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
OrB Ormas	Good	Probable	Probable	Poor: area reclaim.
OtB Ormas Variant	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Pa Papineau	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
PaB Parr	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
PdB*:				
Parr	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Ayr	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Pf*. Pits				
Px Prochaska	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Rd Reddick	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Re, Rs Rensselaer	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Rw*:				
Rensselaer	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wolcott	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
RxB Rockton	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
SmA Simonin	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
So Sloan	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SpB: Sparta	Good	Probable	Improbable: too sandy.	Poor: too sandy.
SsB: Sparta	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: thin layer.
St: Strole	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Sx: Suman	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Wb: Warners	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
We: Watseka	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
Wm*:				
Watseka	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
Maumee	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
WsB2: Wawasee	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Wt: Whitaker	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Za*:				
Zadog	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Maumee	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ab: Ackerman	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, percs slowly, frost action.	Ponding, soil blowing, percs slowly.	Ponding, too sandy, soil blowing.	Wetness, percs slowly.
As: Adrian	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing.	Ponding, soil blowing, too sandy.	Wetness.
AtA: Andres	Moderate: seepage.	Severe: slow refill.	Frost action	Wetness	Wetness, erodes easily.	Wetness, erodes easily.
AyB: Ayr	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, too sandy, soil blowing.	Erodes easily, droughty.
BeB: Brems	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Br: Brookston	Moderate: seepage.	Moderate: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
ChB: Chelsea	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
CoB: Corwin	Moderate: seepage.	Moderate: deep to water, slow refill.	Favorable	Wetness	Wetness	Favorable.
Cp: Craigmile	Severe: seepage.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, soil blowing, flooding.	Soil blowing, wetness, too sandy.	Wetness, erodes easily.
Dc: Darroch	Moderate: seepage.	Severe: cutbanks cave.	Cutbanks cave, frost action.	Wetness	Wetness	Wetness.
Dg*:						
Darroch	Moderate: seepage.	Severe: cutbanks cave.	Cutbanks cave, frost action.	Wetness	Wetness, too sandy.	Wetness.
Odell	Moderate: seepage.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
Ed: Edwards	Severe: seepage.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Fa: Faxon	Moderate: seepage, depth to rock.	Severe: depth to rock.	Thin layer, frost action, ponding.	Ponding, thin layer.	Depth to rock, area reclaim, ponding.	Wetness, depth to rock, area reclaim.
Gf: Gilford	Severe: seepage.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
GzB----------------- Grovecity	Severe: seepage.	Moderate: deep to water.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Favorable.
Ho----------------- Houghton	Severe: seepage.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
Hp----------------- Houghton	Severe: seepage.	Severe: slow refill.	Flooding, subsides, frost action.	Wetness, soil blowing, flooding.	Wetness, soil blowing.	Wetness.
Ir----------------- Iroquois	Slight---------	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing.	Wetness, percs slowly.
LuB2--------------- Lucas	Moderate: slope.	Moderate: deep to water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
MaB*:						
Markton-----------	Severe: seepage.	Severe: cutbanks cave.	Frost action---	Wetness, droughty, fast intake.	Wetness, soil blowing.	Wetness, droughty.
Aubbeenaubbee-----	Severe: seepage.	Moderate: slow refill.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
McB---------------- Martinsville	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
MeA, MeB----------- Metamora	Moderate: seepage.	Moderate: slow refill.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
MkB---------------- Metea	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
Mp----------------- Montgomery	Slight---------	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
Mu----------------- Morocco	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Droughty, fast intake, wetness.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Mw----------------- Muskego	Moderate: seepage.	Severe: slow refill.	Ponding, percs slowly.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
Mz----------------- Mussey	Slight---------	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, droughty, soil blowing.	Ponding, too sandy, soil blowing.	Wetness, droughty.
NaB---------------- Nesius	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ne Newton	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty, rooting depth.
OaB Oakville	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
OaC Oakville	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
ObB Oakville	Severe: seepage.	Severe: cutbanks cave.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
OcC2 Octagon	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope	Slope	Slope.
OrB Ormas	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing	Droughty.
OtB Ormas Variant	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
Pa Papineau	Moderate: seepage.	Severe: slow refill.	Percs slowly, frost action.	Wetness, soil blowing, percs slowly.	Wetness, soil blowing, percs slowly.	Wetness, percs slowly.
PaB Parr	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing	Favorable.
PdB*:						
Parr	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing	Favorable.
Ayr	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, too sandy, soil blowing.	Erodes easily, droughty.
Pf*. Pits						
Px Prochaska	Severe: seepage.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty, rooting depth.
Rd Reddick	Moderate: seepage.	Severe: slow refill.	Percs slowly, frost action, ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Re Rensselaer	Moderate: seepage.	Severe: cutbanks cave.	Ponding, frost action.	Ponding	Ponding	Wetness.
Rs Rensselaer	Moderate: seepage.	Severe: cutbanks cave.	Ponding, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Rw*:						
Rensselaer	Moderate: seepage.	Severe: cutbanks cave.	Ponding, frost action.	Ponding	Ponding	Wetness.
Wolcott	Moderate: seepage.	Moderate: slow refill.	Ponding, frost action.	Ponding	Erodes easily, ponding.	Wetness, erodes easily.
RxB: Rockton	Moderate: seepage, depth to rock.	Severe: no water, depth to rock.	Deep to water	Soil blowing, thin layer.	Depth to rock, area reclaim, soil blowing.	Depth to rock, area reclaim.
SmA: Simonin	Severe: seepage.	Severe: slow refill, cutbanks cave.	Percs slowly	Wetness, droughty, fast intake.	Wetness, soil blowing, percs slowly.	Droughty, percs slowly.
So: Sloan	Moderate: seepage.	Moderate: slow refill.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
SpB: Sparta	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
SsB: Sparta	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
St: Strole	Slight	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Sx: Suman	Severe: seepage.	Severe: cutbanks cave, slow refill.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Wetness.
Wb: Warners	Severe: seepage.	Slight	Frost action, ponding.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
We: Watseka	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Wm*:						
Watseka	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Maumee	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty, rooting depth.
WsB2: Wawasee	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
Wt: Whitaker	Moderate: seepage.	Moderate: slow refill, cutbanks cave.	Frost action	Wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Za*:						
Zadog	Severe: seepage.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty, rooting depth.
Maumee	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ab----------------- Ackerman	0-10	Sapric material	PT	A-8	0	---	---	---	---	---	---
	10-27	Coprogenous earth	OH, OL	A-8	0	---	---	---	---	---	---
	27-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-2-4	0	100	100	85-95	10-20	---	NP
As----------------- Adrian	0-24	Sapric material	PT	A-8	---	---	---	---	---	---	---
	24-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	100	100	35-75	0-30	---	NP
AtA---------------- Andres	0-11	Loam--------------	CL, OL	A-7, A-6	0	95-100	90-100	90-99	80-94	35-50	13-21
	11-34	Silty clay loam, clay loam, sandy clay loam.	CL	A-7	0-5	90-100	85-100	65-100	50-85	40-50	16-26
	34-60	Silty clay loam, silt loam.	CL	A-6, A-7	0-5	90-100	85-100	80-100	70-95	28-48	11-26
AyB---------------- Ayr	0-13	Loamy sand, loamy fine sand.	SM	A-2	0	100	95-100	50-85	15-35	---	NP
	13-33	Sand, fine sand, loamy sand	SM, SP-SM	A-2, A-3	0	100	95-100	50-85	5-35	---	NP
	33-37	Loam--------------	CL, CL-ML	A-4	0-3	95-100	90-100	85-95	60-90	20-30	5-10
	37-60	Loam--------------	CL, CL-ML	A-4	0-3	95-100	90-100	70-90	50-85	<25	5-10
BeB---------------- Brems	0-6	Loamy sand--------	SM, SP-SM	A-2-4	0	100	100	50-85	10-30	---	NP
	6-40	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2-4	0	100	100	50-85	5-25	---	NP
	40-60	Sand, fine sand	SP-SM	A-3, A-2-4	0	100	100	50-85	5-10	---	NP
Br----------------- Brookston	0-10	Loam--------------	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-90	20-30	5-15
	10-40	Clay loam, silty clay loam, loam.	CL	A-6, A-4	0	90-100	85-100	75-95	60-85	25-40	8-20
	40-60	Loam--------------	CL, CL-ML	A-4, A-6	0-3	90-100	85-95	78-90	55-70	20-30	5-15
ChB---------------- Chelsea	0-4	Sand--------------	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
	4-80	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
CoB---------------- Corwin	0-13	Loam--------------	CL-ML, CL	A-4	0	95-100	90-100	80-100	50-90	20-25	5-8
	13-35	Clay loam, loam	CL	A-6, A-4	0	90-100	90-100	80-100	60-80	25-40	7-15
	35-40	Loam--------------	CL	A-4	0	90-100	90-100	75-85	50-65	25-30	7-10
	40-60	Loam--------------	CL, CL-ML, ML	A-4	0-3	90-100	85-95	75-85	50-65	18-30	3-10
Cp----------------- Craigmile	0-14	Sandy loam--------	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	100	95-100	60-80	30-55	<20	NP-6
	14-37	Fine sandy loam, sandy loam.	ML, CL, SM, SC	A-4	0	100	95-100	65-95	40-55	<25	3-8
	37-60	Loamy sand, sand	SM, SP-SM, SP	A-3, A-2	0	100	95-100	50-75	3-20	---	NP
Dc----------------- Darroch	0-10	Loam--------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-95	55-75	20-35	4-15
	10-34	Clay loam, loam	CL	A-4, A-6	0	100	95-100	85-95	60-90	20-40	7-20
	34-60	Stratified very fine sand to silt loam.	SM-SC, CL-ML, SM, ML	A-4, A-2	0	100	95-100	65-90	30-85	<25	NP-6

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Dg*:											
Darroch	0-10	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	65-90	20-35	5-15
	10-30	Clay loam, sandy clay loam.	CL, SC	A-4, A-6, A-2	0	100	95-100	75-100	30-80	20-40	7-20
	30-42	Stratified sand to loam.	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0	100	95-100	50-85	25-60	<20	NP-5
	42-60	Loam	CL-ML, CL, ML	A-4	0-5	90-100	85-95	75-95	50-75	<30	4-9
Odell	0-10	Loam	CL-ML, CL, ML	A-4	0	95-100	95-100	80-95	55-75	<25	3-8
	10-46	Clay loam	CL	A-6	0	95-100	90-100	80-100	60-80	30-40	11-16
	46-60	Loam	CL-ML, CL, ML	A-4	0-3	95-100	85-100	70-95	50-75	<25	3-8
Ed: Edwards	0-20	Sapric material	PT	A-8	0	---	---	---	---	---	---
	20-60	Marl	---	---	0	100	95-100	80-90	60-80	---	---
Fa: Faxon	0-10	Loam	ML, CL	A-6, A-4	0-10	95-100	90-100	85-100	50-80	30-40	5-15
	10-36	Loam, fine sandy loam, sandy clay loam.	CL, ML, SC, SM	A-7, A-6	0-10	95-100	85-100	65-95	40-85	30-50	10-20
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gf: Gilford	0-15	Fine sandy loam	SM, SC, SM-SC	A-4	0	95-100	90-100	65-80	35-45	<25	2-10
	15-28	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	20-35	15-30	NP-8
	28-60	Fine sand, sand, coarse sand.	SM, SP, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	18-60	3-20	---	NP
GzB: Grovecity	0-16	Fine sandy loam	SM, SC, SM-SC	A-4, A-2, A-6	0	95-100	85-100	45-80	30-50	20-35	2-11
	16-32	Sandy loam, fine sandy loam, coarse sandy loam.	SM, SC, CL, ML	A-4, A-6	0	90-100	80-100	50-85	35-65	<35	2-7
	32-60	Fine sandy loam, sandy loam, loam.	SM, SC, CL, ML	A-4, A-6	0	80-100	75-100	50-85	35-65	<35	NP-7
Ho, Hp: Houghton	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
Ir: Iroquois	0-16	Fine sandy loam, sandy loam.	SC, SM-SC, CL-ML, CL	A-4	0	95-100	95-100	65-85	35-55	20-25	5-8
	16-27	Sandy loam, sandy clay loam.	CL, SC	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	55-100	25-80	20-30	7-16
	27-31	Sandy clay loam, clay loam.	CL, SC	A-6, A-2-6	0	95-100	95-100	75-100	30-80	30-45	10-20
	31-60	Silty clay, clay	CL, CH	A-7	0	100	100	90-100	70-95	45-60	20-30
LuB2: Lucas	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	80-95	30-45	13-25
	8-24	Silty clay, clay	CH, CL, MH, ML	A-7	0	100	100	95-100	80-95	40-65	18-34
	24-60	Silty clay, clay, silty clay loam.	CH, CL, MH, ML	A-7	0	100	100	95-100	80-95	40-65	18-34

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MaB*:											
Markton	0-10	Sand	SM	A-2-4	0	100	95-100	50-75	15-30	---	NP
	10-27	Sand, loamy sand	SP-SM, SM	A-2-4, A-1-b, A-3	0	100	95-100	45-75	5-30	---	NP
	27-38	Sandy loam, loam	ML, CL-ML, SM, SM-SC	A-4, A-2-4	0-3	95-100	90-100	60-95	30-70	18-25	NP-7
	38-60	Loam	ML, CL-ML	A-4	0-3	95-100	90-100	80-95	55-75	14-21	NP-6
Aubbeenaubbee	0-15	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	100	90-100	50-85	30-50	<21	NP-6
	15-20	Fine sandy loam, sandy clay loam, sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	100	90-100	50-90	25-55	16-30	3-10
	20-33	Clay loam, loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	75-100	55-80	25-35	5-15
	33-60	Loam	ML, CL-ML, CL	A-4	0-3	90-100	85-100	75-100	55-80	15-25	2-10
McB Martinsville	0-8	Fine sandy loam	SM, SM-SC	A-4, A-2-4	0	100	85-100	55-85	30-50	<20	NP-6
	8-35	Sandy loam, loam, sandy clay loam.	SM-SC, CL-ML, CL, SC	A-2, A-4, A-6	0	95-100	85-100	55-95	30-75	20-30	5-11
	35-60	Stratified sand to silt loam.	SM, SM-SC, CL-ML	A-4, A-2-4, A-1	0	95-100	85-100	45-95	10-75	<25	NP-8
MeA, MeB Metamora	0-8	Fine sandy loam	SM, SM-SC	A-2, A-4	0-3	95-100	95-100	60-80	25-45	<25	NP-7
	8-36	Loam, clay loam	CL-ML, CL	A-6, A-4	0-3	95-100	95-100	85-95	50-75	20-35	5-15
	36-60	Loam	CL-ML, SM-SC, SC, CL	A-4	0-3	95-100	90-100	65-95	40-75	<25	4-8
MkB Metea	0-8	Loamy sand	SM	A-2-4	0	95-100	90-100	50-80	15-35	---	NP
	8-28	Loamy sand, sand	SP-SM, SM	A-2-4, A-3	0	100	90-100	50-80	5-35	---	NP
	28-38	Sandy clay loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-2-4	0	95-100	95-100	55-90	15-75	<27	4-9
	38-60	Loam	CL, CL-ML	A-4	0-3	85-95	75-95	65-90	50-75	<25	5-10
Mp Montgomery	0-10	Silty clay loam	CL	A-7	0	100	100	100	85-100	40-50	20-30
	10-22	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	90-100	50-65	30-42
	22-60	Stratified clay to silty clay loam.	CL, CH	A-7	0	100	100	90-100	85-100	40-55	20-32
Mu Morocco	0-14	Loamy sand, loamy fine sand.	SM, SM-SC	A-2-4	0	100	100	50-85	15-35	<20	NP-5
	14-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
Mw Muskego	0-18	Sapric material	PT	A-8	0	---	---	---	---	---	---
	18-60	Coprogenous earth	OL	A-5	0	95-100	95-100	85-100	75-96	40-50	2-8
Mz Mussey	0-10	Mucky sandy loam	SM, SC, ML, CL	A-2, A-4	0-5	90-100	85-100	50-90	25-70	<25	2-10
	10-13	Clay loam, loam	CL, SC, CL-ML, SM-SC	A-6, A-4	0-10	90-100	85-100	50-95	40-80	20-35	5-15
	13-60	Sand, gravelly sand.	SP, SP-SM	A-1	0-10	55-100	45-100	0-30	0-10	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
NaB: Nesius	0-18	Fine sand	SM	A-2-4	0	100	100	65-80	15-35	<20	NP
	18-51	Fine sand	SM	A-2-4	0	100	100	65-80	15-35	<20	NP
	51-60	Fine sand, sand	SM, SW-SM, SP-SM	A-2-4, A-3	0	100	100	50-80	5-35	---	NP
Ne: Newton	0-10	Loamy fine sand	SM, SM-SC	A-2-4	0	100	100	50-75	15-30	<20	NP-5
	10-60	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2-4, A-3	0	100	100	50-75	5-25	---	NP
OaB, OaC: Oakville	0-9	Fine sand	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	9-60	Fine sand, sand, loamy fine sand.	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
ObB: Oakville	0-3	Sand	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	3-60	Fine sand, sand, loamy fine sand.	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
OcC2: Octagon	0-13	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	95-100	90-100	50-70	25-40	<25	NP-7
	13-30	Clay loam, loam	CL	A-4, A-6	0	95-100	90-100	70-100	55-95	20-35	7-15
	30-60	Loam	CL, CL-ML	A-4	0-3	85-100	85-95	65-95	50-65	<25	4-8
OrB: Ormas	0-12	Loamy fine sand	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	12-37	Sand, loamy sand, loamy fine sand.	SW-SM, SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-70	10-20	---	NP
	37-46	Sandy loam, fine sandy loam, sandy clay loam.	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	46-50	Gravelly sandy clay loam, gravelly fine sandy loam, gravelly coarse sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0-3	60-80	55-80	35-70	20-45	20-40	6-20
	50-60	Gravelly sand, very gravelly coarse sand, gravelly coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0-3	35-80	30-80	30-55	3-12	---	NP
OtB: Ormas Variant	0-8	Loamy sand	SM, SP-SM	A-1-b, A-2-4, A-3	0-2	95-100	90-100	45-75	5-30	---	NP
	8-24	Loamy sand, sand	SM, SP-SM	A-1-b, A-2-4, A-3	0-2	95-100	90-100	45-75	5-30	---	NP
	24-33	Loamy coarse sand	SM, SP-SM	A-1-b, A-2-4, A-3	0-2	85-100	80-95	40-70	5-15	<20	NP-4
	33-60	Gravelly coarse sand, coarse sand, gravelly sand.	SM, SW-SM	A-1-b, A-2-4, A-3	0-5	80-90	75-85	35-65	5-15	---	NP
Pa: Papineau	0-10	Sandy loam	SM-SC, SC	A-4, A-2-4	0	100	95-100	65-85	30-50	<25	5-10
	10-24	Sandy loam, sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	100	100	70-95	36-85	20-40	8-25
	24-60	Clay, silty clay	CH	A-7	0	100	100	95-100	75-100	50-65	30-45

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
PaB----------------- Parr	0-10	Fine sandy loam	SM, SM-SC	A-4	0	95-100	90-100	65-80	35-45	<21	3-6
	10-30	Clay loam, loam	CL	A-4, A-6	0	90-100	90-100	75-100	50-80	25-35	9-15
	30-60	Loam-------------	CL-ML, ML, CL	A-4	0-3	85-95	85-95	75-85	50-65	<25	3-8
PdB*:											
Parr-------------	0-14	Fine sandy loam	SM, SM-SC	A-4	0	95-100	90-100	65-80	35-45	<21	3-6
	14-31	Clay loam, loam, sandy clay loam.	CL	A-4, A-6	0	90-100	90-100	75-100	50-80	25-35	9-15
	31-60	Loam-------------	CL-ML, ML, CL	A-4	0-3	85-95	85-95	75-85	50-65	<25	3-8
Ayr--------------	0-14	Loamy sand-------	SM	A-2	0	100	95-100	50-85	15-35	---	NP
	14-34	Sand, fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	100	95-100	50-85	5-35	---	NP
	34-38	Loam, sandy clay loam.	CL, CL-ML	A-4	0-3	95-100	90-100	85-95	60-90	20-30	5-10
	38-60	Loam-------------	CL, CL-ML	A-4	0-3	95-100	90-100	70-90	50-85	<25	5-10
Pf*. Pits											
Px----------------- Prochaska	0-14	Loamy sand-------	SM	A-2	0	100	95-100	50-80	15-35	---	NP
	14-36	Sand, loamy sand	SP-SM, SM	A-3, A-2	0	95-100	90-100	50-80	5-30	---	NP
	36-60	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-3, A-1, A-2	0	95-100	90-100	45-70	2-15	---	NP
Rd----------------- Reddick	0-11	Silty clay loam	CL	A-6, A-7	0	95-100	85-100	85-95	75-90	30-50	10-25
	11-42	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	85-95	80-90	65-90	30-50	10-25
	42-60	Silty clay loam, clay loam, clay.	CL, CH	A-6, A-7	0-10	90-100	85-95	85-95	80-95	35-55	15-30
Re----------------- Rensselaer	0-15	Loam-------------	CL, ML, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	15-35	4-15
	15-37	Clay loam, silty clay loam, loam.	CL	A-6, A-4	0	95-100	90-100	80-100	50-95	25-40	8-20
	37-60	Stratified fine sand to silt loam.	CL, SC, ML, SM	A-4, A-2	0	95-100	90-100	45-95	25-85	<25	2-10
Rs----------------- Rensselaer	0-16	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	95-100	90-100	60-85	35-55	<25	NP-6
	16-41	Sandy loam, loam	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	95-100	90-100	50-95	25-75	<25	NP-7
	41-55	Stratified sand to silt loam.	SM, SM-SC, ML, CL-ML	A-4	0	95-100	90-100	60-100	35-75	<25	NP-6
	55-60	Loam-------------	ML, CL, CL-ML	A-4	0	85-100	85-100	70-90	50-70	<25	NP-10
Rw*:											
Rensselaer-------	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	80-100	70-95	50-75	20-35	4-15
	13-28	Sandy loam, loam, clay loam.	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	95-100	90-100	50-95	25-75	<25	NP-7
	28-44	Stratified sand to silt loam.	SM, SM-SC, ML, CL-ML	A-4	0	95-100	90-100	60-100	35-75	<25	NP-6
	44-60	Loam-------------	ML, CL, CL-ML	A-4	0	85-100	85-100	70-90	50-70	<25	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Rw*:											
Wolcott----------	0-11	Clay loam---------	CL, ML	A-6, A-7	0	100	90-100	90-100	70-90	35-50	10-20
	11-33	Clay loam, loam	CL	A-6, A-7	0	90-100	85-100	85-98	60-90	35-50	18-30
	33-60	Loam--------------	CL, CL-ML	A-4	0	90-100	80-95	80-95	55-95	20-30	4-10
RxB--------------- Rockton	0-15	Fine sandy loam	SC, CL, SM-SC, CL-ML	A-4	0-5	95-100	90-100	60-95	40-55	18-25	4-8
	15-36	Loam, sandy clay loam, clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-5	95-100	90-100	70-100	40-75	23-29	7-11
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SmA--------------- Simonin	0-14	Loamy sand--------	SM-SC, SM	A-2-4	0	100	95-100	50-75	15-30	<25	NP-5
	14-26	Loamy sand, sand	SM-SC, SM	A-2-4	0	100	95-100	50-75	15-30	<25	NP-5
	26-34	Fine sandy loam, sandy loam.	CL-ML, SM, SM-SC, ML	A-2-4, A-4	0	100	95-100	55-85	25-55	<25	3-7
	34-40	Silty clay, clay	CH, MH	A-7	0	100	100	90-100	75-95	50-70	20-40
	40-60	Silty clay, clay	CH, MH	A-7	0	100	100	90-100	75-95	50-70	20-40
So---------------- Sloan	0-6	Silt loam---------	CL, ML, CL-ML	A-6, A-4	0	100	95-100	85-100	70-95	20-40	3-15
	6-40	Silty clay loam, clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	40-60	Stratified gravelly sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	95-100	70-100	60-95	50-90	25-40	3-15
SpB--------------- Sparta	0-17	Sand, fine sand	SP-SM, SM	A-3, A-2	0	85-100	85-100	50-75	5-35	---	NP
	17-48	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
	48-80	Sand, fine sand, loamy sand.	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
SsB--------------- Sparta	0-14	Loamy sand--------	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	14-44	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
	44-60	Loam, fine sandy loam, gravelly fine sandy loam.	CL	A-6	2-5	80-95	75-90	80-90	55-65	25-35	11-20
St---------------- Strole	0-13	Clay loam---------	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	14-20
	13-29	Silty clay, clay	CL, CH	A-7	0	100	100	90-100	80-95	40-60	18-30
	29-60	Silty clay, clay	CL, CH	A-7	0	100	100	90-100	80-95	40-60	15-30
Sx---------------- Suman	0-10	Loam--------------	CL, CL-ML	A-4, A-6	0	100	90-100	75-95	60-85	20-35	5-15
	10-28	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0	100	90-100	65-95	50-85	30-50	10-30
	28-60	Sand, coarse sand, loamy sand.	SM, SP-SM	A-3, A-2-4, A-1-b	0	100	90-100	40-75	5-25	---	NP
Wb---------------- Warners	0-14	Fine sandy loam	SM, SC, SM-SC	A-4, A-6, A-2	0	100	95-100	55-70	30-40	15-30	2-15
	14-60	Marl--------------	---	---	0	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
We---------------- Watseka	0-10	Loamy fine sand	SM, SM-SC	A-2	0	100	95-100	80-100	17-35	<25	NP-5
	10-60	Fine sand, sand, loamy fine sand.	SP, SM, SP-SM	A-3, A-2	0	90-100	90-100	60-80	3-25	<20	NP-4
Wm*:											
Watseka----------	0-14	Loamy sand--------	SM, SM-SC	A-2	0	100	95-100	80-100	17-35	<25	NP-5
	14-60	Fine sand, sand, loamy fine sand.	SP, SM, SP-SM	A-3, A-2	0	90-100	90-100	60-80	3-25	<20	NP-4
Maumee-----------	0-18	Loamy sand--------	SM, SP-SM	A-2-4, A-3	0	95-100	90-100	50-75	5-30	<30	NP-5
	18-60	Sand, loamy fine sand, fine sand.	SP, SP-SM, SM	A-1-b, A-3, A-2-4	0	85-100	75-95	35-70	3-25	<30	NP
WsB2-------------- Wawasee	0-7	Loam--------------	CL, CL-ML	A-4, A-6	0	90-100	85-95	80-95	50-70	20-30	4-12
	7-28	Loam, sandy clay loam.	CL, SC	A-4, A-6	0	90-100	85-95	80-95	45-70	25-35	7-15
	28-60	Loam, sandy loam, fine sandy loam.	SM-SC, SC, CL-ML, CL	A-4, A-6, A-2	0	90-100	80-95	50-90	25-66	20-30	4-12
Wt---------------- Whitaker	0-9	Fine sandy loam	SM, SM-SC	A-4	0	100	95-100	65-80	35-45	<25	2-6
	9-34	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-6, A-4	0	100	95-100	90-100	70-80	20-35	5-15
	34-60	Stratified coarse sand to silt loam.	ML, SM, CL-ML, SM-SC	A-4	0	98-100	98-100	60-85	40-60	<25	NP-7
Za*:											
Zadog------------	0-11	Loamy sand--------	SM, SP-SM	A-1-b, A-2-4, A-3	0-5	95-100	95-100	45-75	5-30	<25	NP
	11-17	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0-10	85-100	85-100	50-90	20-50	<25	NP-10
	17-24	Fine sandy loam, sandy loam, sandy clay loam.	SM-SC, CL, CL-ML, SC	A-2-4, A-4, A-6, A-2-6	0-10	85-100	85-95	50-85	20-55	<25	4-15
	24-26	Fine sandy loam, sandy loam, sandy clay loam.	SM-SC, CL, CL-ML, SC	A-2-4, A-4, A-6, A-2-6	0-10	85-100	85-95	50-85	20-55	<25	4-15
	26-60	Sand, loamy sand	SM, SP-SM	A-1-b, A-2-4, A-3	0	100	100	40-80	5-30	---	NP
Maumee-----------	0-15	Loamy sand--------	SM, SP-SM	A-2-4, A-3	0	95-100	90-100	50-75	5-30	<30	NP-5
	15-60	Sand, loamy sand	SP, SP-SM, SM	A-1-b, A-3, A-2-4	0	85-100	75-95	35-70	3-25	<30	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Ab-----------------	0-10	---	0.20-0.80	0.2-6.0	0.35-0.45	6.6-7.3	-------------	----	2	3	30-40
Ackerman	10-27	---	0.50-1.20	0.06-0.2	0.18-0.24	6.6-8.4	-------------	----			
	27-60	2-5	1.55-1.60	6.0-20	0.06-0.08	6.6-8.4	Low----------	0.15			
As-----------------	0-24	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	2	2	55-75
Adrian	24-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low----------	----			
AtA----------------	0-11	15-25	1.20-1.40	0.6-2.0	0.21-0.24	5.6-7.3	Low----------	0.28	5	6	2-4
Andres	11-34	20-35	1.35-1.60	0.6-2.0	0.16-0.20	5.6-8.4	Moderate-----	0.28			
	34-60	24-35	1.45-1.70	0.2-0.6	0.18-0.20	7.4-8.4	Moderate-----	0.37			
AyB----------------	0-13	3-10	1.20-1.40	6.0-20	0.10-0.12	6.1-7.3	Low----------	0.17	5	1	1-2
Ayr	13-33	2-10	1.20-1.45	6.0-20	0.06-0.11	6.1-7.3	Low----------	0.17			
	33-37	17-27	1.50-1.70	0.6-2.0	0.17-0.19	6.1-7.8	Low----------	0.37			
	37-60	10-18	1.50-1.70	0.6-2.0	0.05-0.13	7.4-8.4	Low----------	0.37			
BeB----------------	0-6	3-7	1.50-1.65	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.17	5	2	.5-1
Brems	6-40	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.0	Low----------	0.17			
	40-60	2-6	1.60-1.75	6.0-20	0.05-0.07	5.1-6.5	Low----------	0.17			
Br-----------------	0-10	14-27	1.35-1.50	0.6-2.0	0.21-0.24	6.1-7.3	Low----------	0.28	5	6	4-8
Brookston	10-40	25-35	1.40-1.60	0.6-2.0	0.15-0.19	6.1-7.3	Moderate-----	0.28			
	40-60	15-26	1.45-1.70	0.6-2.0	0.05-0.19	7.4-8.4	Low----------	0.28			
ChB----------------	0-4	1-8	1.50-1.55	6.0-20	0.06-0.08	5.6-7.3	Low----------	0.15	5	1	2-4
Chelsea	4-80	1-10	1.55-1.70	6.0-20	0.06-0.08	5.1-7.3	Low----------	0.17			
CoB----------------	0-13	15-20	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	5	5	2-4
Corwin	13-35	22-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.28			
	35-40	20-25	1.40-1.60	0.6-2.0	0.17-0.19	6.6-8.4	Low----------	0.28			
	40-60	12-22	1.50-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.28			
Cp-----------------	0-14	5-15	1.50-1.70	2.0-6.0	0.13-0.18	5.6-7.3	Low----------	0.20	5	3	2-4
Craigmile	14-37	5-18	1.35-1.60	2.0-6.0	0.15-0.22	6.1-7.3	Low----------	0.37			
	37-60	2-10	1.60-1.75	6.0-20	0.05-0.10	6.6-7.8	Low----------	0.15			
Dc-----------------	0-10	10-27	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	5	5	2-4
Darroch	10-34	18-35	1.40-1.60	0.6-2.0	0.17-0.19	5.6-7.3	Moderate-----	0.28			
	34-60	5-15	1.50-1.70	0.6-2.0	0.19-0.21	7.4-8.4	Low----------	0.28			
Dg*:											
Darroch----------	0-10	10-27	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	5	5	2-4
	10-30	18-35	1.40-1.60	0.6-2.0	0.15-0.18	5.6-7.3	Moderate-----	0.28			
	30-42	5-15	1.50-1.70	0.6-2.0	0.19-0.21	7.4-8.4	Low----------	0.28			
	42-60	10-22	1.45-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.28			
Odell------------	0-10	10-20	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	5	5	2-4
	10-46	20-33	1.40-1.60	0.6-2.0	0.15-0.19	5.6-7.8	Moderate-----	0.28			
	46-60	10-20	1.50-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.28			
Ed-----------------	0-20	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	2	2	55-75
Edwards	20-60	---	---	---	---	7.4-8.4	-------------	----			
Fa-----------------	0-10	12-20	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.28	4	6	5-15
Faxon	10-36	18-30	1.40-1.60	0.6-2.0	0.12-0.19	6.6-7.8	Moderate-----	0.28			
	36	---	---	---	---	---	-------------	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Gf----------------- Gilford	0-15	10-20	1.50-1.70	2.0-6.0	0.16-0.18	5.6-7.3	Low------------	0.20	4	3	2-4
	15-28	8-20	1.60-1.80	2.0-6.0	0.12-0.14	5.6-7.3	Low------------	0.20			
	28-60	1-10	1.70-1.90	6.0-20	0.05-0.08	6.1-8.4	Low------------	0.15			
GzB--------------- Grovecity	0-16	12-20	1.35-1.55	2.0-6.0	0.13-0.18	6.1-7.3	Low------------	0.20	5	3	2-5
	16-32	10-18	1.30-1.55	2.0-6.0	0.12-0.19	6.1-7.8	Low------------	0.20			
	32-60	3-18	1.40-1.60	2.0-6.0	0.11-0.19	7.4-8.4	Low------------	0.20			
Ho----------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	---------------	----	2	2	>70
Hp----------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.3	---------------	----	2	2	>70
Ir----------------- Iroquois	0-16	16-20	1.40-1.60	0.6-2.0	0.16-0.18	5.6-7.3	Low------------	0.20	4	3	3-6
	16-27	18-25	1.50-1.70	0.6-2.0	0.15-0.19	5.6-7.3	Low------------	0.32			
	27-31	27-40	1.55-1.60	0.06-0.2	0.16-0.19	5.6-7.3	Moderate------	0.32			
	31-60	45-60	1.40-1.65	<0.06	0.08-0.12	7.4-8.4	High-----------	0.32			
LuB2-------------- Lucas	0-8	27-40	1.35-1.55	0.2-0.6	0.16-0.19	5.1-7.3	Moderate------	0.43	3	7	1-2
	8-24	45-60	1.40-1.70	0.06-0.2	0.12-0.14	6.1-8.4	High-----------	0.32			
	24-60	35-60	1.45-1.70	<0.2	0.08-0.12	7.4-8.4	High-----------	0.32			
MaB*:											
Markton-----------	0-10	3-7	1.40-1.55	6.0-20	0.10-0.12	5.6-7.3	Low------------	0.17	5	2	1-3
	10-27	2-8	1.50-1.70	6.0-20	0.06-0.11	5.6-7.3	Low------------	0.17			
	27-38	12-20	1.50-1.70	0.6-2.0	0.12-0.19	6.1-7.8	Low------------	0.28			
	38-60	8-16	1.50-1.70	0.6-2.0	0.17-0.19	7.4-8.4	Low------------	0.28			
Aubbeenaubbee----	0-15	5-15	1.45-1.55	0.6-6.0	0.12-0.18	5.6-7.3	Low------------	0.24	5	3	1-2
	15-20	10-25	1.55-1.65	0.6-6.0	0.11-0.16	5.1-7.3	Low------------	0.24			
	20-33	22-32	1.40-1.65	0.6-2.0	0.14-0.18	5.6-7.3	Moderate------	0.32			
	33-60	10-20	1.55-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low------------	0.32			
McB--------------- Martinsville	0-8	5-15	1.35-1.50	2.0-6.0	0.13-0.18	5.1-7.3	Low------------	0.24	5	3	2-4
	8-35	15-25	1.40-1.60	0.6-2.0	0.12-0.17	5.1-6.5	Low------------	0.24			
	35-60	2-20	1.50-1.70	0.6-6.0	0.08-0.17	5.6-8.4	Low------------	0.24			
MeA, MeB---------- Metamora	0-8	5-15	1.40-1.50	2.0-6.0	0.13-0.18	5.1-6.5	Low------------	0.20	5	3	1-2
	8-36	10-28	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Low------------	0.32			
	36-60	12-20	1.45-1.65	0.6-2.0	0.10-0.15	7.4-8.4	Low------------	0.32			
MkB--------------- Metea	0-8	3-8	1.55-1.65	6.0-20	0.10-0.12	5.6-7.3	Low------------	0.17	5	2	.5-2
	8-28	2-10	1.65-1.80	6.0-20	0.06-0.11	5.1-7.3	Low------------	0.17			
	28-38	12-35	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low------------	0.32			
	38-60	10-24	1.55-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low------------	0.32			
Mp----------------- Montgomery	0-10	35-40	1.35-1.55	0.06-0.6	0.20-0.23	6.1-7.8	High-----------	0.37	5	7	3-6
	10-22	30-50	1.45-1.65	0.06-0.2	0.11-0.18	6.1-7.8	High-----------	0.37			
	22-60	35-48	1.50-1.70	0.06-0.2	0.18-0.20	7.4-8.4	Moderate------	0.37			
Mu----------------- Morocco	0-14	1-10	1.40-1.60	6.0-20	0.10-0.12	5.1-6.5	Low------------	0.17	5	2	.5-2
	14-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	Low------------	0.15			
Mw----------------- Muskego	0-18	0	0.10-0.21	0.6-6.0	0.35-0.45	5.6-7.3	---------------	----	2	2	>50
	18-60	18-35	0.30-1.10	0.06-0.2	0.18-0.24	6.6-8.4	Moderate------	0.28			
Mz----------------- Mussey	0-10	10-18	1.35-1.50	0.6-6.0	0.12-0.20	6.1-7.8	Low------------	0.24	3	3	8-14
	10-13	18-30	1.40-1.55	0.6-2.0	0.08-0.19	6.1-7.8	Low------------	0.24			
	13-60	0-10	1.40-1.65	6.0-20	0.02-0.03	6.6-7.8	Low------------	0.10			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
NaB-------------- Nesius	0-18	3-10	1.45-1.65	6.0-20	0.08-0.10	6.6-7.3	Low----------	0.15	5	1	1-3
	18-51	3-10	1.55-1.70	6.0-20	0.06-0.09	6.6-7.3	Low----------	0.15			
	51-60	1-5	1.55-1.70	6.0-20	0.05-0.07	6.6-7.3	Low----------	0.15			
Ne--------------- Newton	0-10	3-7	1.45-1.60	6.0-20	0.10-0.12	4.5-6.0	Low----------	0.17	5	2	4-8
	10-60	0-7	1.60-1.75	6.0-20	0.05-0.07	4.5-6.0	Low----------	0.17			
OaB, OaC--------- Oakville	0-9	0-10	1.30-1.55	6.0-20	0.07-0.09	5.6-7.3	Low----------	0.15	5	1	.5-2
	9-60	0-10	1.30-1.65	6.0-20	0.06-0.10	5.6-7.3	Low----------	0.15			
ObB-------------- Oakville	0-3	0-10	1.30-1.55	6.0-20	0.07-0.09	5.6-7.3	Low----------	0.15	5	1	.5-2
	3-60	0-10	1.30-1.65	6.0-20	0.06-0.08	5.6-7.3	Low----------	0.15			
OcC2------------- Octagon	0-13	8-15	1.35-1.50	0.6-2.0	0.16-0.18	5.6-7.3	Low----------	0.20	5	5	2-4
	13-30	12-30	1.40-1.60	0.6-2.0	0.15-0.20	5.6-7.3	Moderate-----	0.28			
	30-60	12-20	1.50-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.28			
OrB-------------- Ormas	0-12	2-12	1.40-1.60	6.0-20	0.10-0.12	4.5-7.3	Low----------	0.17	5	2	1-3
	12-37	3-10	1.45-1.60	6.0-20	0.07-0.09	4.5-6.5	Low----------	0.17			
	37-46	10-25	1.50-1.70	2.0-6.0	0.12-0.14	5.1-7.3	Low----------	0.17			
	46-50	15-25	1.50-1.60	2.0-6.0	0.11-0.14	5.6-7.3	Low----------	0.32			
	50-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low----------	0.15			
OtB-------------- Ormas Variant	0-8	0-8	1.35-1.70	6.0-20	0.09-0.12	5.1-6.5	Low----------	0.17	5	2	.5-2
	8-24	0-8	1.35-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	24-33	4-12	1.55-1.85	6.0-20	0.03-0.08	5.1-7.3	Low----------	0.17			
	33-60	0-5	1.70-1.85	6.0-20	0.02-0.04	6.6-8.4	Low----------	0.10			
Pa--------------- Papineau	0-10	10-20	1.40-1.60	2.0-6.0	0.14-0.17	4.5-7.3	Low----------	0.20	4	3	2-4
	10-24	17-32	1.45-1.65	0.6-2.0	0.13-0.17	5.1-7.3	Moderate-----	0.28			
	24-60	40-60	1.65-1.85	0.06-0.2	0.08-0.12	6.6-8.4	Moderate-----	0.28			
PaB-------------- Parr	0-10	10-18	1.35-1.50	0.6-2.0	0.16-0.18	5.6-7.3	Low----------	0.20	5	3	2-4
	10-30	22-32	1.40-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	30-60	10-20	1.50-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.32			
PdB*:											
Parr------------	0-14	10-18	1.35-1.50	0.6-2.0	0.16-0.18	5.6-7.3	Low----------	0.20	5	3	2-4
	14-31	22-32	1.40-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	31-60	10-20	1.50-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.32			
Ayr-------------	0-14	3-10	1.20-1.40	6.0-20	0.10-0.12	6.1-7.3	Low----------	0.17	5	1	2-4
	14-34	2-10	1.20-1.45	6.0-20	0.06-0.11	6.1-7.3	Low----------	0.17			
	34-38	17-27	1.50-1.70	0.6-2.0	0.17-0.19	6.1-7.8	Low----------	0.37			
	38-60	10-18	1.50-1.70	0.6-2.0	0.05-0.13	7.4-8.4	Low----------	0.37			
Pf*. Pits											
Px--------------- Prochaska	0-14	3-8	1.40-1.60	6.0-20	0.10-0.12	5.1-7.3	Low----------	0.17	5	2	2-5
	14-36	2-10	1.50-1.75	6.0-20	0.04-0.09	5.6-7.3	Low----------	0.17			
	36-60	1-8	1.50-1.75	6.0-20	0.02-0.06	5.6-7.8	Low----------	0.17			
Rd--------------- Reddick	0-11	27-35	1.20-1.40	0.6-2.0	0.17-0.23	5.6-7.8	Moderate-----	0.28	5	7	5-8
	11-42	25-35	1.35-1.60	0.6-2.0	0.15-0.20	6.1-7.8	Moderate-----	0.28			
	42-60	25-43	1.50-1.70	<0.2	0.08-0.20	7.4-8.4	Moderate-----	0.28			
Re--------------- Rensselaer	0-15	11-27	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	5	5	2-8
	15-37	20-35	1.40-1.60	0.6-2.0	0.15-0.20	6.1-7.8	Moderate-----	0.32			
	37-60	8-20	1.50-1.70	0.6-2.0	0.10-0.18	7.4-8.4	Low----------	0.43			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Rs--------------- Rensselaer	0-16	10-20	1.35-1.40	0.6-2.0	0.16-0.18	5.6-7.3	Low-----------	0.20	5	3	3-8
	16-41	18-27	1.40-1.60	0.6-2.0	0.15-0.19	6.1-7.3	Low-----------	0.28			
	41-55	12-20	1.40-1.60	0.6-2.0	0.19-0.21	7.4-8.4	Low-----------	0.28			
	55-60	8-18	1.45-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low-----------	0.28			
Rw*:											
Rensselaer------	0-13	11-25	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	5	3-8
	13-28	18-35	1.40-1.60	0.6-2.0	0.15-0.19	6.1-7.3	Low-----------	0.28			
	28-44	8-12	1.40-1.60	0.6-2.0	0.19-0.21	7.4-8.4	Low-----------	0.28			
	44-60	8-18	1.45-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low-----------	0.28			
Wolcott---------	0-11	27-33	1.40-1.55	0.6-2.0	0.17-0.19	6.1-7.3	Moderate------	0.28	5	7	4-8
	11-33	27-35	1.55-1.65	0.6-2.0	0.15-0.19	6.1-7.3	Moderate------	0.37			
	33-60	11-25	1.50-1.65	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
RxB-------------- Rockton	0-15	12-20	1.40-1.55	0.6-2.0	0.16-0.18	5.6-6.5	Low-----------	0.28	4	3	1-3
	15-36	18-30	1.40-1.60	0.6-2.0	0.16-0.19	5.6-7.3	Low-----------	0.28			
	36	---	---	---	---	---	--------------	----			
SmA-------------- Simonin	0-14	4-14	1.40-1.60	6.0-20	0.10-0.12	6.1-7.3	Low-----------	0.17	4	2	1-3
	14-26	4-14	1.40-1.60	6.0-20	0.09-0.11	6.1-7.3	Low-----------	0.17			
	26-34	10-18	1.45-1.60	2.0-6.0	0.12-0.17	5.6-6.5	Low-----------	0.20			
	34-40	50-65	1.50-1.60	0.06-0.2	0.08-0.12	6.1-7.3	High----------	0.28			
	40-60	50-65	1.50-1.60	0.06-0.2	0.08-0.12	7.4-8.4	High----------	0.28			
So--------------- Sloan	0-6	15-27	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.37	5	6	3-6
	6-40	22-35	1.25-1.55	0.6-2.0	0.15-0.19	6.1-8.4	Moderate------	0.37			
	40-60	10-30	1.20-1.50	0.6-2.0	0.13-0.18	6.6-8.4	Low-----------	0.37			
SpB-------------- Sparta	0-17	1-5	1.30-1.50	6.0-20	0.06-0.09	5.1-7.3	Low-----------	0.17	5	1	.5-2
	17-48	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-7.3	Low-----------	0.17			
	48-80	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-7.3	Low-----------	0.17			
SsB-------------- Sparta	0-14	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low-----------	0.17	5	2	1-2
	14-44	2-15	1.40-1.60	6.0-20	0.05-0.11	5.1-7.3	Low-----------	0.17			
	44-60	3-20	1.55-1.80	0.6-2.0	0.10-0.16	5.6-7.3	Low-----------	0.37			
St--------------- Strole	0-13	27-40	1.25-1.50	0.06-0.6	0.17-0.23	5.6-7.3	Moderate------	0.43	3	7	3-6
	13-29	40-60	1.30-1.50	0.06-0.2	0.09-0.13	5.6-7.8	High----------	0.32			
	29-60	35-60	1.30-1.50	0.06-0.2	0.08-0.12	7.4-8.4	High----------	0.32			
Sx--------------- Suman	0-10	18-30	1.30-1.45	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.32	5	6	4-8
	10-28	20-32	1.40-1.60	0.2-0.6	0.17-0.20	6.1-7.8	Moderate------	0.32			
	28-60	3-10	1.60-1.75	6.0-20	0.04-0.09	6.1-7.8	Low-----------	0.10			
Wb--------------- Warners	0-14	10-20	1.05-1.40	0.2-2.0	0.13-0.17	6.1-8.4	Low-----------	0.20	5	3	4-8
	14-60	---	---	0.6-2.0	---	7.4-8.4	Low-----------	----			
We--------------- Watseka	0-10	2-10	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	1-3
	10-60	1-10	1.70-2.00	6.0-20	0.05-0.10	5.1-7.3	Low-----------	0.17			
Wm*:											
Watseka---------	0-14	2-10	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	1-3
	14-60	1-10	1.70-2.00	6.0-20	0.05-0.10	5.1-7.3	Low-----------	0.17			
Maumee----------	0-18	2-10	1.60-1.75	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	2-4
	18-60	2-10	1.60-1.75	6.0-20	0.05-0.07	5.6-8.4	Low-----------	0.17			
WsB2------------- Wawasee	0-7	10-18	1.20-1.40	0.6-2.0	0.16-0.20	5.6-7.3	Low-----------	0.28	4	5	1-3
	7-28	18-27	1.50-1.70	0.6-2.0	0.12-0.18	5.1-7.3	Moderate------	0.28			
	28-60	12-18	1.50-1.70	0.6-2.0	0.11-0.18	6.6-8.4	Low-----------	0.28			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Wt----------------	0-9	7-16	1.35-1.50	0.6-2.0	0.16-0.18	5.6-7.3	Low----------	0.24	5	3	1-3
Whitaker	9-34	18-33	1.40-1.60	0.6-2.0	0.15-0.19	4.5-7.3	Moderate-----	0.37			
	34-60	3-18	1.50-1.70	0.6-6.0	0.19-0.21	6.1-8.4	Low----------	0.37			
Za*:											
Zadog-----------	0-11	3-10	1.65-1.80	0.6-6.0	0.10-0.12	6.1-7.3	Low----------	0.17	5	2	1-4
	11-17	8-18	1.45-1.60	0.6-6.0	0.13-0.18	6.1-7.3	Low----------	0.17			
	17-24	12-30	1.40-1.65	0.6-2.0	0.13-0.19	6.1-7.3	Low----------	0.32			
	24-26	12-25	1.40-1.65	0.6-2.0	0.13-0.19	6.6-8.4	Low----------	0.32			
	26-60	1-5	1.65-1.80	6.0-20.0	0.05-0.10	7.4-8.4	Low----------	0.17			
Maumee----------	0-15	2-10	1.60-1.75	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	2-4
	15-60	2-10	1.60-1.75	6.0-20	0.05-0.07	6.1-8.4	Low----------	0.17			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "frequent," "long," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ab Ackerman	A/D	None	---	---	+5-1.0	Apparent	Nov-May	>60	---	High	High	Low.
As Adrian	A/D	None	---	---	+1-1.0	Apparent	Nov-May	>60	---	High	High	Moderate.
AtA Andres	B	None	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High	High	Low.
AyB Ayr	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
BeB Brems	A	None	---	---	2.0-3.0	Apparent	Jan-Apr	>60	---	Low	Low	High.
Br Brookston	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Low.
ChB Chelsea	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
CoB Corwin	B	None	---	---	2.0-4.0	Apparent	Jan-Apr	>60	---	Moderate	High	Moderate.
Cp Craigmile	B/D	Frequent	Long	Nov-Jun	0-1.0	Apparent	Oct-Jun	>60	---	High	High	Moderate.
Dc Darroch	B	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.
Dg*:												
Darroch	B	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.
Odell	B	None	---	---	1.0-3.0	Apparent	Dec-May	>60	---	High	High	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ed------------------ Edwards	B/D	None---------	---	---	+1-0.5	Apparent	Sep-Jun	>60	---	High------	High------	Low.
Fa------------------ Faxon	B/D	None---------	---	---	+.5-1.0	Apparent	Nov-May	20-40	Hard	High------	High------	Low.
Gf------------------ Gilford	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High------	High------	Moderate.
GzB----------------- Grovecity	B	None---------	---	---	1.5-3.0	Apparent	Dec-Jun	>60	---	High------	Moderate	Low.
Ho------------------ Houghton	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	High------	High------	Low.
Hp------------------ Houghton	A/D	Frequent----	Long------	Oct-May	0-1.0	Apparent	Sep-Jun	>60	---	High------	High------	Low.
Ir------------------ Iroquois	B/D	None---------	---	---	+.5-1.0	Apparent	Nov-May	>60	---	High------	High------	Moderate.
LuB2---------------- Lucas	D	None---------	---	---	2.5-4.0	Apparent	Jan-Apr	>60	---	Moderate	High------	Moderate.
MaB*:												
Markton-------------	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High------	Moderate	Low.
Aubbeenaubbee-------	B	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High------	High------	Moderate.
McB----------------- Martinsville	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
MeA, MeB------------ Metamora	B	None---------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	High------	Moderate	Moderate.
MkB----------------- Metea	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Mp----------------- Montgomery	D	None---------	---	---	+1-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
Mu----------------- Morocco	B	None---------	---	---	1.0-2.0	Apparent	Jan-Apr	>60	---	Moderate	Low------	High.
Mw----------------- Muskego	A/D	None---------	---	---	+1-1.0	Apparent	Nov-Aug	>60	---	High-----	Moderate	Moderate.
Mz----------------- Mussey	B/D	None---------	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
NaB---------------- Nesius	A	None---------	---	---	2.5-4.0	Apparent	Nov-May	>60	---	Low------	Low------	Moderate.
Ne----------------- Newton	A/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High-----	High.
OaB, OaC----------- Oakville	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
ObB---------------- Oakville	A	None---------	---	---	3.0-6.0	Apparent	Nov-Apr	>60	---	Low------	Low------	Moderate.
OcC2--------------- Octagon	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
OrB---------------- Ormas	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
OtB---------------- Ormas Variant	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
Pa----------------- Papineau	C	None---------	---	---	1.0-3.0	Apparent	Feb-Jun	>60	---	High-----	High-----	Low.
PaB---------------- Parr	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
PdB*:												
Parr	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Ayr	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
Pf*. Pits												
Px Prochaska	A/D	Frequent	Long	Nov-Jun	0-1.0	Apparent	Oct-Jun	>60	---	Moderate	High	Moderate.
Rd Reddick	B/D	None	---	---	+.5-1.0	Apparent	Mar-Jun	>60	---	High	High	Low.
Re Rensselaer	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	Moderate	Low.
Rs Rensselaer	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Low.
Rw*:												
Rensselaer	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Low.
Wolcott	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Low.
RxB Rockton	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Low	Low.
SmA Simonin	B	None	---	---	2.5-4.0	Apparent	Nov-May	>60	---	Moderate	Moderate	Moderate.
So Sloan	B/D	Frequent	Long	Nov-Jun	0-1.0	Apparent	Nov-Jun	>60	---	High	High	Low.
SpB, SsB Sparta	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
St Strole	C	None	---	---	1.0-2.0	Apparent	Dec-May	>60	---	High	High	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Sx----------------- Suman	B/D	Frequent----	Long------	Nov-Jun	0-0.5	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
Wb----------------- Warners	C/D	None--------	---	---	+.5-1.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
We----------------- Watseka	B	None--------	---	---	1.0-3.0	Apparent	Feb-May	>60	---	Moderate	Low------	High.
Wm*:												
Watseka----------	B	None--------	---	---	1.0-3.0	Apparent	Feb-May	>60	---	Moderate	Low------	High.
Maumee-----------	A/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High-----	Moderate.
WsB2-------------- Wawasee	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Wt----------------- Whitaker	C	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
Za*:												
Zadog------------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
Maumee-----------	A/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

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

Soil name	Family or higher taxonomic class
Ackerman	Sandy, mixed, mesic Histic Humaquepts
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Andres	Fine-loamy, mixed, mesic Aquic Argiudolls
Aubbeenaubbee	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Ayr	Sandy over loamy, mixed, mesic Typic Argiudolls
Brems	Mixed, mesic Aquic Udipsamments
Brookston	Fine-loamy, mixed, mesic Typic Argiaquolls
Chelsea	Mixed, mesic Alfic Udipsamments
Corwin	Fine-loamy, mixed, mesic Typic Argiudolls
*Craigmile	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Fluvaquentic Haplaquolls
Darroch	Fine-loamy, mixed, mesic Aquic Argiudolls
Edwards	Marly, euic, mesic Limnic Medisaprists
Faxon	Fine-loamy, mixed, mesic Typic Haplaquolls
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Grovecity	Coarse-loamy, mixed, mesic Aquic Hapludolls
Houghton	Euic, mesic Typic Medisaprists
Iroquois	Fine-loamy over clayey, mixed, mesic Typic Argiaquolls
Lucas	Fine, illitic, mesic Typic Hapludalfs
Markton	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Martinsville	Fine-loamy, mixed, mesic Typic Hapludalfs
Maumee	Sandy, mixed, mesic Typic Haplaquolls
*Metamora	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Montgomery	Fine, mixed, mesic Typic Haplaquolls
Morocco	Mixed, mesic Aquic Udipsamments
Muskego	Coprogenous, euic, mesic Limnic Medisaprists
Mussey	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Nesius	Sandy, mixed, mesic Entic Hapludolls
Newton	Sandy, mixed, mesic Typic Humaquepts
Oakville	Mixed, mesic Typic Udipsamments
Octagon	Fine-loamy, mixed, mesic Mollic Hapludalfs
Odell	Fine-loamy, mixed, mesic Aquic Argiudolls
Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Ormas Variant	Sandy, mixed, mesic Psammentic Hapludalfs
*Papineau	Fine-loamy over clayey, mixed, mesic Aquic Argiudolls
Parr	Fine-loamy, mixed, mesic Typic Argiudolls
Prochaska	Sandy, mixed, mesic Fluvaquentic Haplaquolls
Reddick	Fine-loamy, mixed, mesic Typic Haplaquolls
Rensselaer	Fine-loamy, mixed, mesic Typic Argiaquolls
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Simonin	Coarse-loamy over clayey, mixed, mesic Typic Argiudolls
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
Strole	Fine, illitic, mesic Aquic Argiudolls
Suman	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Fluvaquentic Haplaquolls
*Warners	Fine-silty, carbonatic, mesic Fluvaquentic Haplaquolls
Watseka	Sandy, mixed, mesic Aquic Hapludolls
Wawasee	Fine-loamy, mixed, mesic Typic Hapludalfs
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Wolcott	Fine-loamy, mixed, mesic Typic Haplaquolls
Zadog	Coarse-loamy, mixed, mesic Typic Haplaquolls

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