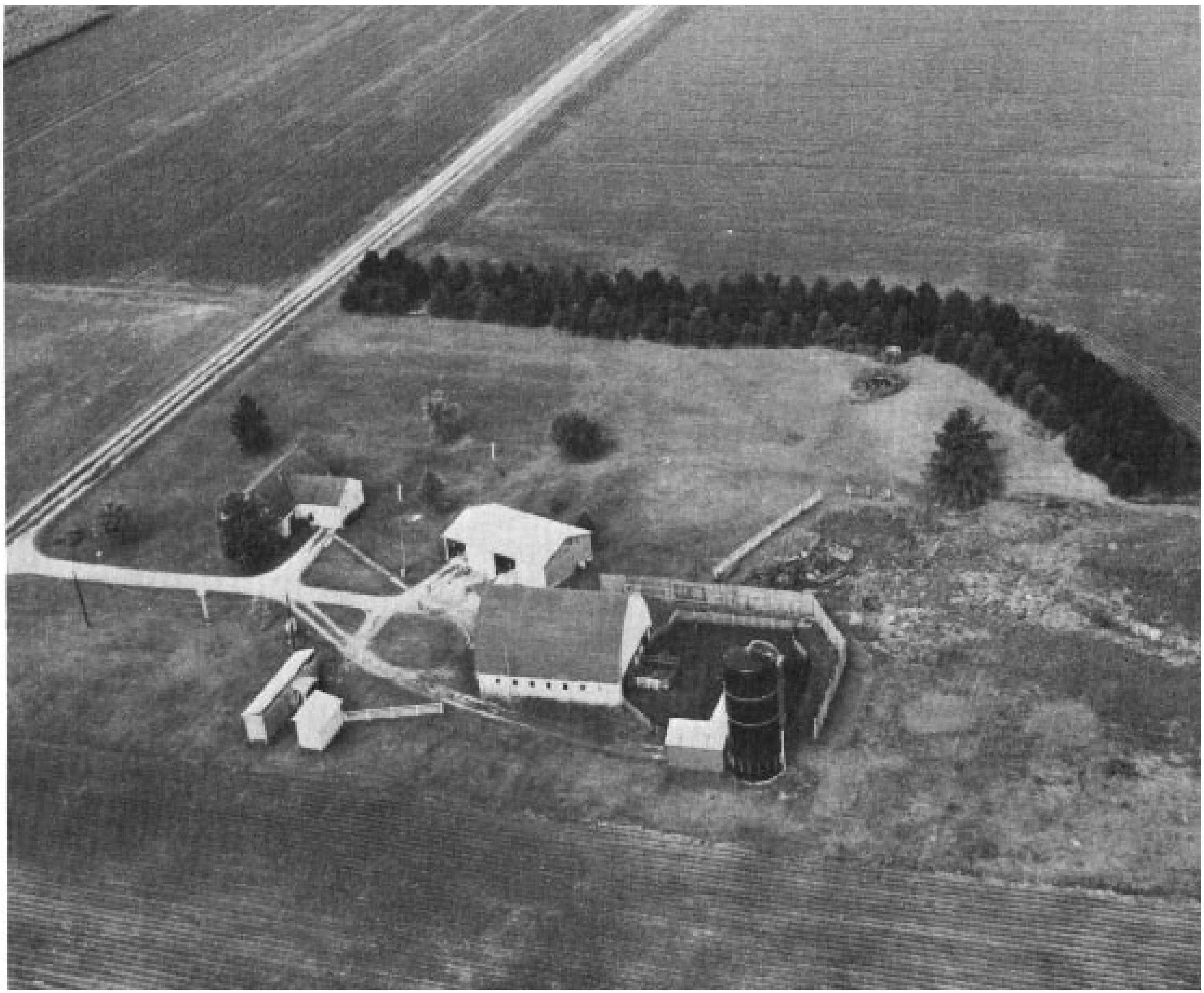
United States
Department of
Agriculture

Soil
Conservation
Service

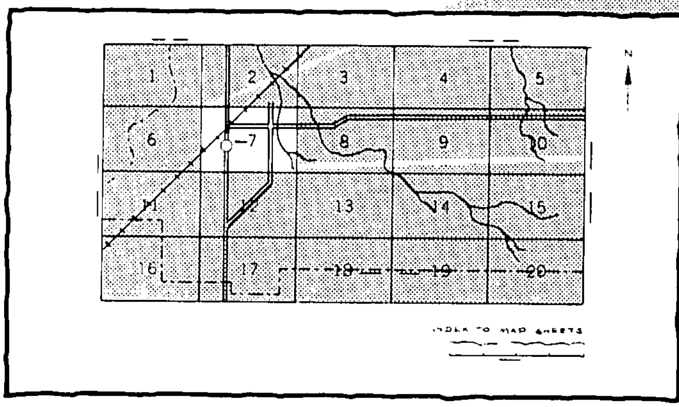
In cooperation with
Ohio Department of
Natural Resources
Division of Soil and
Water Conservation
and
Ohio Agricultural
Research and
Development Center

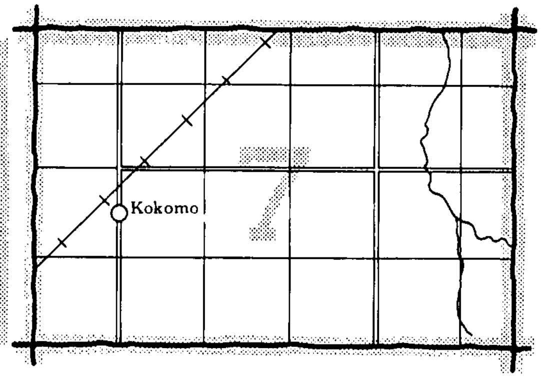
Soil Survey of Defiance County, Ohio



HOW TO USE

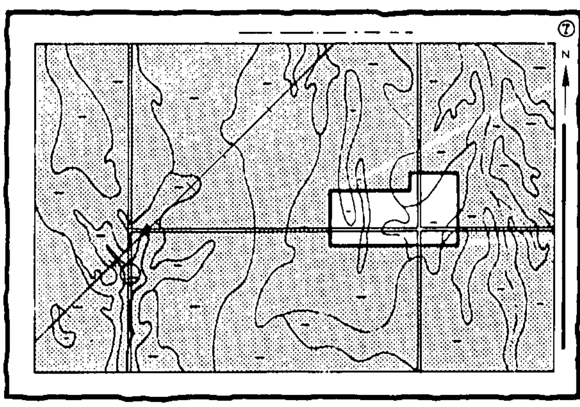
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

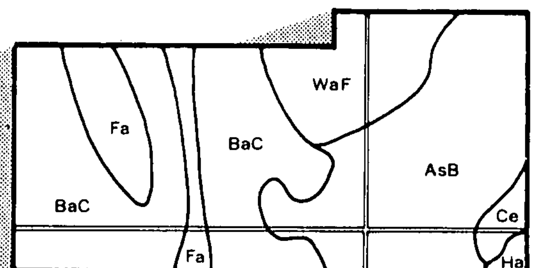




2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





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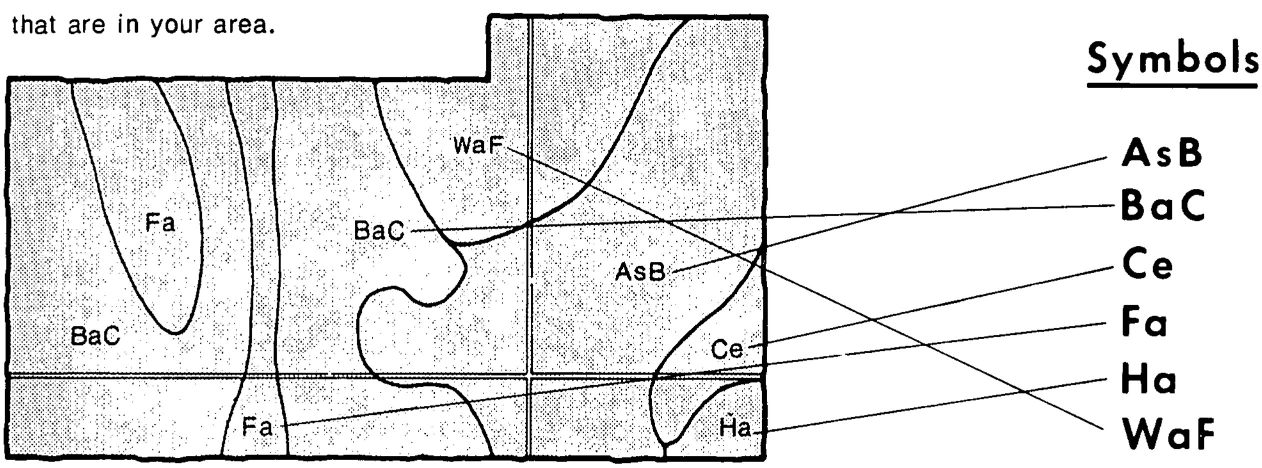
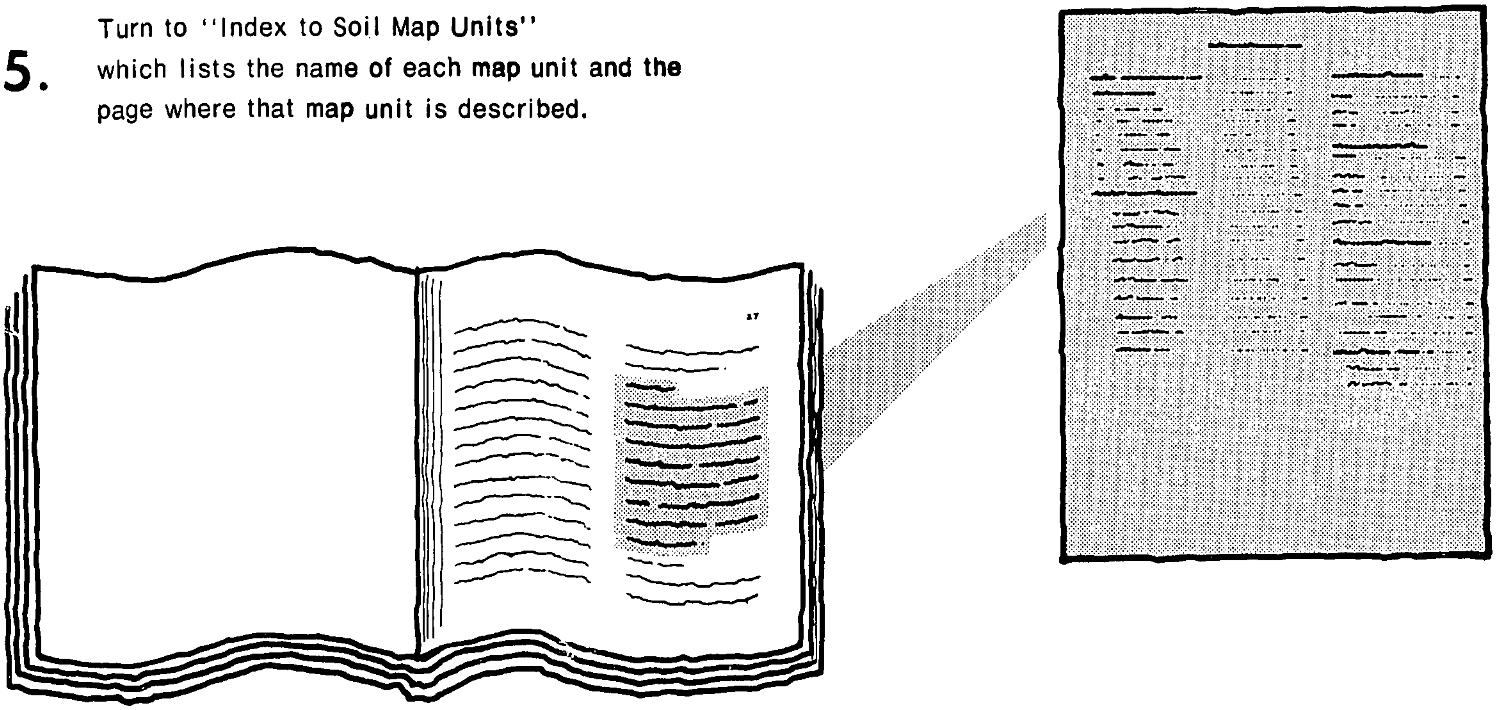
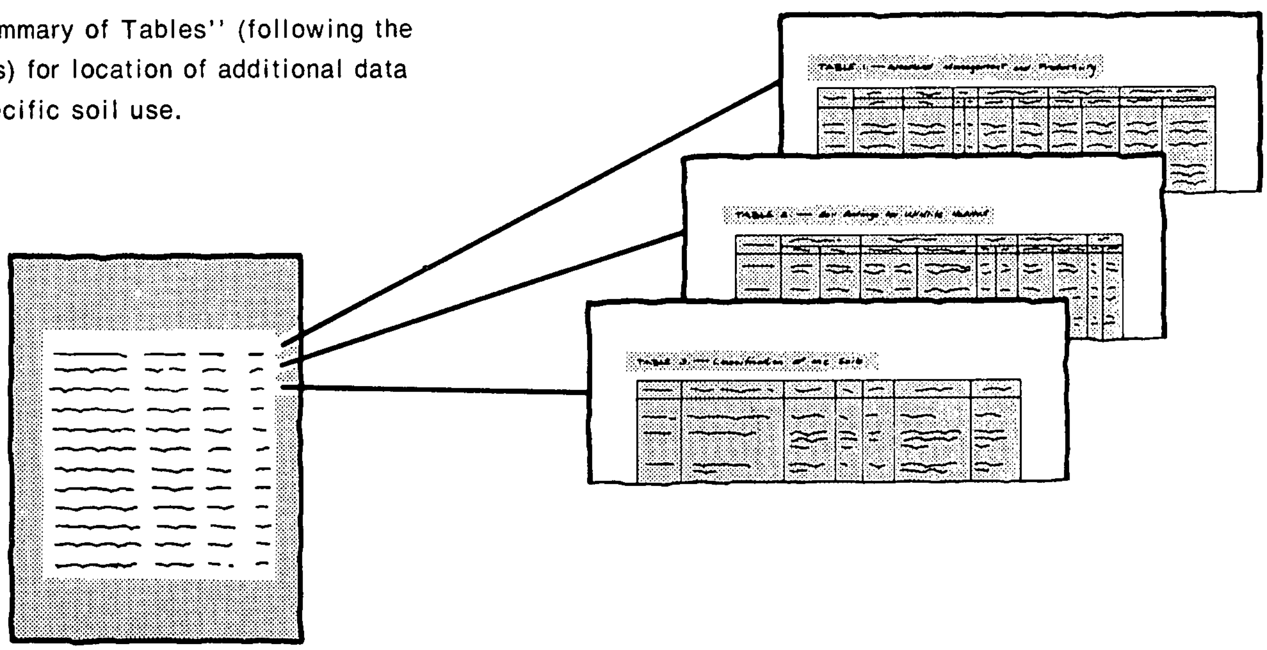


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

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, or age.

Major fieldwork for this soil survey was completed in 1980. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Ohio Agricultural Research and Development Center. This survey was materially aided by funds provided by the Defiance County Commissioners. It is part of the technical assistance furnished to the Defiance Soil and Water Conservation District.

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

Cover: Circular windbreaks on Roselms soils protect the farmstead from wind and snow.

Contents

Soil Series

Issued July 1984

Index to Map Units

Summary of Tables

Foreword

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

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure 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 water table near the surface 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 R. Shaw
State Conservationist
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Soil Survey of
Defiance County, Ohio

By E. C. Flesher, Soil Conservation Service

Fieldwork by E. C. Flesher, D. J. Crowner,
D. N. McClure, and D. R. Urban, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
In cooperation with
Ohio Department of Natural Resources, Division of Soil and Water Conservation,
and
Ohio Agricultural Research and Development Center

General Nature of the County

Defiance County, in the northwestern part of Ohio, is along the Indiana border (fig. 1). It occupies about 412 square miles, or 263,680 acres. Defiance, the only city in the county, is the county seat. It is in the east-central part and had a population of about 16,633 in 1980. There are several smaller villages: Ayersville, Evansport, Farmer, Hicksville, Jewell, Mark Center, Ney, Sherwood, and the Bend. The total population of the county in 1960 was 31,508; in 1970, 36,949; and in 1980, 39,825 (*15*). Urban population in 1970 was 19,742, or 53.4 percent of the total population.

Defiance County consists mainly of rural, agricultural land. Cash-grain and livestock farming are the major enterprises. Soybeans, corn, wheat, hay, and oats are the main crops. There are several industries in the county, especially at Defiance and Hicksville.

In general, most of the terrain of the county is nearly level. More sloping soils are in the northwestern part of the county and along larger drainageways. Most of the county is in the Maumee River watershed, which flows eastward to Lake Erie. The extreme northwest part of the county is part of the St. Joseph River watershed, which flows southwestward. This river, however, joins the Maumee at Ft. Wayne, so it too is part of the Maumee River watershed.

Figure 1.—Location of Defiance County in Ohio.

Climate

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

Defiance County is cold in winter and warm and occasionally hot in summer. Precipitation is well distributed throughout the year but peaks moderately in summer. It is adequate for most crops on most soils. Winter precipitation is mainly snow. Blizzards sometimes occur.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Defiance, Ohio, 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 25 degrees F, and the average daily minimum temperature is 17 degrees. The lowest temperature on record, which occurred at Defiance on January 17, 1972, is -19 degrees. In summer the average temperature is 71 degrees, and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred on July 1, 1970, is 104 degrees.

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

Of the total annual precipitation, 19 inches, or 60 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 17 inches. The heaviest 1-day rainfall during the period of record was 4.10 inches at Defiance on April 23, 1977. Thunderstorms occur on about 40 days each year, and most occur in summer.

The average seasonal snowfall is 27 inches. The greatest snow depth at any one time during the period of record was 21 inches. On an average of 27 days, at least 1 inch of snow is 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 at dawn the average is about 85 percent. The percentage of possible sunshine is 65 in summer and 40 in winter. The prevailing wind is from the west-southwest. Average windspeed is highest, 11 miles per hour, in spring.

Severe thunderstorms occur occasionally, and tornadoes are rare, but both are generally local, of short duration, and cause damage in a variable pattern.

Physiography, Relief, and Drainage

Defiance County is part of the Indiana and Ohio Till Plains Section and the Lakes Plain Section of the Central Lowlands Physiographic Province. The highest elevation in the county is about 874 feet above sea level near the intersection of Seevers and Hicksville-Edgerton Roads in section 21 of Milford Township. The lowest elevation, about 645 feet above sea level, is where the Maumee River flows into Henry County.

The northwestern part of the county shows stronger relief and is composed mostly of gently sloping and sloping ground and end moraines deposited during the ice age. The more rolling relief is on the Ft. Wayne end moraine, which formed when the ice front remained stationary for a period of time. Less rolling areas, which are ground moraines, illustrate the relatively uniform rate of retreat of the glacier.

The broad flats, representative of much of the county, were formed during various stages of glacial lakes. These flats are broken only by the drainage patterns of the Auglaize, Tiffin, and Maumee Rivers. Short, steep slopes are along these rivers and their tributaries.

The Blount, Glynwood, and Pewamo soils are on the more rolling topography of much of the northwestern part of the county. Hoytville and Nappanee soils are on the flat lake plains of the county. Here, the glacial deposits were leveled by the water action of the lakes. Paulding, Roselms, Latty, and Fulton soils are dominant where clayey sediment was deposited in glacial lakes. Other soils are on outwash plains, beach ridges, and stream terraces.

Defiance County is a part of the Maumee River watershed, although much of the county drains into tributaries of the Maumee River. The high point of the Ft. Wayne moraine divides drainage in the county. This divide lies in a southwest to northeast direction of Milford Township. The drainage northwest of the moraine flows into the St. Joseph River. The St. Joseph River flows in a southwestward direction into Indiana. It eventually joins the St. Marys River at Ft. Wayne. The convergence of these two rivers forms the Maumee River.

Much of the north-central part of the county is drained by the Tiffin River and its tributaries, Buckskin Creek, Mud Creek, and Lick Creek. The Tiffin River flows into the Maumee River at Defiance.

The southeastern part of the county is drained by the Auglaize River and its tributary, Powell Creek. The Auglaize River flows into the Maumee River at Defiance.

Water Resources

The Maumee, Auglaize, and Tiffin Rivers are sources of water in Defiance County. Treatment is necessary to attain potable water. The Maumee River is used as the water supply for the City of Defiance. Water levels of the Maumee and Auglaize Rivers are controlled by the dams at Independence and by the Power Dam. Recreation includes boating, water skiing, and fishing.

Ground water supplies vary in the county and are dependent on extensiveness of sand and gravel deposits in the glacial drift. In the northwestern part of the county, the 90 to 200 feet of glacial drift has extensive sand and gravel deposits (*18*). These deposits can produce 500 gallons or more of water per minute. To the east of this area, a belt of glacial drift 3 to 5 miles wide passes through the county from Williams Center to Hicksville and into Indiana. The glacial drift is from 80 to 150 feet deep to shale bedrock and has extensive sand and gravel deposits and artesian wells. Flowing wells are common in this belt. Water yields of 200 to 1,000 gallons per minute can be obtained from these sand and gravel deposits (*19, 20*). East of this belt, water yields decrease as the sand and gravel layers become less frequent. Wells that produce from 25 to 100 gallons per minute can be developed from the sand and gravel deposits if they can be tapped. Wells in glacial drift where there are no coarse deposits yield only a few gallons per minute (*17*).

Much of the county is underlain with shale bedrock that is not a source of water or is a poor source because it is weathered (*19*). Most of the water from shale is of poor quality because of the sulfur content. Calcitic and dolomitic limestone bedrock is across the southern part of the county. It underlies 40 to 100 feet of glacial drift (*20*). Water yields from the glacial drift are generally less than 10 gallons per minute. Water yields from the limestone to a depth of 300 feet can be up to 200 gallons per minute. This water generally is hard and contains some sulfur.

Geology

Defiance County has been covered by continental glaciers at least three times. Wisconsin Age glacial drift covers the entire county (*9*). Older glacial deposits of the Illinoian glaciation are present only in deeply buried, preglacial tributary valleys of the Teays River System. Three tributaries of this drainage system have their headwaters in northwestern Ohio and enter or cross Defiance County (*16*).

The Wisconsin Age glacial drift includes till; outwash; lacustrine or clayey and silty, water-deposited material; and alluvium that was washed from the above materials (fig. 2). The glacial drift covers limestone bedrock that is mostly of the Traverse Group of the Devonian Age. It is in the southwestern and southeastern parts of the county. The rest of the county is underlain by the Ohio Shale of the Mississippian Age. The glacial drift ranges in thickness from 30 to 200 feet. The thinner drift is in the Mark Center and southeastern parts of the county, and the thicker drift is in the western and northern parts. The drift is thicker in buried valleys of the Teays River System.

Evidence indicates that the last glacier advanced from a general northeast to southwest direction across the county. As the glacier began to melt and recede, an interstage period began. This is revealed by the presence of the two end moraines that are combined with gently sloping and sloping landforms and the nearly level, vague landforms that were created by successive advances and retreats of the ice mass over a period of several thousand years. The end moraines are identified according to age as the Ft. Wayne, the older of the two, and the Defiance. The Defiance end moraine, eroded by the action of lake water and streams, is nearly level.

The melt water from retreating glaciers cut channels through the glacial till, which created drainage patterns. These patterns underwent change as outlets formed during periods of ice retreat, then were later blocked by ice advances. Eventually melt water flows cut channels into the glacial till that created the drainage pattern that exists today.

Movement of the glacial ice over what is now Defiance County enriched the glacial till with a high percent of limestone and dolomite pebbles, including fine material in the form of ground limestone and dolomite. Shale fragments are also common in most of the drift. The glacial drift also includes numerous igneous rocks that were transported hundreds of miles from the north.

As the last glacier retreated, low lying areas west of the ice front were filled with melt water from the glacier and runoff from the morainic areas. A series of large, shallow lakes covered the county. These lakes are identified by geologists as Lake Maumee, stages I, II, and III, and Lake Whittlesey (*5*). Each of these lakes, or their substages, had different shoreline elevations. Defiance County was covered by this series of lakes for about 2,000 years, from about 11,700 to 13,700 years ago. Silt and clay sediment settled to the bottom and accumulated to several feet in thickness. Paulding, Latty, Toledo, Lenawee soils, and their better drained associates, formed in these deposits.

Wave action and underwater currents produced gravelly and sandy deposits, which formed long, narrow beach ridges and offshore bars along the shorelines of the glacial lakes. Examples of these deposits are the Lake Whittlesey shoreline and the Lake Maumee shoreline.

As the glacier further retreated northward into Canada, lower drainage outlets formed. The lakes gradually subsided into the present day Lake Erie. When the lakes drained from Defiance County, large, flat swamps were exposed. They were a part of the Black Swamp that covered several counties. These counties are in the Lake Plain Section.

In postglacial times, erosion by streams began slightly dissecting the land surface. This stream dissection left steeper slopes adjacent to the major streams and their tributaries. Except for the northwestern part of the county, however, much of the topography remains relatively level.

In the present stream valleys, a more recent deposition of alluvium has taken place. This alluvium has been eroded from soils in uplands and on terraces and has been deposited on the flood plains. The Defiance,

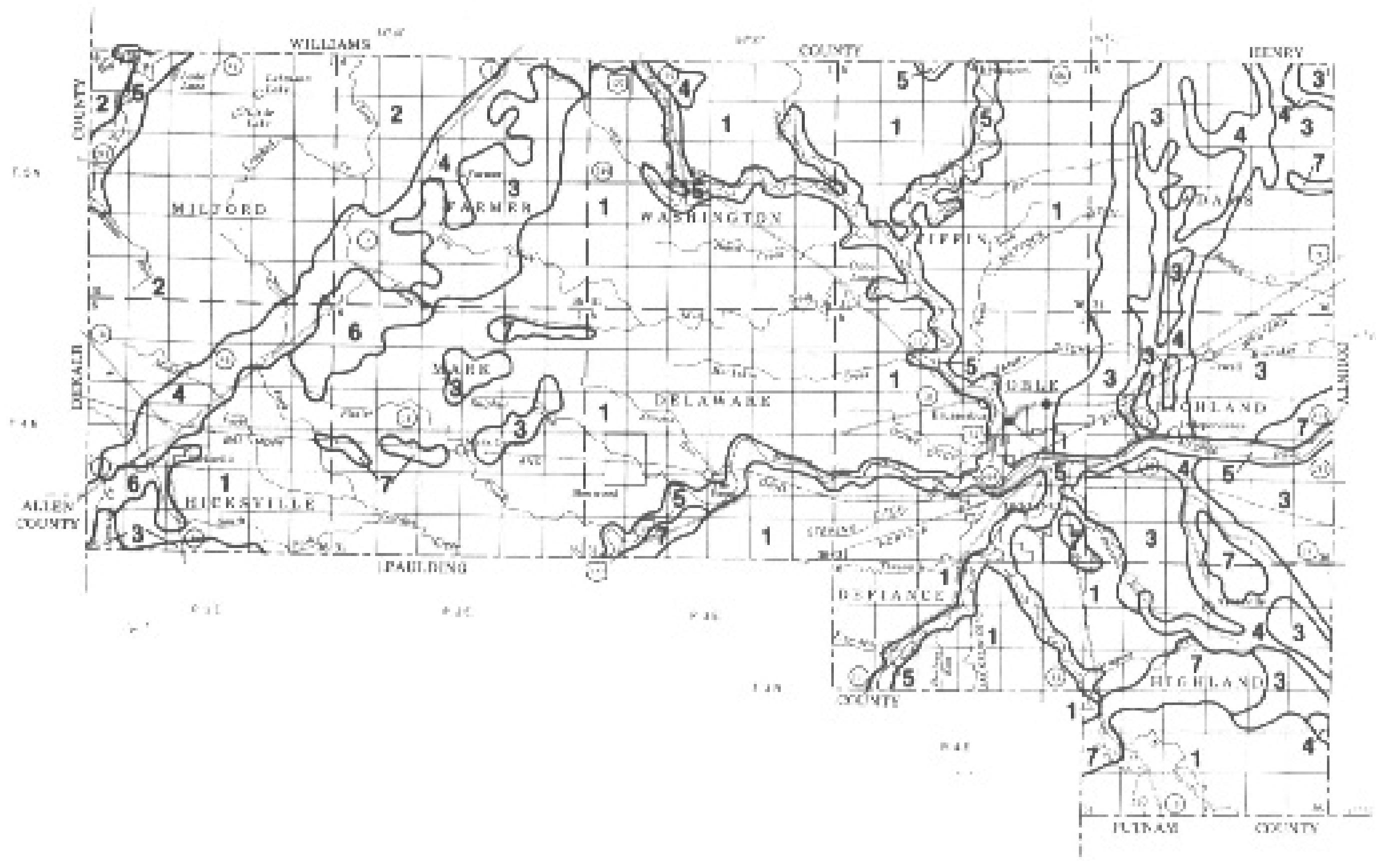

Figure 2.—Location and extent of kinds of parent material: 1—lacustrine deposits; 2—glacial till; 3—glacial till modified by water action; 4—glaciolacustine, outwash, and glacial till; 5—alluvium and glaciofluvial deposits; 6—glaciolacustrine deposits; 7—outwash deposits.

Genesee, Landes, Ross, Shoals, Sloan, and Wabasha soils formed in this alluvium.

Agriculture

Defiance County consists mainly of agricultural land. Approximately 85 percent of the county was in farmland in 1980, according to Ohio Agricultural Statistics (*14*). Farmland includes harvested cropland, pasture, woodland, and homesteads. There were 1,180 farms in 1980. The average size was 190 acres. The main field crops are soybeans, corn, wheat, hay, and oats. Some tomatoes for processing are grown, and some acreage is used for other specialty crops.

The total yield of major crops harvested from the total number of acres planted to these crops in 1980 follows: 2,881,000 bushels of soybeans from 89,500 acres; 4,660,000 bushels of corn from 40,000 acres; 1,446,000 bushels of wheat from 31,500 acres; 19,400 tons of hay from 7,300 acres; 503,000 bushels of oats from 6,600 acres; 3,100 tons of processing tomatoes from 220 acres.

The major kinds of livestock in the county consisted of 12,000 cattle and calves; 2,800 milk cows and heifers; 24,600 hogs and pigs; 70,000 chickens; 60,000 hens and pullets; and less than 1,000 sheep.

History

Members of the Shawnee, Miami, and Ottawa Nations were the earliest residents of this area (*4*). Most of Defiance County at that time consisted of fertile wetlands, which remained unsettled because of poor drainage. The fringes of higher, better drained grounds were tilled and used for hunting by the Indians.

A few Europeans passed through this area prior to permanent settlement. Between 1672 and 1712, French missionaries ventured among the Miami Indians along the Miami River (*4*).

Tuendawie and Enswoscah tribes of the Wyandott and Miami Nations permanently occupied high ground at the junction of the Auglaize and Maumee Rivers. Tribal leaders met here frequently for trading and councils. This place was called "Au Glaize" or "Grand Glaize" by the French (*4*).

As settlers advanced, Indian nations aided by the British discouraged settlers with raids and killings or kidnappings. General Anthony Wayne was sent in to appease and subdue the Indians and break the hold of the British. Wayne moved his army into "Au Glaize" in the summer of 1794 and constructed Fort Defiance. A few weeks later, unable to arrange a peaceful settlement, Wayne defeated the Indians at Fallen Timbers (*4*).

As a result, the Peace Treaty of Greenville was signed in 1795. Indians were allowed to retain most of the northwestern territory, and in 1795 northwest Ohio became the last Indian Reserve east of Indiana. Soon, however, following the treaty of Fort Meigs, the Indians had to withdraw completely from the region.

In 1820, Williams County was organized. This land included what is now part of Defiance County. Early trade was in fur pelts and wolf scalps. With decreasing wilderness and increasing population, grain farming gradually increased and eventually became the main industry for many years.

In 1845, Defiance County was formed from parts of Williams, Henry, and Paulding Counties, and Defiance became the county seat. The population of the county at that time was about 2,818 (*4*).

With the advent of railroads and canals, the safe settlement of the Black Swamp became a reality (*7*). Because of the tremendous earthwork and drainage needed, people were encouraged to reclaim the valuable soil from the swamp.

By 1845, Defiance was connected by canals to Toledo, Dayton, and Cincinnati, Ohio, and Ft. Wayne, Indiana. By 1855, a railroad line from Toledo to Ft. Wayne established Defiance on the rail circuit. By 1872, another line passed through Defiance to Chicago. Since then, economic growth and technological advances have changed lifestyles (*4*).

Several sites are denoted as being of historical interest. These include the Fort Grounds which designate the location of Wayne's Fort Defiance. Auglaize Village, west of the city of Defiance, is a collection of buildings and equipment representative of early days in Defiance County. Several monuments, along the Maumee River in or near Pontiac Park, tell of historical events in the area.

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 resulting in gradual changes in characteristics. 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 by 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 soils on the landscape.

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

General Soil Map Units

The general soil map at the back of this publication shows broad areas called soil associations that have a distinctive pattern of soils, relief, and drainage. Each soil association on the general soil map is a unique natural landscape. Typically, a soil 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 other units 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 soil association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Fine to Medium Textured Soils on Lake Plains

This group of five associations makes up about 78 percent of the county. The level and nearly level soils are very poorly drained or somewhat poorly drained. They formed in fine textured to medium textured lacustrine sediment and in glacial till modified by water. They are on broad flats and slight rises. The soils are used mainly for crops. Seasonal wetness, ponding, slow or very slow permeability, high shrink-swell potential, and a fine textured surface layer are major limitations of these soils.

1. Paulding-Roselms Association

Level and nearly level, very poorly drained and somewhat poorly drained soils formed in fine textured lacustrine sediment

The soils of this association are on broad flats and very slight rises of lake plains. Narrow strips of more sloping soils are along sides of major drainageways. Slope ranges from 0 to 3 percent.

This association makes up about 31 percent of the county. It is about 35 percent Paulding soils, 30 percent Roselms soils, and 35 percent minor soils (fig. 3).

The level and nearly level Paulding soils are fine textured and very poorly drained. They are on broad flats and in poorly defined drainageways. The nearly level Roselms soils are medium textured or fine textured and somewhat poorly drained. They are on slight rises and along sides of drainageways.

The soils in this association are very slowly permeable. A seasonal high water table is near or above the surface in the Paulding soils and at a depth of 12 to 30 inches in the Roselms soils. The shrink-swell potential is high in both soils. Runoff is very slow on the Paulding soils and slow on the Roselms soils. At times the Paulding soils are ponded.

Some of the minor soils in this association are Broughton, Del Rey Variant, Fulton, Genesee, Haskins, Rimer, Shoals, Sloan, Toledo, and Wabasha soils. Broughton soils are along sides of drainageways. Genesee, Shoals, Sloan, and Wabasha soils are on flood plains. Del Rey Variant, Fulton, Haskins, and Rimer soils are on slight rises and on slope breaks along drainageways. Toledo soils are on broad flats.

The soils in this association are mainly cropped to soybeans and small grain. In some areas corn is grown. The soils are moderately well suited to soybeans, small grain, and hay. Wetness delays planting and limits the choice of crops. A system of surface drains is commonly used to improve drainage. Subsurface drains have very limited effectiveness in removing excess water from the subsoil. Planting crops on tilled ridges improves growth. The fine textured soils have poor tilth. Surface crusting limits seedling emergence. Tilling at optimum moisture conditions, limiting the number of tillage operations, incorporating crop residue into the soil, and rotating crops improve tilth and reduce crusting.

These soils are generally not suited as sites for septic tank absorption fields. They are poorly suited to buildings. Very slow permeability, ponding, wetness, and high shrink-swell potential severely limit these soils. These limitations can be partially or completely overcome by building on raised fill, constructing foundations of poured, reinforced concrete, and using drains at the base of footings. Local roads and streets can be improved by using a suitable base material and by artificially draining the soils to reduce damage from ponding, shrinking and swelling, and low strength.

2. Latty-Fulton Association

Level and nearly level, very poorly drained and somewhat poorly drained soils formed in fine textured and moderately fine textured lacustrine sediment

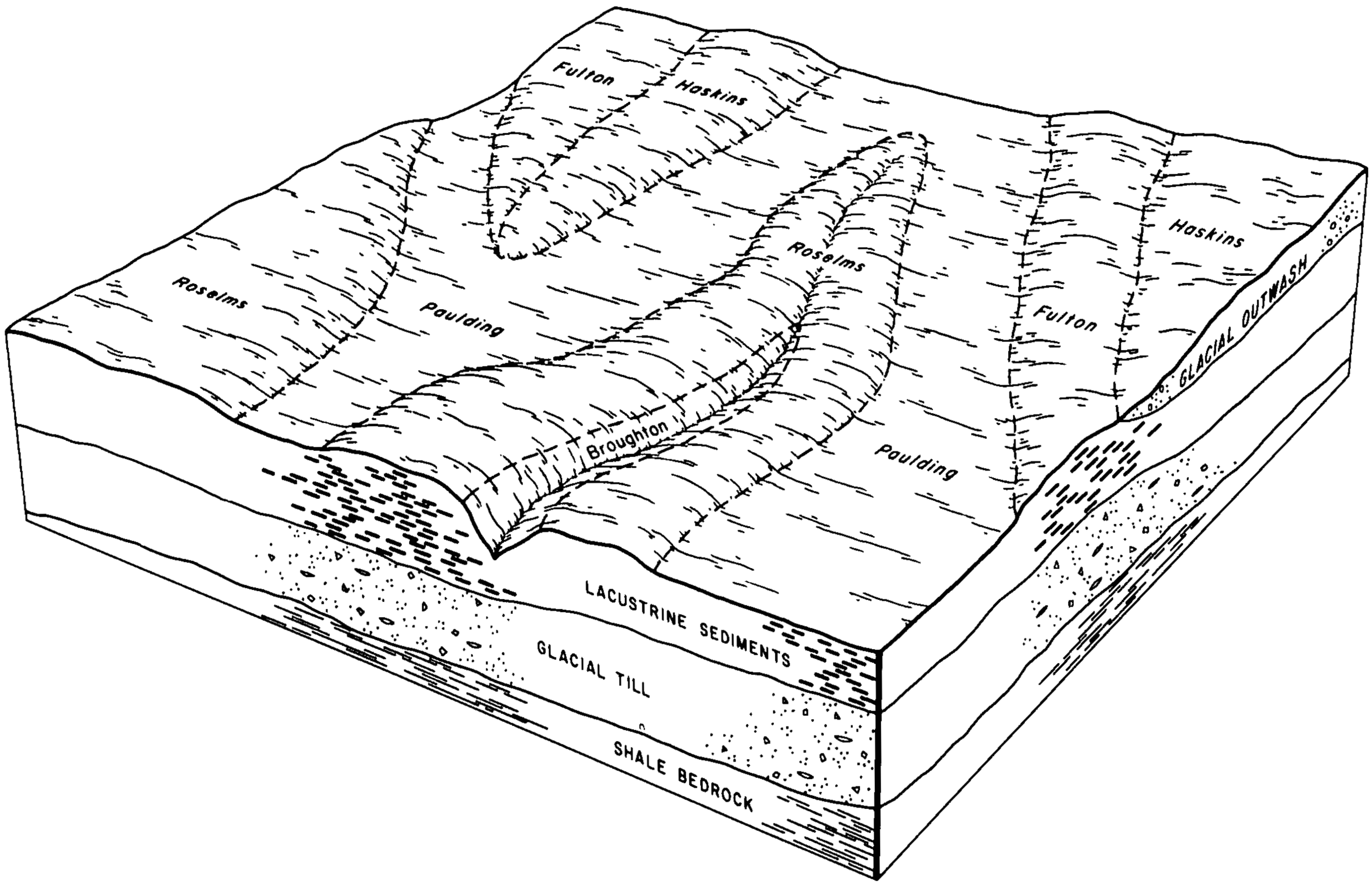

Figure 3.—Typical pattern of soils in the Paulding-Roselms Association.

The soils in this association are on broad flats and very slight rises of lake plains. Narrow strips of more sloping soils are along the sides of major drainageways. Slope ranges from 0 to 3 percent.

This association makes up about 21 percent of the county. It is about 65 percent Latty soils, 15 percent Fulton soils, and 20 percent minor soils (fig. 4).

The level and nearly level Latty soils are fine textured and very poorly drained. They are on broad flats and in poorly defined drainageways. The nearly level Fulton soils are medium textured and moderately fine textured. They are somewhat poorly drained soils on slight rises.

Permeability is very slow in the Latty soils and slow or very slow in the Fulton soils. A seasonal high water table is near or above the surface in the Latty soils and at a depth of 12 to 30 inches in the Fulton soils. The shrink-swell potential is high in both soils. Runoff is very slow on the Latty soils and slow on the Fulton soils. At times the Latty soils are ponded.

Some of the minor soils in this association are Genesee, Haskins, Mermill, Shoals, Sloan, and Toledo soils. The Genesee, Shoals, and Sloan soils are on flood plains. Haskins soils are on slight rises. Mermill and Toledo soils are on broad flats and along drainageways.

The soils in this association are mainly cropped. They are moderately well suited to corn, soybeans, small grain, hay, and pasture and to woodland. Wetness delays planting and limits the choice of crops. A system of surface and subsurface drains is commonly used to improve drainage. Because of the slow or very slow permeability, water moves into subsurface drains very slowly. Planting crops on tilled ridges improves growth. The fine textured soils have poor tilth. Surface crusting limits seedling emergence. Tillage at optimum moisture conditions, incorporating crop residue into the soil, and rotating crops improve tilth and reduce crusting.

Fulton soils are moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. They are better suited to these uses than Latty

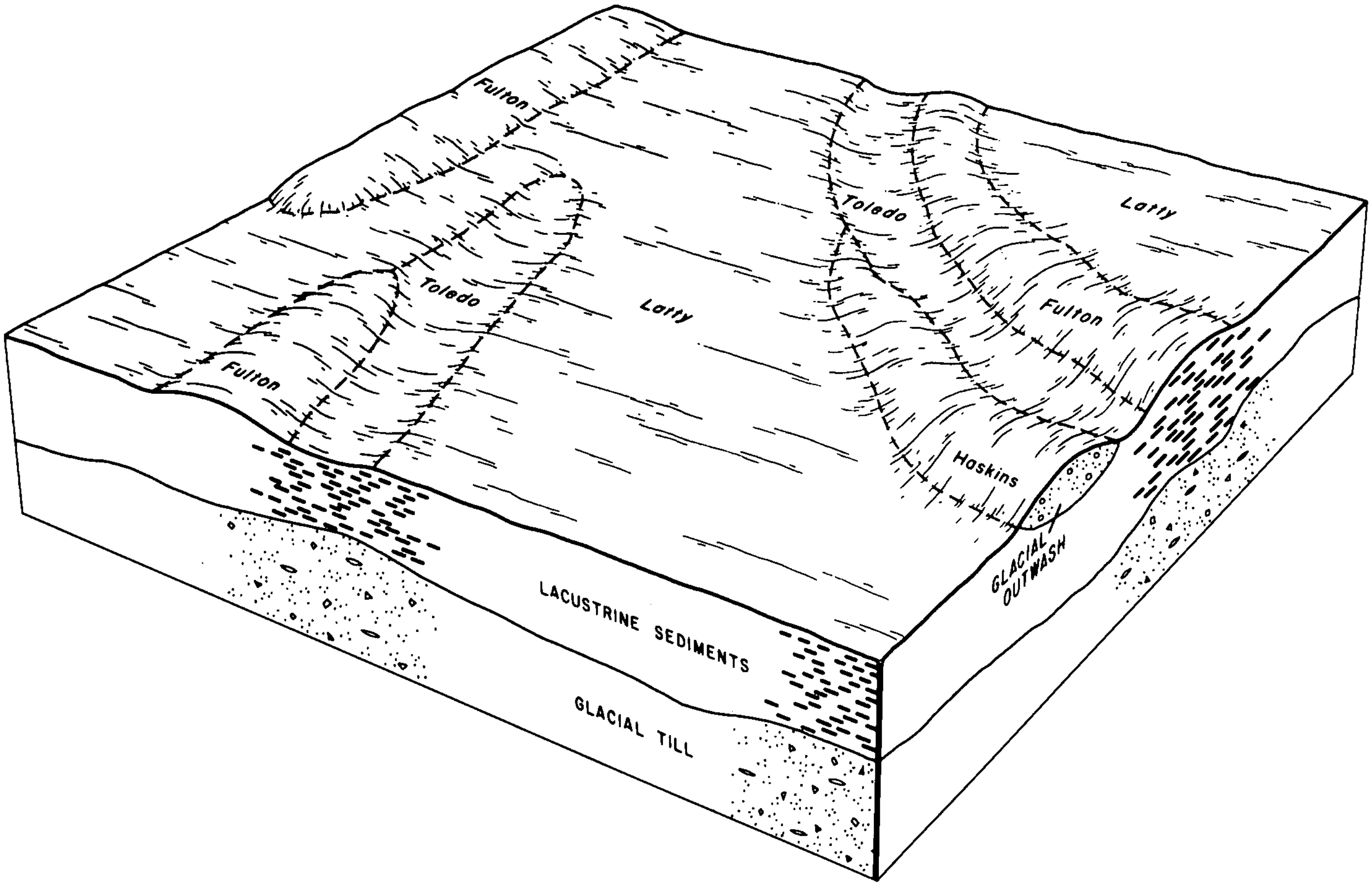

Figure 4.—Typical pattern of soils in the Latty-Fulton Association.

soils. Slow or very slow permeability, ponding, wetness, and high shrink-swell potential severely limit these soils. Building sites and septic tank absorption fields need to be landscaped to provide good surface drainage. Using subsurface drains around septic tank absorption fields helps lower the seasonal high water table. Backfilling along the foundation with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Local roads and streets can be improved by using suitable base material and by artificially draining the soil to reduce damage from shrinking and swelling and to improve strength.

3. Toledo-Fulton Association

Level and nearly level, very poorly drained and somewhat poorly drained soils formed in fine textured and moderately fine textured lacustrine sediment

The soils in this association are on broad flats and very slight rises of lake plains. Some sloping soils are along the sides of major drainageways. Slope ranges from 0 to 3 percent.

This association makes up about 1 percent of the county. It is about 25 percent Toledo soils, 15 percent Fulton soils, and 60 percent minor soils.

The level and nearly level Toledo soils are moderately fine textured and very poorly drained. They are on broad flats and in long, narrow depressions. The nearly level Fulton soils are medium textured and moderately fine textured and are somewhat poorly drained. They are on broad, slight rises.

Permeability is slow in the Toledo soils and slow or very slow in the Fulton soils. A seasonal high water table is near or above the surface in the Toledo soils and at a depth of 12 to 30 inches in the Fulton soils. The shrink-swell potential is high in both soils. Runoff is very slow on the Toledo soils and slow on the Fulton soils. At times the Toledo soils are ponded.

Some of the minor soils in this association are Haskins, St. Clair, Mermill, and Rimer soils. The Haskins, Mermill, and Rimer soils are on outwash plains and stream terraces. They are also on or near beach ridges. St. Clair soils are on slope breaks along streams.

The soils in this association are mainly cropped to corn, soybeans, and wheat. They are moderately well suited to these crops and to hay, pasture, and woodland. Wetness delays planting and limits the choice of crops. A system of surface and subsurface drains improves drainage. Subsurface drains are more effective in Toledo soils than in Fulton soils. Surface crusting limits seedling emergence. Tillage at optimum moisture conditions, incorporating crop residue into the soil, and rotating crops improve tilth and reduce crusting.

Fulton soils are moderately well suited as a site for buildings and are poorly suited to septic tank absorption fields. They are better suited to these uses than Toledo soils. Slow or very slow permeability, ponding, wetness, and high shrink-swell potential severely limit these soils. Building sites and septic tank absorption fields need to be landscaped to provide good surface drainage. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Using subsurface drains around septic tank absorption fields helps lower the seasonal high water table. Local roads and streets can be improved by using suitable base material and by artificially draining the soil to reduce damage from shrinking and swelling and to improve strength.

4. Lenawee-Del Rey Association

Level and nearly level, very poorly drained and somewhat poorly drained soils formed in medium textured to fine textured lacustrine sediment

The soils in this association are on broad flats and slight rises of lake plains. Slope ranges from 0 to 3 percent.

This association makes up about 3 percent of the county. It is about 70 percent Lenawee soils, 15 percent Del Rey soils, and 15 percent minor soils.

The level and nearly level Lenawee soils are moderately fine textured and very poorly drained. These soils are on broad flats and in long, narrow depressions. The nearly level Del Rey soils are medium textured and somewhat poorly drained. They are on low ridges and knolls.

Permeability is moderately slow in the Lenawee soils and slow in the Del Rey soils. A seasonal high water table is near or above the surface in the Lenawee soils and at a depth of 12 to 36 inches in the Del Rey soils. Runoff is very slow on the Lenawee soils and slow on the Del Rey soils. At times the Lenawee soils are ponded.

Some of the minor soils in this association are the Haskins, Kibbie, Mermill, and Millgrove soils. Haskins and Kibbie soils are on low beach ridges and on slight rises of lake and outwash plains. Mermill and Millgrove soils are on flats and in depressions of stream terraces and outwash plains. They are also in low lying areas between beach ridges of lake plains.

This association is mainly cropped to corn, soybeans, and wheat. Some areas are used for tomatoes and other specialty crops. These soils are well suited to these uses. Wetness delays planting of crops. Subsurface drains are used to lower the seasonal high water table. Surface drains are used to remove ponded water.

Del Rey soils are moderately well suited as a site for buildings but are poorly suited to septic tank absorption fields. They are better suited to these uses than Lenawee soils. Slow or moderately slow permeability, ponding, and wetness limit these soils. These soils are better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to provide good surface drainage. Installing drains at the base of footings and coating the exterior of basement walls help prevent wet basements. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Local roads and streets can be improved by using suitable base material and by artificially draining the soil to improve strength and to reduce damage from ponding and frost action.

5. Hoytville-Nappanee Association

Level and nearly level, very poorly drained and somewhat poorly drained soils formed in moderately fine textured and fine textured glacial till modified by water action

The soils in this association are on broad flats of lake plains. They formed in glacial till that was reworked and leveled by water. The more sloping soils are along sides of major drainageways. Slope ranges from 0 to 3 percent.

This association makes up about 22 percent of the county. It is about 65 percent Hoytville soils, 15 percent Nappanee soils, and 20 percent minor soils (fig. 5).

The level and nearly level Hoytville soils are moderately fine textured and fine textured. These very poorly drained soils are on broad flats and in poorly defined drainageways. The nearly level Nappanee soils are medium textured and moderately fine textured. These somewhat poorly drained soils are on slight rises. Both soils are slowly permeable.

A seasonal high water table is near or above the surface of the Hoytville soils and at a depth of 12 to 24 inches in the Nappanee soils. The Hoytville soils have high shrink-swell potential, and the Nappanee soils have moderate shrink-swell potential. Runoff is very slow on the Hoytville soils and is slow on the Nappanee soils. At times the Hoytville soils are ponded.

Some of the minor soils in this association are Haskins, Mermill, Millgrove, Oshtemo, Ottokee, Rawson,

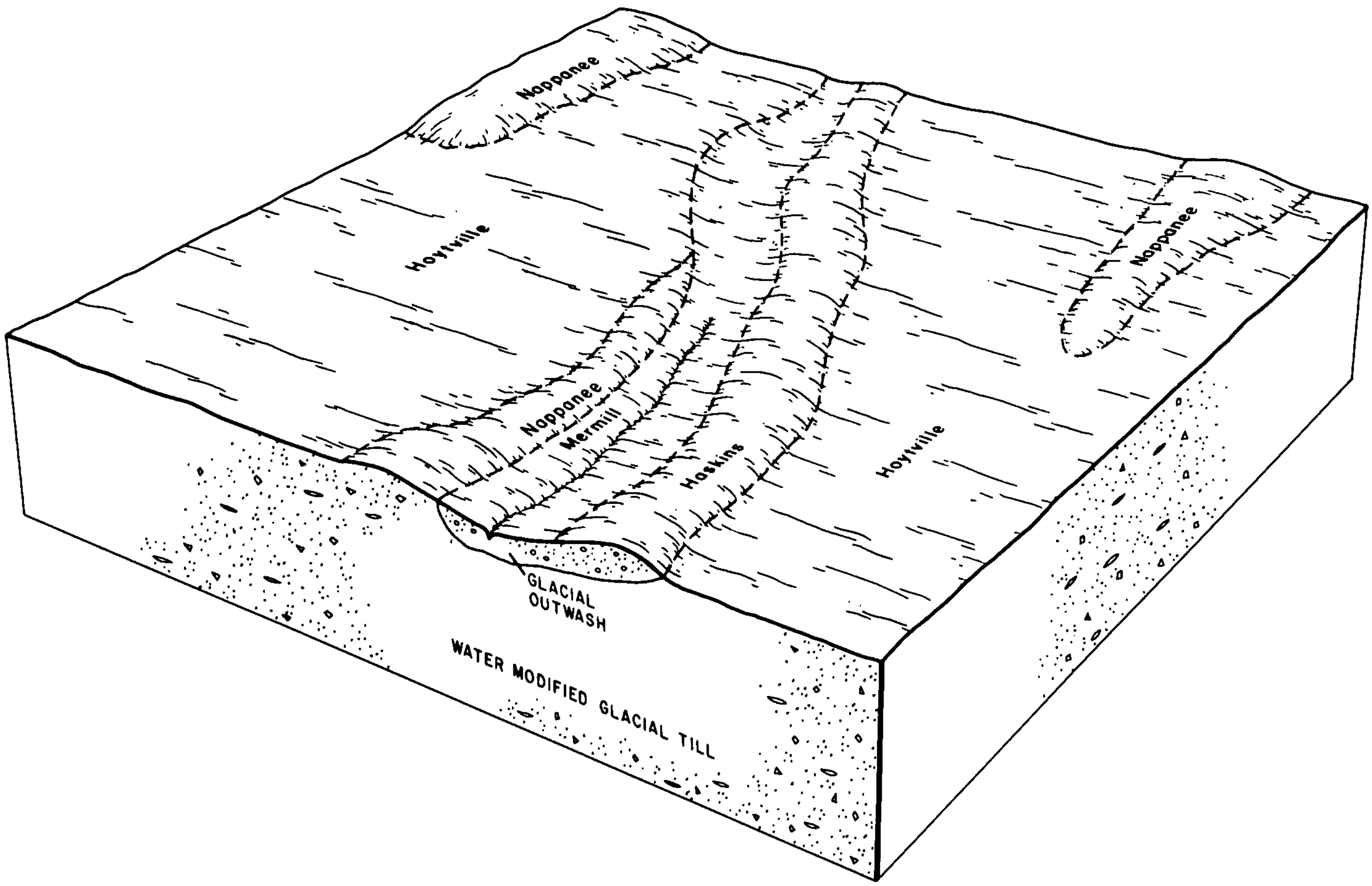

Figure 5.—Typical pattern of soils in the Hoytville-Nappanee Association.

Rimer, St. Clair, and Seward soils. The Haskins, Mermill, Millgrove, Oshtemo, Ottokee, Rawson, Rimer, and Seward soils are on outwash plains, low sand dunes, and deltas. They are also on and between beach ridges. St. Clair soils are on slope breaks along drainageways.

This association is mainly cropped to corn, soybeans, and wheat. Tomatoes are grown in a few areas. Hoytville soils are well suited to these crops, and Nappanee soils are moderately well suited. Wetness delays planting and limits the choice of crops. A system of surface and subsurface drains is used in many areas to improve drainage. Soil tilth is medium or poor in many areas. Surface crusting limits seedling emergence in soils that have a fine textured or moderately fine textured surface layer. Tillage at optimum moisture content, incorporating crop residue into the soil, and rotating crops improve tilth and reduce crusting.

Nappanee soils are moderately well suited as a site for buildings and are poorly suited to septic tank absorption fields. They are better suited to these uses than Hoytville soils. Slow permeability, ponding, wetness, and high shrink-swell potential limit these uses. Houses without basements are better suited to these soils than houses with basements. Building sites and septic tank absorption fields need to be landscaped to provide good surface drainage. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps prevent wet basements. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Local roads and streets can be improved by using a suitable base material and by artificially draining.

Medium Textured Soils on Beach Ridges, Lake Plains, Deltas, Stream Terraces, Outwash Plains, and Moraines

The two soil associations in this group make up about 8 percent of the county. The soils in these associations are level and nearly level and somewhat poorly drained and very poorly drained. They are on beach ridges, lake plains, deltas, stream terraces, outwash plains, and moraines. The soils formed in moderately fine textured to coarse textured glacial outwash and in the underlying glacial till, lacustrine sediment, or glacial outwash. These soils are on flats and on slight rises and ridges. They are used mainly as cropland. In some areas specialty crops are grown. Seasonal wetness, ponding, and slow or very slow permeability are the main limitations of these soils.

6. Mermill-Haskins-Millgrove Association

Level and nearly level, very poorly drained and somewhat poorly drained soils formed in moderately coarse textured to moderately fine textured glacial outwash and the underlying glacial till or lacustrine sediment or glacial outwash

These soils are on flats and slight rises of outwash plains, beach ridges, stream terraces, lake plains, and moraines. The more sloping soils are along sides of beach ridges and drainageways. Slope ranges from 0 to 3 percent.

This association makes up about 6 percent of the county. It is about 20 percent Mermill soils, 15 percent Haskins soils, 15 percent Millgrove soils, and 50 percent minor soils.

The level and nearly level Mermill and Millgrove soils are very poorly drained. They are on broad flats and in poorly defined drainageways. The nearly level Haskins soils are somewhat poorly drained. They are on slight rises and knolls.

Mermill and Haskins soils are moderately permeable in the upper part and slowly permeable or very slowly permeable in the lower part. Millgrove soils are moderately permeable. A seasonal high water table is near or above the surface in the Mermill and Millgrove soils and at a depth of 12 to 30 inches in the Haskins soils. Runoff is very slow on the Mermill and Millgrove soils and slow on the Haskins soils. At times the Mermill and Millgrove soils are ponded.

Some of the minor soils in this association are Belmore, Hoytville, Nappanee, Oshtemo, Ottokee, Rawson, and Tedrow soils. Nappanee and Tedrow soils are on slight rises and on foot slopes of beach ridges. Belmore, Oshtemo, Ottokee, and Rawson soils are in the highest positions in the landscape. Hoytville soils are on broad flats and in depressions between beach ridges.

The soils in this association are mainly cropped to corn, soybeans, and wheat. Tomatoes and other specialty crops are grown in some areas. These soils are well suited to these crops. Wetness delays planting and limits the choice of crops. Subsurface drains are commonly used to improve drainage. These drains are more effective in the Mermill and Haskins soils if they are placed on or above the slowly or very slowly permeable glacial till or lacustrine material. These soils are well suited to irrigation.

Haskins soils are moderately well suited as a site for buildings but are poorly suited to septic tank absorption fields. They are better suited to these uses than Mermill and Millgrove soils. Ponding, wetness, and slow or very slow permeability limit these soils. Buildings without basements are better suited to these soils than buildings with basements. Building sites and septic tank absorption fields need to be landscaped to provide good surface drainage. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Local roads and streets can be improved by artificially draining the soil and by using a suitable base material to reduce damage from ponding and frost action.

7. Kibbie-Colwood Association

Nearly level and level, somewhat poorly drained and very poorly drained soils formed in moderately fine textured to coarse textured glaciofluvial deposits

The soils in this association are in areas of outwash materials of lake plains. They are on broad flats and slight rises. The more sloping soils are on the sides of beach ridges and major drainageways.

This association makes up about 2 percent of the county. It is about 40 percent Kibbie soils, 25 percent Colwood soils, and 35 percent minor soils.

The nearly level Kibbie soils are somewhat poorly drained. These soils are on slight rises and on long, narrow, low ridges. The level and nearly level Colwood soils are very poorly drained. They are on broad flats or in long and narrow, slight depressions.

Kibbie and Colwood soils are moderately permeable. Kibbie soils have a seasonal high water table at a depth of 12 to 24 inches, and Colwood soils have a seasonal high water table near or above the surface. Runoff is slow on the Kibbie soils and very slow or ponds on the Colwood soils.

Some of the minor soils in this association are Del Rey, Hoytville, Lenawee, and Tuscola soils. The Del Rey and Tuscola soils are on slight rises and ridges. Hoytville and Lenawee soils are on flats and in depressions.

The soils in this association are mainly cropped to corn, soybeans, and wheat. In some areas of the association, such specialty crops as tomatoes, cucumbers, and other vegetables are grown. The soils are well suited to these crops and to hay and pasture. Wetness delays planting and limits the choice of crops. A system of subsurface drains is commonly used to improve drainage. Incorporating crop residue into the soil and planting cover crops maintain tilth and increase water infiltration.

Kibbie soils are moderately well suited as sites for buildings and septic tank absorption fields. Colwood soils are poorly suited as sites for buildings and generally not suited to septic tank absorption fields. Wetness and ponding limit these soils. These soils are better suited as

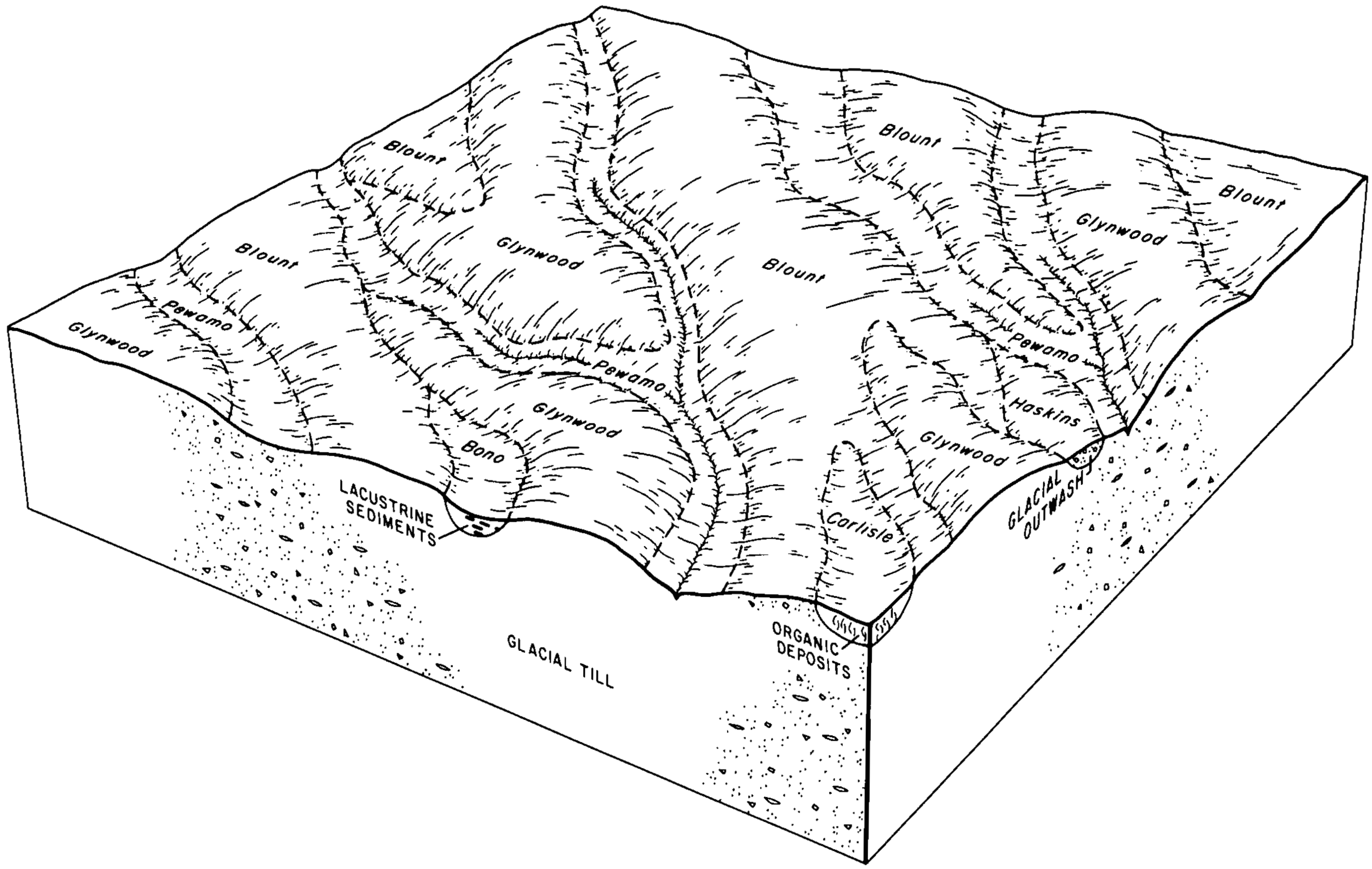

Figure 6.—Typical pattern of soils in the Blount-Glynwood-Pewamo Association.

sites for buildings without basements than to buildings with basements. Building sites and septic tank absorption fields need to be landscaped to provide good surface drainage. Using drains at the base of foundations and coating the exterior of basement walls help prevent wet basements. Constructing roads and streets on raised, well compacted, suitable fill material and providing side ditches and culverts reduce damage from wetness, ponding, and frost action. The walls of shallow excavations tend to collapse, especially when these soils are wet.

Medium Textured and Moderately Fine Textured Soils on Moraines

This group of two associations makes up about 12 percent of the county. Soils in these associations are level to sloping and moderately well drained to very poorly drained. These soils formed in moderately fine textured glacial till. They are used mainly for crops. Some areas are in pasture and woodland. Seasonal wetness, erosion hazard, ponding, moderate shrink-swell potential, and slow or moderately slow permeability are the major soil limitations.

8. Blount-Glynwood-Pewamo Association

Level to sloping, somewhat poorly drained, moderately well drained, and very poorly drained soils formed in moderately fine textured glacial till

The soils of this association are on undulating moraines. The landscape consists of knolls, ridges, shallow depressions, and drainageways. The more sloping soils are along the sides of major drainageways. Slope ranges from 0 to 12 percent.

This association makes up about 7 percent of the county. It is 40 percent Blount soils, 30 percent Glynwood soils, 15 percent Pewamo soils, and 15 percent minor soils (fig. 6).

The nearly level Blount soils are somewhat poorly drained. These soils are on slight rises. The gently sloping and sloping Glynwood soils are moderately well drained. They are on hill crests, narrow ridges, convex knolls, and sides of drainageways. The level and nearly level Pewamo soils are very poorly drained. They are in shallow depressions and along poorly defined drainageways.

Permeability of the Blount soils is slow or moderately slow. Permeability of the Glynwood soils is slow, and permeability of the Pewamo soils is moderately slow. A seasonal high water table is near or above the surface of the Pewamo soils, at a depth of 12 to 36 inches in the Blount soils, and at a depth of 24 to 42 inches in the Glynwood soils. Runoff is slow on the Blount soils, medium or rapid on the Glynwood soils, and very slow or ponds on the Pewamo soils.

Some of the minor soils in this association are Bono, Carlisle, Haskins, Rawson, Shoals, and Sloan soils and the Wallkill Variant. Haskins and Rawson soils are on terraces and outwash plains. Bono and Carlisle soils and the Wallkill Variant are in the deeper depressions. Shoals and Sloan soils are on flood plains.

The soils in this association are cropped mainly to corn, soybeans, and wheat. Some areas are in pasture or are woodland. Wetness delays planting and limits the choice of crops on Blount and Pewamo soils. A system of subsurface drainage is commonly used on these soils. Surface drains are used to remove ponded water from depressional areas. Soil erosion is a hazard, especially on the more sloping Blount and Glynwood soils. Contour tillage, crop rotation, and conservation tillage that leaves crop residue on the surface reduce soil loss by erosion. Grassed waterways are needed in many areas to reduce gullying.

Blount and Glynwood soils are better suited as sites for buildings and septic tank absorption fields than Pewamo soils. Moderately slow or slow permeability, seasonal wetness, ponding, and moderate shrink-swell potential limit the soils for these uses. Building sites and septic tank absorption fields need to be landscaped to provide good surface drainage. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements. Backfilling along foundations with a coarser textured material reduces damage from shrinking and swelling of the soils. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields also increases the absorption of effluent. Using a suitable base material and artificially draining the soil reduce damage to local roads and streets from low strength, frost action, ponding, and wetness.

9. Glynwood-Blount Association

Sloping to nearly level, moderately well drained and somewhat poorly drained soils formed in moderately fine textured glacial till

The soils of this association are on crests of knolls and in slight undulations of the rolling end moraines. The more sloping soils are along sides of major drainageways, in depressions, and on the more hilly parts of end moraines. Slope ranges from 0 to 12 percent.

This association makes up about 5 percent of the county. It is about 40 percent Glynwood soils, 20 percent Blount soils, and 40 percent minor soils.

The gently sloping and sloping Glynwood soils are moderately well drained. These soils are on hill crests, narrow ridges, and convex knolls. The nearly level Blount soils are somewhat poorly drained. They are in moderately wide areas on slightly elevated flats and low rises.

Glynwood soils are slowly permeable. Permeability of the Blount soils is slow or moderately slow. A seasonal high water table is at a depth of 24 to 42 inches in Glynwood soils and at a depth of 12 to 36 inches in Blount soils.

Some of the minor soils in this association are Bono, Carlisle, Mermill, Pewamo, Shoals, and Sloan soils and the Wallkill Variant. The very poorly drained Bono, Carlisle, Mermill, and Pewamo soils and the Wallkill Variant are in depressions. Shoals and Sloan soils are on flood plains.

The soils in this association are cropped mainly to corn, soybeans, and wheat. Some areas are in hay or pasture or are woodland. The soils are well suited or moderately well suited to corn, soybeans, and small grain. They are well suited to hay, pasture, and woodland. Erosion on both soils and drainage of the Blount soils are the main management concerns. Contour tillage, crop rotation, conservation tillage that leaves crop residue on the surface, and no-till methods reduce soil loss by erosion. Grassed waterways and parallel terraces that have an underground outlet are also needed to reduce soil loss. Wetness delays planting in areas of Blount soils. This limits the choice of crops. A system of subsurface drains is used to improve drainage.

These soils are moderately well suited as a site for buildings but poorly suited to septic tank absorption fields. Slow permeability or moderately slow permeability, seasonal wetness, and moderate shrink-swell potential limit these soils for these uses. Building sites and septic tank absorption fields, especially on the Blount soils, need to be landscaped to provide good surface drainage. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements. Backfilling along foundations with a coarser textured material reduces damage from the shrinking and swelling of the soil. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields also increases the absorption of effluent. Using a suitable base material and artificially draining the soil reduce damage to local roads and streets from frost action, low strength, and wetness. The runoff and erosion that increase during construction can be reduced by maintaining plant cover where possible.

Moderately Fine to Moderately Coarse Textured Soils Mainly on Flood Plains, Stream Terraces, and Moraines

This group of two associations makes up about 2 percent of the county. These level to gently sloping soils are somewhat poorly drained, well drained, and very poorly drained. They are mainly on flood plains, stream terraces, and moraines. The soils formed in moderately fine textured glacial till; medium textured and moderately fine textured recent alluvium; and moderately coarse textured and coarse textured glacial outwash. These soils are on broad flats of the flood plains, on elevated low ridges and knolls of stream terraces, and on slope breaks to uplands. These soils are mainly used for crops. Some areas are in pasture or are woodland. Seasonal wetness, the hazard of flooding, and slow or moderately slow permeability are the major soil limitations.

10. Blount-Genesee-Oshtemo Association

Level to gently sloping, somewhat poorly drained and well drained soils formed in moderately fine textured to coarse textured glacial till, recent alluvium, and glacial outwash

This association is in valleys and on nearby uplands. It consists of moderately wide flood plains, adjacent stream terraces, and the adjacent undulating uplands. Slope ranges from 0 to 3 percent.

This association makes up about 1 percent of the county. It is about 30 percent Blount soils, 15 percent Genesee soils, 10 percent Oshtemo soils, and 45 percent minor soils.

The nearly level Blount soils are somewhat poorly drained. These soils are on long, moderately wide breaks to uplands. The level and nearly level Genesee soils are well drained. These soils are on moderately wide flats of flood plains. The gently sloping Oshtemo soils are well drained. They are on long, low ridges and knolls of stream terraces.

Permeability of the Blount soils is moderately slow or slow. These soils have a seasonal high water table at a depth of 12 to 36 inches. Genesee soils are moderately permeable. They are subject to flooding. Permeability of the Oshtemo soils is moderately rapid in the subsoil and very rapid in the substratum. Runoff is slow on all three soils.

Some of the minor soils of this association are Digby, Landes, Millgrove, Pewamo, and Sloan soils. Digby and Millgrove soils are on flats and in depressions of stream terraces. Landes soils are on slight rises, and Sloan soils are in depressions and high water channels of flood plains. Pewamo soils are in poorly defined drainageways in uplands.

The soils in this association are cropped mainly to corn, soybeans, and wheat. Blount and Genesee soils are well suited to corn and soybeans. Oshtemo soils are moderately well suited to these crops. Seasonal wetness of the Blount soils, flooding hazard of Genesee soils, and droughtiness of Oshtemo soils are the main concerns of management. Wetness delays planting and limits the choice of crops on Blount soils. Subsurface drains are commonly used in these soils to improve drainage. Corn and soybeans on the Genesee soils are normally not damaged by flooding; however, wheat is usually not grown because of this hazard. Because of droughtiness, Oshtemo soils are better suited to early maturing crops than to those that mature late in summer. These soils are suited to irrigation. Planting cover crops and incorporating crop residue into the soil reduce erosion on Blount and Oshtemo soils. These practices also protect the surface of Genesee soils in areas that are subject to scouring during floods.

Oshtemo soils in this association are better suited as sites for buildings and septic tank absorption fields than Blount and Genesee soils. Because of the hazard of flooding, Genesee soils are generally not suited to these uses. The effluent from septic tank absorption fields drains freely in the Oshtemo soils but is a pollution hazard to streams, lakes, ponds, and underground water supplies. Because of the seasonal wetness, the Blount soils are better suited to buildings without basements than to buildings with basements. Building sites need to be landscaped to drain surface water away from foundations. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements.

11. Genesee-Sloan Association

Level and nearly level, well drained and very poorly drained soils formed in medium textured and moderately fine textured recent alluvium

The soils in this association are on moderately wide flats of flood plains. Slope is 0 to 2 percent.

This association makes up about 1 percent of the county. It is about 30 percent Genesee soils, 15 percent Sloan soils, and 55 percent minor soils.

The level and nearly level Genesee soils are well drained. These soils are on moderately wide, slightly elevated flats. They are nearer the stream channel than Sloan soils. The level and nearly level Sloan soils are very poorly drained. They are in depressions near slope breaks to terraces and uplands and in the lowest positions on wide flood plains.

Genesee soils are moderately permeable. Permeability of the Sloan soils is moderate or moderately slow. Sloan soils have a seasonal high water table near the surface. Both soils are susceptible to flooding, but flooding is more frequent on Sloan soils.

Some of the minor soils of this association are the Shoals soils on flood plains and Bronson, Digby, and Millgrove soils on stream terraces. Shoals soils are in an intermediate position between Genesee and Sloan soils.

The soils in this association are cropped mainly to corn and soybeans. Genesee soils are well suited to these crops. Sloan soils are moderately well suited. Wheat generally is not grown because of the flooding hazard. Wetness of the Sloan soils delays planting and limits the choice of crops. A subsurface drainage system lowers the seasonal high water table in Sloan soils if good drainage outlets are available. Good outlets are not available in some areas because of the water level in adjacent streams. Tillage of the Sloan soils at optimum moisture content is important. These soils become compact and cloddy if worked when wet and sticky. Planting cover crops and incorporating crop residue into the soil help maintain tilth. These practices protect the surface in areas where these soils are subject to scouring during flooding.

The soils in this association are generally not suited as a site for buildings and septic tank absorption fields. They are subject to flooding and wetness. Fill for roads should not block the flow of floodwaters.

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 underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, 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, Glynwood loam, 2 to 6 percent slopes, is one of several phases in the Glynwood series.

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, gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

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

Soil Descriptions

BmB—Belmore loam, 2 to 6 percent slopes. This deep, gently sloping soil is on the crests of beach ridges. It is well drained. Most areas are long and narrow. They range from 5 to 30 acres.

Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. The subsoil is about 19 inches thick. It is brown, friable sandy clay loam and firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is dark brown and brown, loose gravelly sandy loam and very gravelly sand. In some small areas the subsoil has more sand and less clay or is not so well drained. In a few places the surface layer is sandy loam. In some areas the lower part of the soil is glacial till or lacustrine material.

Included with this soil in mapping are small areas of the somewhat poorly drained Digby soils. They are on the lower part of slopes. The included soils make up about 15 percent of most areas.

Permeability in this Belmore soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is moderate, and surface runoff is medium. Organic matter content is moderate. Reaction in the subsoil is neutral to medium acid in the upper part and mildly alkaline to slightly acid in the lower part.

Most of the acreage is in crops and is used for cash-grain farming. Some areas are in apple and peach orchards. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is also well suited to some specialty crops.

This soil has limited available water capacity. It is better suited to earlier maturing crops than to those that mature later in the summer. It dries early in spring. It is well suited to tillage and grazing early in spring. Controlling water erosion and droughtiness are the main management concerns. The soil is suited to irrigation. Conservation tillage that leaves crop residue on the surface helps reduce erosion in row cropped areas. Returning crop residue to the soil and including sod crops in the cropping system reduce erosion, improve tilth, and increase water intake. These practices and applying barnyard manure to the soil increase the organic matter content. Pastures and meadows of shallow rooted legumes and grasses tend to dry up during periods of below normal rainfall. Plant nutrients are leached from this soil at a moderately rapid rate. The soil responds better to smaller, but more frequent or timely, applications of fertilizer than to one large application.

This soil is well suited to trees. Seedlings are difficult to establish during dry periods. Plant competition can be reduced by spraying, mowing, or disking.

This soil is well suited as a site for buildings and is moderately well suited to septic tank absorption fields. The soil easily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may cause the pollution of ground water supplies. This pollution hazard can be reduced by placing the absorption field in suitable fill material. Lawns dry up during periods of low rainfall in summer. New seedlings need to be mulched and watered.

The land capability classification is IIe; the woodland ordination symbol is 2o.

BnA—Blount loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is on slight rises. Most areas are irregular in shape. They range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is about 22 inches thick. The upper part is dark yellowish brown, mottled, friable clay loam. The middle part is light brownish gray and grayish brown, mottled, firm clay. The lower part is brown, mottled, very firm clay. The substratum to a depth of about 60 inches is pale brown, brown, and yellowish brown clay loam that has mottles to a depth of 44 inches. This clay loam is very firm and calcareous.

Included with this soil in mapping are narrow strips of very poorly drained Pewamo soils along drainageways and in depressions. Small areas of moderately well drained Glynwood soils are on somewhat higher rises. Also included are small areas of Haskins soils, which have 20 to 40 inches of medium textured or moderately fine textured material over glacial till or lacustrine deposits. The included soils make up about 15 percent of most areas.

Permeability in this Blount soil is slow or moderately slow, available water capacity is moderate, and surface runoff is slow. Organic matter content is moderate. Reaction in the subsoil is medium acid or strongly acid in the upper part and medium acid to moderately alkaline in the lower part. The seasonal high water table is at a depth of 1 to 3 feet during extended wet periods.

Much of the acreage of this soil is in crops and is used for cash-grain farming. Some areas are in pasture. This soil is well suited to corn, soybeans, and small grain and grasses and legumes for hay and pasture.

If this soil is used for crops or pasture, drainage is needed. A subsurface drainage system is used to lower the seasonal high water table. In places surface drains remove excess surface water. Areas of this soil that are gently sloping need erosion control practices. Returning crop residue to the soil and including sod crops in the cropping system reduce erosion, improve tilth, and increase water intake. These practices and applying barnyard manure to the soil increase the organic matter content. If this soil is used as pasture, grazing needs to be restricted when the soil is wet to reduce compaction.

Some areas are in woodland. This soil is well suited to trees. Seedling mortality and the windthrow hazard are severe. Trees need to be tolerant of some wetness and high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting. Seedlings of adapted species grow well if competing vegetation is controlled or removed by disking, spraying, girdling, or mowing.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of the seasonal wetness, buildings without basements are better suited to this soil than those with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings; using poured, reinforced concrete walls; and coating the exterior of basement walls also help prevent wet basements. Installing subsurface drains around septic tank absorption fields helps lower the seasonal high water table. Sanitary facilities need to be connected to central sewers and sewage treatment plants where possible.

Local roads and streets can be improved by using a suitable base material and by draining to reduce damage from frost action, seasonal wetness, and low strength.

The land capability classification is IIw; the woodland ordination symbol is 3c.

Bp—Bono silty clay loam. This deep, level and nearly level soil is very poorly drained. It is in depressions in moraines. Slope is 0 to 2 percent. Water ponds on this soil. Most areas are oval or somewhat long and narrow. They range from 5 to 30 acres.

Typically, the surface layer is very dark gray, friable silty clay loam about 6 inches thick. The subsoil is about 32 inches thick. It is very dark gray, dark grayish brown, and dark gray, mottled silty clay that is firm and very firm. The substratum to a depth of about 60 inches is gray, mottled, very firm silty clay. In some areas the surface layer is several inches of silt loam overwash.

Included with this soil in mapping are small areas of Wallkill soils in depressions. Muck is in the lower part of the Wallkill soils. Also included are small areas of Pewamo soils and loamy Mermill soils on the periphery of mapped areas. Permeability of Pewamo soils is moderately slow. The included soils make up about 5 percent of most areas.

Permeability in this Bono soil is slow or very slow, and available water capacity is moderate. Surface runoff is very slow or is ponded. Organic matter content is high, and the root zone is deep. Reaction in the subsoil is slightly acid or neutral in the upper part and is neutral or mildly alkaline in the lower part. The seasonal high water table is near or above the surface during wet periods.

Some of the acreage of this soil is in crops and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain.

If this soil is used as cropland, artificial drainage is needed. A combination of surface and subsurface drains is commonly used to improve drainage. Suitable subsurface drainage outlets are difficult to establish in some areas. Restricting tillage to a limited range of moisture content is important. This soil becomes compacted and cloddy if worked when wet and sticky. Minimizing tillage and planting cover crops are good management practices. Incorporating crop residue or other organic matter into the surface layer increases water infiltration and improves tilth and fertility. These practices also reduce crusting and improve the contact of seed with the soil.

Some areas are in pasture. This soil is moderately well suited to pasture and hay. It is poorly suited to grazing early in spring. This soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes surface compaction, poor tilth, reduced growth of plants, and decreased infiltration. Proper stocking rates, selection of species for planting, pasture rotation, deferment of grazing, artificial drainage, and weed control help keep the pasture and the soil in good condition.

Some areas are woodland. This soil is moderately well suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. Logging can be done during the drier parts of the year. Plant competition can be controlled or removed by disking, spraying, girdling, or mowing. Species need to be tolerant of prolonged wetness and high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting. Undrained areas are well suited to habitat for wetland wildlife.

This soil is poorly suited as a site for buildings. It is generally not suited to septic tank absorption fields. Ponding and high shrink-swell potential are limitations. This soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from the foundations. Poured concrete, steel reinforced walls stiffened with pilasters protect against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps prevent wet basements. Local roads and streets are limited by ponding, shrinking and swelling of the soil, and soil strength. They can be improved by using suitable base material and by providing artificial drainage. Constructing roads on well compacted fill material raises them above high, ponded water. This soil is a good site for pond reservoirs.

The land capability classification is IIIw; the woodland ordination symbol is 3w.

BrB—Bronson sandy loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping soil is moderately well drained. It is on low ridges and flats of stream terraces and outwash plains. It is also on the lower part of beach ridges. Most areas are long and narrow. Some areas on terraces are broad. Areas range from 3 to 30 acres.

Typically, the surface layer is dark brown, friable sandy loam about 8 inches thick. The subsoil is about 31 inches thick. The upper part is dark yellowish brown, mottled, friable sandy loam. The lower part is dark yellowish brown, mottled, very friable loamy sand. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, very friable and loose gravelly loamy sand. In some areas more gravel is in the subsoil, or layers of loam or clay loam are in the subsoil. In some areas the surface layer is loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Digby soils. These soils are nearly level and on the lower part of slopes. Also included are areas of well drained Belmore soils on the crests of rises. The included soils make up about 15 percent of most areas.

Permeability in this Bronson soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is moderately low or low, and runoff is slow or medium. Organic matter content is moderately low. Reaction in the subsoil is medium acid to neutral. The seasonal high water table is at a depth of 2 to 3 1/2 feet during extended wet periods.

Most of the acreage is in crops and is used for cash-grain farming. A few areas are in apple and peach orchards or in specialty crops. This soil is well suited to corn, soybeans, small grain, and some specialty crops.

Row crops can be grown continuously if erosion is controlled. The surface layer can be tilled over a wide range of moisture content. The soil dries early in spring so is well suited to early tillage. The soil is droughty during extended dry periods. It is suited to irrigation. Conservation tillage that leaves crop residue on the surface, planting cover crops, and using grassed waterways reduce soil loss. Incorporating crop residue or other organic matter into the surface layer increases water infiltration, maintains tilth, and improves fertility.

This soil is well suited to pasture or hay. It is well suited to grazing early in spring. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing for short periods, and weed control keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas are in native hardwoods. Plant competition can be controlled or removed by disking, spraying, girdling, or mowing.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of wetness, it is better suited to houses without basements than to houses with basements. Using drains at the base of footings and coating the exterior of basement walls help keep basements dry. If drains around foundations are connected to a sump, the pump needs to be large enough to handle rather large volumes of water. The soil easily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may cause pollution of ground water supplies. This hazard can be reduced by placing the field in suitable fill material. Local roads and streets can be improved by using a suitable base material and by draining to reduce damage from frost action and seasonal wetness. Sloughing is a hazard in excavations. This soil is a source of gravel and sand.

The land capability classification is IIs; the woodland ordination symbol is 3o.

BsB—Boyer loamy sand, 1 to 6 percent slopes. This deep, nearly level and gently sloping soil is well drained. It is on stream terraces and, less commonly, on beach ridges. Most areas on stream terraces are long and narrow or moderately wide. They range from 8 to 50 acres. Areas on beach ridges are long and narrow and range from 4 to 15 acres.

Typically, the surface layer is very dark grayish brown, very friable loamy sand about 9 inches thick. The subsoil is about 18 inches thick. The upper part is brown, friable gravelly sandy loam. The lower part is brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is pale brown and light brownish gray, loose very gravelly sand. In some areas the surface layer is gravelly sandy loam. In places gravel and sand are at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the moderately well drained Bronson soils in low spots. These included soils make up about 10 percent of most areas.

Permeability of this Boyer soil is moderately rapid in the subsoil and very rapid in the substratum. Available water capacity is low, and runoff is slow. Organic matter content is moderately low. Reaction in the subsoil is medium acid to neutral.

Most of the acreage is in crops and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is well suited to some specialty crops. The soil has limited available water capacity. It is better suited to the earlier maturing crops than to those that mature later in the summer.

This soil dries early in spring. It is well suited to tillage and grazing early in the spring. It is suited to irrigation. Control of water erosion and soil blowing are the main concerns. Conservation tillage that leaves crop residue on the surface reduces soil blowing if row crops are to be planted. Returning crop residue to the soil and including sod crops in the cropping system reduce erosion. These practices and applying barnyard manure increase organic matter content. Pastures and meadows of shallow rooted legumes and grasses dry up when rainfall is below normal. Plant nutrients are leached from this soil at a moderately rapid rate. This soil generally responds better to smaller, but more frequent and timely applications of fertilizer than to one large application.

This soil is moderately well suited to trees. Seedling mortality is moderate for woodland. Seedlings are difficult to establish during dry periods. Plant competition can be reduced by spraying, mowing, or disking. Using seedlings that have been transplanted once or mulching reduces seedling mortality.

This soil is well suited as a site for buildings and is moderately well suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may cause pollution of ground water supplies. This hazard can be reduced by placing the field in suitable fill material. Lawns dry up when rainfall is low in summer. New seedlings need to be mulched and watered. Sloughing of excavation walls is a hazard.

The land capability classification is IIIs; the woodland ordination symbol is 3s.

BvE—Broughton silt loam, 12 to 35 percent slopes. This deep, moderately steep to very steep soil is moderately well drained. This soil is on lake plains. It is on short slope breaks along drainageways and along sides of valleys. Most areas are long and narrow and range from 5 to 40 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is light yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part is yellowish brown, firm silty clay. The middle and lower parts are brown, mottled, very firm clay. The substratum to a depth of about 60 inches is brown, firm clay. In some areas the subsoil and substratum have less clay.

Included with this soil in mapping are small areas of eroded or severely eroded soils that have a surface layer of silty clay loam or clay. These included soils have fair or poor tilth. They make up about 15 percent of most areas.

Permeability in this Broughton soil is very slow, available water capacity is low, and surface runoff is very rapid. Organic matter content is moderately low. Reaction in the subsoil is medium acid to moderately alkaline. The seasonal high water table is at a depth of 1 1/2 to 3 feet during extended wet periods.

Some areas are in pasture. A few areas of less sloping soil are in row crops and small grain. This soil is generally not suited to cultivation. It is poorly suited to grasses and legumes for hay. Unless adequate cover is maintained, erosion is a severe hazard. The short, moderately steep to very steep slopes limit the use of farm machinery and the installation of erosion control practices. The surface layer crusts after hard rains, which hinders seedling emergence. Returning crop residue or other organic material to the soil helps to reduce surface crusting and erosion. The trash-mulch method of reseeding helps reduce erosion. Because of the loss of water by runoff and the low available water capacity, forage plants grow little during dry periods in summer. Restricting grazing when the soil is wet reduces compaction and damage to pasture plants.

Most of the acreage is woodland. This soil is moderately well suited to trees. Erosion hazard and equipment limitation are moderate for woodland. Seedling mortality and windthrow hazard are severe. Locating logging roads and skid trails on or near the contour and using erosion control practices, such as water bars, reduce erosion. Seedlings are difficult to establish during dry periods because of the low available water capacity. Species selected for planting need to be tolerant of high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is generally not suited as a site for buildings and septic tank absorption fields. Slope, seasonal wetness, high shrink-swell potential, and very slow permeability are limitations. Local roads can be improved by using suitable fill material and by artificially draining the soil to reduce the damage from shrinking and swelling and to improve soil strength. The runoff and erosion that increase during construction can be reduced by maintaining soil cover where possible. This soil is a good site for pond reservoirs. An earth embankment can be constructed across the narrower parts of the valley.

The land capability classification is VIIe; the woodland ordination symbol is 4c.

BwC3—Broughton clay, 6 to 12 percent slopes, severely eroded. This deep, sloping soil is moderately well drained. Most of the original surface layer has been removed by erosion. Subsoil material that has higher clay content is mixed into the present surface layer. This soil is on lake plains. It is on short slope breaks along drainageways and along the sides of valleys. Most areas are long and narrow. They range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, very firm clay about 5 inches thick. The subsoil is about 12 inches thick. It is brown and yellowish brown, mottled, very firm clay. The substratum to a depth of about 60 inches is brown, very firm clay.

Included with this soil in mapping are small areas of soils which are not so severely eroded as this Broughton soil and which have a surface layer of silt loam or silty clay loam. Also included are small areas of a soil that is so severely eroded that the clay substratum is exposed. The included soils make up about 15 percent of most areas.

Permeability in this Broughton soil is very slow, available water capacity is low, and surface runoff is rapid. Organic matter content is low. Reaction in the subsoil is medium acid to moderately alkaline. A seasonal high water table is at a depth of 1 1/2 to 3 feet during extended wet periods.

Much of the acreage of this soil is in pasture. Some areas are planted to row crops, small grain, and hay. This soil is generally not suitable for cultivation because of the severe erosion hazard. It is moderately well suited to grasses and legumes for hay and pasture. Restricting grazing when the soil is wet reduces compaction and damage to plants. The trash-mulch method of pasture renovation reduces the erosion hazard during reseeding.

Some areas are in woodland. This soil is moderately well suited to trees. Seedling mortality and windthrow hazard are severe, and equipment limitations are moderate. Seedlings are difficult to establish during dry periods because of the low available water capacity. Species that are tolerant of high clay content in the subsoil need to be planted. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting. The surface layer is sticky and slippery when wet. Logging can be done during the drier parts of the year.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential, it is better suited to buildings without basements than to buildings with basements. Poured concrete, steel reinforced walls stiffened with pilasters protect against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps prevent wet basements. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of absorption fields and placing distribution lines in suitable fill material increase the absorption of effluent. Local streets and roads can be improved by using suitable fill material and by artificially draining the soil to reduce the damage from shrinking and swelling and to improve soil strength. The runoff and erosion that increase during construction can be reduced by maintaining soil cover where possible. This soil is a good site for pond reservoirs. An earth embankment can be constructed across the narrower parts of the valley.

The land capability classification is VIe; the woodland ordination symbol is 4c.

Ca—Carlisle muck. This deep, level and nearly level soil is very poorly drained. It is in slightly concave depressions in end moraines. Slope is 0 to 2 percent. The soil is subject to ponding. Most areas are oval or somewhat long and narrow. They range from 3 to 160 acres.

Typically, the surface layer is very dark gray, friable muck about 8 inches thick. Below this to a depth of about 60 inches is very dark gray, dark brown, and dark reddish brown, friable muck. In some areas the muck is less than 52 inches deep to loamy material or sedimentary peat. In a few areas a mineral layer is over the muck.

Included with this soil in mapping are small areas of soils that are 3 to 4 feet deep to fine textured glacial till or marl. Narrow strips of Mermill and Pewamo soils that formed in mineral material are on the periphery of many areas. Also included are narrow strips of soils that are subject to flooding. The included soils make up about 15 percent of most areas.

The seasonal high water table in this Carlisle soil is near or above the surface for long periods. Permeability is moderately slow to moderately rapid, and available water capacity is very high. Surface runoff is very slow, and water ponds after rains. Organic matter content is very high. Reaction is medium acid to neutral in the upper part and strongly acid to mildly alkaline in the lower part.

Most of the acreage is cropland and in pasture. Undrained areas are swampy and marshy. Drained areas are well suited to corn and soybeans and grasses and legumes for hay and pasture. The ponding and very poor natural drainage are limitations for agricultural uses. Surface and subsurface drains are effective in removing excess water, but suitable outlets are difficult to establish in many areas. It is difficult to maintain the subsurface drains on a grade. Subsidence, or shrinkage, is the result of oxidation of the organic material after drainage. Controlled drainage reduces the shrinkage in areas where the water table can be raised or lowered. This soil is soft and highly compressible. It does not support narrow wheeled equipment, especially when wet. During dry periods, and where the soil is artificially drained, soil blowing and the risk of fire are major concerns. The muck can be removed or destroyed rather quickly by these hazards. Planting cover crops, returning crop residue to the soil, irrigating, and planting windbreaks reduce soil blowing. Because this soil is in low positions in the landscape, crops are susceptible to frost damage.

Some areas are used as woodland or support habitat for wildlife. This soil is poorly suited to trees unless it is drained. Equipment limitation, seedling mortality, and windthrow hazard are severe for woodland. The wetness and low soil strength seriously limit the use of logging equipment. Undrained areas support water-tolerant trees and some cattails, reeds, or sedges. They provide good habitat for ducks, muskrats, and other wetland wildlife.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of ponding, low strength, and moderately slow permeability. The soil is highly compressible and unstable. Roads should be located on more stable soils nearby. If the soil is used for local roads, the organic deposit needs to be removed and replaced with a suitable, well compacted fill material. Side ditches and culverts that have good outlets help protect roads from ponding. This soil is a source of organic material.

The land capability classification is IIIw; the woodland ordination symbol is 4w.

Cm—Colwood loam. This deep, level and nearly level soil is very poorly drained. This soil is in areas of outwash material on lake plains. It is in long, narrow depressions and on broad flats, and it is subject to ponding. Most areas range from 10 to 50 acres.

Typically, the surface layer is very dark brown, friable loam about 8 inches thick. The subsurface layer is very dark brown, friable loam about 4 inches thick. The subsoil is about 22 inches of gray, mottled, friable loam. The substratum to a depth of about 60 inches is gray and olive gray, mottled, friable, stratified fine sandy loam, sandy loam, silt loam, and silty clay loam. In some areas the surface layer is silt loam. In some areas the subsoil has more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Kibbie and Del Rey soils on slight convex rises. The included soils make up about 10 percent of most areas.

Permeability in this Colwood soil is moderate, and available water capacity is high. Surface runoff is very slow, or the soil is ponded. Organic matter content is high. Reaction in the subsoil is neutral or mildly alkaline. The seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, hay, pasture, and some specialty crops.

If this soil is used as cropland, artificial drainage is needed. Ponding damages small grain in some years. A subsurface drainage system is used to lower the seasonal high water table. This soil is well suited to irrigation. Planting cover crops and returning crop residue to the soil help to control erosion and to maintain the organic matter content. This soil can be cultivated year after year if good tilth is maintained. If this soil is used as pasture, restricting grazing when the soil is wet reduces compaction.

This soil is moderately well suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. Wetness severely limits the use of harvesting equipment. Logging can be done during the drier parts of the year. Trees tolerant of wetness need to be planted. Seedlings of adapted species grow well if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing. Using seedlings that have been transplanted once reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is poorly suited as a site for buildings and generally is not suited to septic tank absorption fields. Ponding severely limits these uses. This soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. If drains around foundations connect to a sump, the pump needs to be large enough to handle rather large volumes of water. Artificial drainage and a suitable base material under local roads and streets reduce damage from ponding and frost action. Elevation of the roadway also protects against ponding. Excavating is limited during winter and spring because of ponding and sloughing of banks.

The land capability classification is IIw; the woodland ordination symbol is 2w.

Db—Defiance silty clay loam, frequently flooded. This deep, level and nearly level soil is somewhat poorly drained. It is on flood plains. It is generally adjacent to the larger streams and is on much or all of the flood plain along some smaller streams. Slope is 0 to 2 percent. Most areas are long and narrow or moderately wide. They range from 5 acres to more than 100 acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 8 inches thick. The subsoil is about 31 inches thick. It is dark yellowish brown and grayish brown, mottled, friable and firm silty clay loam and silty clay. The substratum to a depth of about 60 inches is grayish brown, olive gray, and brown and is mottled. It is friable silty clay loam and firm and very firm silty clay. In some areas the surface layer is silty clay. In some areas the subsoil is grayer.

Included with this soil in mapping are small areas of Shoals soils that have less clay throughout. These included soils make up about 10 percent of most areas.

Permeability in this Defiance soil is slow, and available water capacity is moderate or high. Surface runoff is slow or very slow. Organic matter content is moderate. Reaction in the subsoil is slightly acid or neutral in the upper part and slightly acid to mildly alkaline in the lower part. A seasonal high water table is at a depth of 1 to 2 1/2 feet during extended wet periods.

Some areas are used as cropland. This soil is moderately well suited to corn and soybeans. These crops can be planted after spring flooding. Small grain crops are usually not grown because of damage from flooding. This soil is poorly suited to specialty crops. The soil dries slowly in spring. Surface drains are used to remove excess surface water. Subsurface drains are commonly used in areas that have suitable outlets. Outlets are difficult to establish in some areas. This soil becomes compacted and cloddy if worked when wet and sticky. Restricting tillage to a limited range of moisture content is important. Minimizing tillage, incorporating crop residue into the soil, and planting cover crops maintain tilth, reduce crusting, and protect the surface in areas that are subject to scouring during floods.

Some areas are used for pasture. This soil is moderately well suited to pasture. Maintaining soil tilth and desirable forage stands is difficult unless the soil is drained and grazing is controlled. The soil becomes soft and sticky when wet. Grazing when the soil is soft and sticky or overgrazing causes compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods help keep the pasture and the soil in good condition.

Some areas are used for trees. This soil is moderately well suited to trees. Equipment limitations and seedling mortality are moderate. Windthrow hazard is severe. Tree seedlings are subject to flood damage. Plant competition can be controlled or removed by cutting, spraying, girdling, or mowing. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is generally not suited as a site for buildings and septic tank absorption fields. The flooding hazard, wetness, and slow permeability are limitations. The soil can be used for hiking trails during the drier part of the year.

The land capability classification is IIIw; the woodland ordination symbol is 3c.

DfA—Del Rey silt loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. Areas of this soil are on low ridges adjacent to drainageways and on low knolls of lake plains. A few areas are on moraines. Areas on low ridges are long and narrow, and those on low knolls are oval. Most areas range from 3 to 20 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown and dark yellowish brown, mottled, firm silty clay loam and silty clay. The middle and lower parts are gray, mottled, very firm silty clay and silty clay loam. The substratum to a depth of about 60 inches is brown, stratified, firm silty clay loam and friable silt loam. Mottles are in the upper part. In some areas the surface layer is loam. In some areas the substratum is sandy loam, loam, or clay loam. In places the upper part of the subsoil has more sand.

Included with this soil in mapping are small areas of very poorly drained Lenawee soils along drainageways and in slight depressions. This inclusion makes up about 10 percent of most areas.

Permeability in this Del Rey soil is slow, available water capacity is moderate, and runoff is slow. Organic matter content is moderate. Reaction in the subsoil is strongly acid to neutral in the upper part and neutral or mildly alkaline in the lower part. The seasonal high water table is at a depth of 1 to 3 feet during extended wet periods.

Most of the acreage is in cropland and is used for cash-grain farming. A few areas that are artificially drained are used for specialty crops. This soil is well suited to corn, soybeans, and small grain.

If this soil is used as cropland, artificial drainage is needed. A subsurface drainage system is used to lower the seasonal high water table. In some areas surface drains are used to remove excess surface water. The surface layer crusts after hard rains. Tilling at optimum moisture content is important to reduce crusting. Conservation tillage that leaves crop residue on the surface and incorporating crop residue or other organic matter into the surface layer maintain tilth and fertility, increase water infiltration, reduce crusting, and improve contact of seed with the soil.

This soil is well suited to pasture and hay. It is soft and sticky when wet. Grazing when the soil is soft and sticky or overgrazing causes surface compaction, reduced growth of plants, poor tilth, and decreased water infiltration. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, weed control, and artificial drainage help keep the pasture and soil in good condition.

A few areas are wooded. This soil is well suited to trees. Seedling mortality and windthrow hazard are severe for woodland. Species need to be tolerant of fairly high clay content in the subsoil and some seasonal wetness. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Seasonal wetness is a limitation. The soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields increases the absorption of effluent. Local roads and streets can be improved by using suitable base material and by artificially draining to improve soil strength and to reduce damage from frost action and seasonal wetness.

The land capability classification is IIw; the woodland ordination symbol is 3c.

DgA—Del Rey Variant silt loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is on lake plains and on outwash plains adjacent to stream valleys. Most areas are long and range from narrow to moderately wide. They range from 10 to 100 acres.

Typically, the surface layer is grayish brown, friable silt loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, mottled, friable and firm silty clay loam. The lower part is grayish brown and gray, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is grayish brown, dark grayish brown, and brown, mottled, stratified sandy loam, loamy sand, and gravelly sandy loam. It is friable and very friable. In some areas the subsoil has more clay. In places the surface layer is loam.

Included with this soil in mapping are small areas of very poorly drained Lenawee soils along drainageways and in slight depressions. These included soils make up about 10 percent of most areas.

Permeability in this Del Rey Variant is slow in the subsoil and rapid in the substratum. Available water capacity is moderate or high, and runoff is slow. Organic matter content is moderate. Reaction in the subsoil is medium acid or slightly acid in the upper part and medium acid to mildly alkaline in the lower part. The seasonal high water table is at a depth of 1 to 2 1/2 feet during extended wet periods.

Much of the acreage is in cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, and small grain.

If this soil is used as cropland, artificial drainage is needed. A subsurface drainage system is used to lower the seasonal high water table. The surface layer crusts after hard rains. Tilling at optimum moisture content is important to maintain good soil structure. Conservation tillage that leaves crop residue on the surface and incorporating crop residue into the surface layer improve tilth and fertility and increase water infiltration. These practices also reduce crusting and improve the contact of seed with the soil.

A few areas are in pasture. This soil is well suited to pasture and hay. The soil is soft and sticky when wet. Grazing when the soil is soft and sticky or overgrazing causes compaction, reduced growth in plants, poor tilth, and decreased water infiltration. Deferment of grazing, pasture rotation, selection of adapted species for planting, proper stocking rates, weed control, and artificial drainage can help keep the pasture and soil in good condition.

A few areas are in woods. This soil is well suited to trees. Seedling mortality and windthrow hazard are severe for woodland. Species need to be tolerant of fairly high clay content in the subsoil and some seasonal wetness. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements. If drains at the base of footings are connected to a sump, the pump needs to be large enough to handle rather large volumes of water. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. The effluent from septic tank absorption fields drains slowly through the upper layers of this soil. Pollution of streams, lakes, ponds, and shallow underground water supplies is a hazard because of the rapid permeability in the substratum. Installing septic tank absorption fields in elevated mounds reduces the hazard of pollution. Local roads and streets can be improved by using suitable base material and by artificially draining to improve soil strength and to reduce damage from frost action and seasonal wetness. Sloughing is a hazard in excavations.

The land capability classification is IIw; the woodland ordination symbol is 3c.

DmA—Digby loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. The soil is on ridges and low knolls of outwash plains and stream terraces. It is also on beach ridges. The areas on ridges are long and narrow, and those on knolls are oval. Most areas range from 3 to 30 acres.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is about 26 inches thick. The upper part is yellowish brown and dark yellowish brown, mottled, firm clay loam. The lower part is grayish brown and light brownish gray and is mottled. It is firm gravelly clay loam and friable gravelly loam. The substratum to a depth of about 60 inches is brown, grayish brown, and yellowish brown. It is very friable and loose, stratified gravelly sandy loam, gravelly loamy sand, and very gravelly sandy loam. In some areas the surface layer is sandy loam. In other areas the subsoil and substratum do not have gravel.

Included with this soil in mapping are small areas of the very poorly drained Millgrove soils along drainageways and in depressions. This inclusion makes up about 8 percent of most areas.

Permeability in this Digby soil is moderate in the subsoil and rapid in the substratum. Available water capacity is moderate, and runoff is slow. Organic matter content is moderate. Reaction in the subsoil is neutral to medium acid in the upper part and neutral or mildly alkaline in the lower part. The seasonal high water table is at a depth of 1 to 2 1/2 feet during extended wet periods.

Most of the acreage is in cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and some specialty crops.

If this soil is used as cropland, artificial drainage is needed. A subsurface drainage system is used to lower the seasonal high water table. The soil is well suited to irrigation. Incorporating crop residue, applying barnyard manure or other organic material, and planting cover crops increase the organic matter content, maintain tilth, and increase water infiltration. The soil becomes soft and sticky when wet. It compacts if tilling or harvesting is done when it is soft and sticky.

Some areas are used for pasture. Most of these areas are on stream terraces. This soil is well suited to pasture and hay. The soil is soft and sticky when wet. Grazing when the soil is soft and sticky or overgrazing causes surface compaction, poor tilth, reduced growth of plants, and decreased infiltration of water. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, artificial drainage, and weed control help keep the pasture and soil in good condition.

This soil is well suited to trees. Species need to be tolerant of some wetness. Seedlings of adapted species grow well if competing vegetation is controlled or removed by disking, spraying, girdling, or mowing.

This soil is moderately well suited as a site for buildings and is poorly suited to septic tank absorption fields. It is better suited to houses without basements than to houses with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls also help keep basements dry. If drains around foundations connect to a sump, the pump needs to be large enough to handle large volumes of water. Perimeter drains are used around septic tank absorption fields to lower the seasonal high water table. The effluent from septic tank absorption fields drains freely in the substratum. Pollution is a hazard, however, to streams, lakes, ponds, and underground water supplies. This hazard can be reduced by placing the field in suitable fill material. Local roads and streets can be improved by using a suitable base material and by draining to reduce damage from frost action and seasonal wetness. Sloughing is a hazard in excavations.

The land capability classification is IIw; the woodland ordination symbol is 2o.

FsA—Fulton loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is on slightly elevated rises of lake plains. Most areas are oval or irregularly shaped. They range from 3 to 40 acres.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 24 inches thick. It is yellowish brown and gray, mottled, firm clay and silty clay. The substratum to a depth of about 60 inches is gray, mottled, firm clay. In some areas the surface layer is sandy loam. In some areas the upper part of the subsoil is more sandy.

Included with this soil in mapping are small areas of very poorly drained Latty and Toledo soils along drainageways and in slight depressions. The included soils make up about 10 percent of most areas.

Permeability in this Fulton soil is slow or very slow, available water capacity is moderate, and surface runoff is slow. Organic matter content is moderate. Reaction in the subsoil is strongly acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part. The seasonal high water table is at a depth of 1 to 2 1/2 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain.

If this soil is used as cropland, artificial drainage is needed. A subsurface drainage system is commonly used to lower the seasonal high water table. In some areas surface drains are used to remove excess surface water. Tilth is good. Tillage and harvesting are best performed at optimum moisture content with the kind of equipment that minimizes soil compaction.

This soil is moderately well suited to pasture and hay. The soil becomes soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction, reduced growth of plants, and decreased infiltration of water. Proper stocking rates, artificial drainage, selection of adapted species for planting, pasture rotation, deferment of grazing, and weed control help keep the pasture and soil in good condition.

Some areas are woodland. This soil is moderately well suited to trees. Seedling mortality and windthrow hazard are severe for woodland. Species need to be tolerant of high clay content in the subsoil and some wetness. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Poured concrete walls, steel reinforced and stiffened with pilasters, are added protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of absorption fields also increases the absorption of effluent. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce damage from the high shrink-swell potential and to improve soil strength.

The land capability classification is IIIw; the woodland ordination symbol is 3c.

FtA—Fulton silty clay loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is on slightly elevated rises of lake plains. Most areas are oval, long and narrow strips, or moderately wide strips. They range from 3 to 70 acres.

Typically, the surface layer is dark grayish brown, firm silty clay loam about 10 inches thick. The subsoil is about 27 inches thick. It is yellowish brown and grayish brown, mottled, very firm silty clay and clay. The substratum to a depth of about 60 inches is grayish brown, mottled, very firm clay. In some areas the surface layer is loam. In places the subsoil is more sandy. In some areas the subsoil has more sand and some fine gravel.

Included with this soil in mapping are small areas of very poorly drained Latty and Toledo soils along drainageways and in slight depressions. These included soils make up about 10 percent of most areas.

Permeability in this Fulton soil is slow or very slow, available water capacity is moderate, and runoff is slow. Organic matter content is moderate. Reaction in the subsoil is strongly acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part. The seasonal high water table is at a depth of 1 to 2 1/2 feet during extended periods.

Much of the acreage is cropland and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain.

If this soil is used as cropland, artificial drainage is needed. Surface drains are used to remove excess surface water. Subsurface drains are used to lower the seasonal high water table. This soil becomes compacted and cloddy if worked when wet and sticky. Restricting tillage to a limited range of moisture content is important. The surface crusts after a hard rain, which hinders seedling emergence. Minimizing tillage and planting cover crops are good management practices. Incorporating crop residue or other organic matter into the surface layer increases infiltration of water and improves tilth and fertility. These practices also reduce crusting and improve the contact of seed with the soil.

This soil is moderately well suited to pasture and hay. The soil becomes soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction, decreased water infiltration, and reduced growth of plants. Selection of adapted species for planting, pasture rotation, proper stocking rates, deferment of grazing, artificial drainage, and weed control help keep the pasture and soil in good condition.

Some areas are woodland. This soil is moderately well suited to trees. Seedling mortality and windthrow hazard are severe. Species need to be tolerant of high clay content in the subsoil and some seasonal wetness. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements as deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Poured concrete, steel reinforced walls stiffened with pilasters, are added protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps prevent wet basements. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields also increases the absorption of effluent. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce damage from the high shrink-swell potential and to improve soil strength.

The land capability classification is IIIw; the woodland ordination symbol is 3c.

Ge—Genesee loam, occasionally flooded. This deep, level and nearly level soil is well drained. It is on flood plains along the major streams and larger tributaries. It generally is nearer the stream channel than the nearby Shoals and Sloan soils. Some areas are dissected by braided flood channels. Slope is 0 to 2 percent. Most areas are long and narrow to broad. They range from 20 acres to more than 100 acres.

Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and brown. It is friable silt loam and firm silty clay loam. In places the upper part of the soil is weakly calcareous. In some areas the surface layer is darker colored, and in other areas it is silt loam.

Included with this soil in mapping are narrow strips of the somewhat poorly drained Shoals soils in slightly lower positions and the very poorly drained Sloan soils in the lowest positions of wide flood plains. The included soils make up about 15 percent of most areas.

Permeability in this Genesee soil is moderate, available water capacity is high, and surface runoff is slow. Organic matter content is moderate. Below the surface layer, the root zone is commonly slightly acid to mildly alkaline.

Most of the acreage is cropland and is used for cash-grain farming. Some areas are used for pasture. This soil is well suited to corn, soybeans, and grasses and legumes for pasture. Winter small grain is normally not grown because of the possibility of flood damage. Planting cover crops and returning crop residue to the soil maintain the organic matter content and protect the surface in areas that are subject to scouring during floods. Randomly spaced subsurface or surface drains are needed in some areas of the included wetter soils, especially if specialty crops are grown. Restricting grazing when the soil is wet reduces compaction.

Some areas are in woodland. This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by good site preparation and by spraying, cutting, or girdling.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of the flooding hazard. Roads can be protected from flooding by constructing them on raised, well compacted fills. Fills for roads should not block the flow of floodwaters. This soil is well suited to paths and trails and picnic areas.

The land capability classification is IIw; the woodland ordination symbol is 1o.

Gf—Gilford fine sandy loam. This deep, level and nearly level soil is very poorly drained. It is on broad flats of terraces and deltas. It is also in areas of outwash material on lake plains (fig. 7). Slope is 0 to 2 percent. The soil is subject to ponding. Most areas are irregular in shape, and some are long and narrow. Most areas range from 10 to 75 acres.

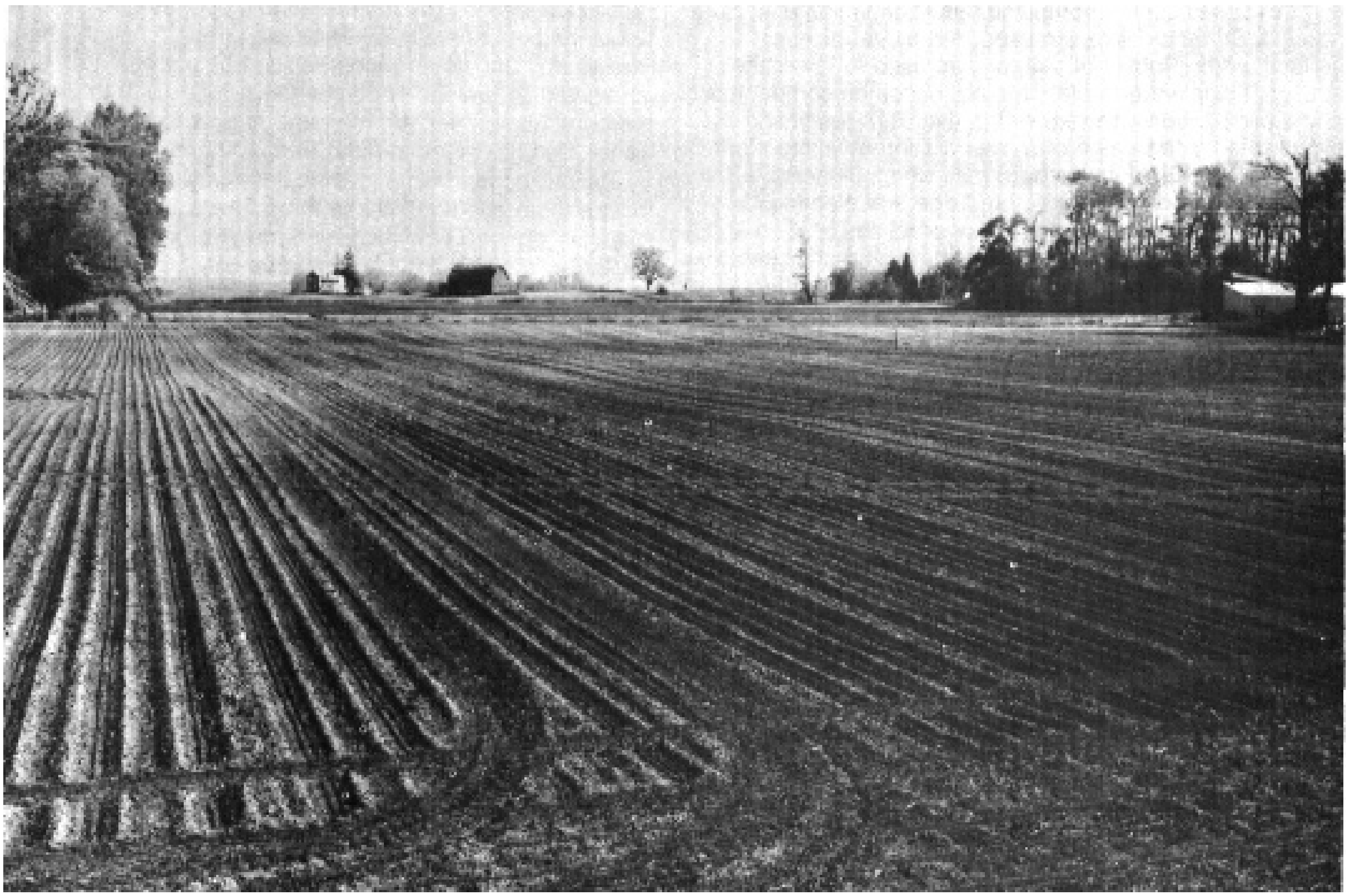

Figure 7.—This broad flat of Gilford fine sandy loam is well suited to corn and soybeans.

Typically, the surface layer is very dark gray, very friable fine sandy loam about 11 inches thick. The subsoil is about 28 inches thick. The upper and middle parts are gray and light gray, mottled, friable and very friable fine sandy loam. The lower part is gray, mottled, very friable loamy fine sand. The substratum to a depth of about 60 inches is light gray, loose, stratified fine sand and loamy fine sand. In some areas the subsoil has more sand, silt, or clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Tedrow soils. These soils are in oval areas or on narrow ridges. Also included are small areas of Mermill soils that have glacial till or lacustrine sediment in the lower part of the soil. The included soils make up about 15 percent of most areas.

Permeability in this Gilford soil is moderately rapid in the upper part and rapid in the lower part. Available water capacity is moderate. Surface runoff is very slow, or the soil is ponded. Organic matter content is moderate. A seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and some specialty crops. Row crops can be grown continuously if the soil is well managed. Artificial drainage is needed for crop production. Ponding damages small grain crops in some years. A subsurface drainage system is commonly used to lower the seasonal high water table. Subsurface drains become filled with fine sand unless some type of filtering material is used. A subsurface drain that has a fiber envelope installed during manufacturing or a gravel or crushed stone filter around and over the drain prior to backfilling the trench lessens the possibility of the drain filling with fine sand. Soil blowing is a hazard. Practices such as conservation tillage that leaves crop residue on the surface reduce soil blowing in row crops. This soil is well suited to irrigation.

This soil is well suited to hay and pasture. It is poorly suited to grazing during wet periods, unless it is artificially drained. Grazing when the soil is wet causes compaction and damages pasture plants.

This soil is moderately well suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. The use of harvesting equipment is restricted when the soil is wet. Logging can be done during drier parts of the year. Trees need to be tolerant of wetness. Plant competition can be reduced by cutting, spraying, girdling, or mowing. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is poorly suited as a site for buildings and is generally not suited to septic tank absorption fields. Because of ponding, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. If drains around foundations connect to a sump, the pump needs to be large enough to handle rather large volumes of water. Artificially draining and using a suitable base material under local roads and streets reduce damage from ponding and frost action. Elevation of the road also protects against ponding. Excavations are limited during winter and spring because of ponding and sloughing of banks.

The land capability classification is IIw; the woodland ordination symbol is 4w.

GwB—Glynwood loam, 2 to 6 percent slopes. This deep, moderately well drained soil is gently sloping. The soil is on end moraines. It is generally on knolls, ridges, and side slopes at the head of drainageways. Slopes are commonly 60 to 150 feet long. They are dominantly 4 to 6 percent. Most areas are irregular in shape, or they are long and narrow or moderately wide. They range from 5 to 50 acres.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsurface layer is brown, friable loam about 2 inches thick. The subsoil is about 26 inches thick. The upper part is dark yellowish brown, firm silty clay loam. The middle and lower parts are yellowish brown and brown and are mottled. They are firm clay and very firm clay loam. The substratum to a depth of about 60 inches is glacial till that is yellowish brown, mottled, very firm clay loam. Some small areas are eroded and have a surface layer of clay loam. A few narrow strips along dissected drainageways have slopes of 6 to 12 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Blount soils and very poorly drained Pewamo soils along drainageways and in small oval depressions. The included soils make up about 10 percent of most areas.

Permeability in this Glynwood soil is slow. The available water capacity is moderate, and surface runoff is medium. Organic matter content is moderate. Reaction in the subsoil is neutral to strongly acid in the upper part and medium acid to mildly alkaline in the lower part. The seasonal high water table is perched. It is at a depth of 2 to 3 1/2 feet in winter, in spring, and in extended wet periods during the fall and summer.

Much of the acreage is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, and small grain.

If row crops are grown, erosion is the main hazard. Conservation tillage that leaves crop residue on the surface, planting cover crops, and using grassed waterways reduce soil loss. Terraces and diversions can be used to intercept runoff on long slopes. Grasses and legumes in the cropping system help control erosion. Incorporating crop residue or other organic matter into the surface layer improves tilth and fertility and increases water infiltration. It also reduces crusting and improves the contact of seed with the soil.

Some areas are in permanent pasture. This soil is well suited to grasses and legumes for hay and pasture. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky and overgrazing cause surface compaction, reduced growth of plants, poor tilth, and increased runoff. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, and weed control help keep the pasture and soil in good condition.

Some areas are in native hardwoods. This soil is well suited to trees. Seedling mortality and windthrow hazard are moderate. Seedlings grow well if competing vegetation is controlled or removed by disking, spraying, girdling, or mowing. Species need to be tolerant of fairly high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings and is poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. Backfilling along foundations with a coarser textured material reduces damage from shrinking and swelling of the soil. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields also increases the absorption of effluent. Local roads and streets can be improved by using suitable base material and by artificially draining to reduce damage from frost action and to improve soil strength.

The land capability classification is IIe; the woodland ordination symbol is 2c.

GwB2—Glynwood loam, 2 to 6 percent slopes, eroded. This deep, gently sloping soil is moderately well drained. The soil is on end moraines. It is on knolls, ridges, and side slopes at the head of drainageways. Slopes are commonly 40 to 100 feet long. They are dominantly 4 to 6 percent. The surface layer is a mixture of the original surface layer and the upper part of the subsoil. Most areas are long and narrow or moderately wide. They range from 5 to 30 acres.

Typically, the surface layer is brown, friable loam about 7 inches thick. The subsoil is about 22 inches thick. It is mostly dark yellowish brown, mottled, firm clay loam and clay. The substratum to a depth of about 60 inches is glacial till of brown, mottled, very firm clay loam. In some areas the surface layer is clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Blount soils on low rises and the very poorly drained Pewamo soils along drainageways. Also included are areas of the Haskins and Rawson soils that have more sand and less clay in the subsoil The included soils make up about 15 percent of most areas.

Permeability in this Glynwood soil is slow. Available water capacity is moderate, and surface runoff is medium or rapid. Organic matter content is moderately low. Reaction in the subsoil is strongly acid to neutral in the upper part and medium acid to mildly alkaline in the lower part. The seasonal high water table is perched. It is at a depth of 2 to 3 1/2 feet in winter, in spring, and in extended wet periods during fall and summer.

Most of the acreage is cropland and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain if it is well managed and erosion is controlled. Controlling runoff is important to reduce further loss of soil. Because of their small size, many areas of this soil are managed with adjacent soils. Terraces and diversions can be used to intercept runoff on long slopes. Grasses and legumes in the cropping system help to control erosion. If plowed when wet and sticky, the soil becomes cloddy. Conservation tillage that leaves crop residue on the surface, planting cover crops, incorporating crop residue into the soil, and tilling at proper moisture levels improve tilth, increase the rate of water infiltration, and reduce the risk of erosion.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is soft and wet compacts the surface layer and causes poor tilth, excessive runoff, and more erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

A few areas are in hardwoods. Seedling mortality and windthrow hazard are moderate for woodland. This soil is suited to trees that are tolerant of a fairly high clay content in the subsoil. Competing vegetation can be controlled or removed by spraying, mowing, disking, or girdling. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements. Backfilling along foundations with coarser textured material reduces damage from shrinking and swelling of the soil. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields also increases the absorption of effluent. Local roads and streets can be improved by using suitable base material and by artificially draining to reduce damage from frost action and to improve soil strength.

The land capability classification is IIIe; the woodland ordination symbol is 2c.

GwC2—Glynwood loam, 6 to 12 percent slopes, eroded. This deep, sloping soil is moderately well drained. Erosion has removed part of the original surface layer, and the present surface layer contains subsoil material that has a higher clay content. The soil is on dissected parts of ground moraines and end moraines. It is also on knolls and along drainageways. In places this soil is on short slope breaks. Most areas are long and narrow. They range from 3 to 30 acres.

Typically, the surface layer is brown, firm loam about 7 inches thick. The subsoil is about 15 inches thick. It is brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, mottled, very firm clay loam. In some areas where this soil is more eroded, the surface layer is clay loam. In some areas where the soil is well drained, the subsoil has fewer gray mottles.

Included with this soil in mapping are small areas of soils that have slopes of 12 to 25 percent. The included soils make up about 10 percent of most areas.

Permeability in this Glynwood soil is slow, available water capacity is moderate, and surface runoff is rapid. Organic matter content is moderately low. Reaction in the subsoil is strongly acid to neutral in the upper part and medium acid to mildly alkaline in the lower part. The seasonal high water table is perched. It is at a depth of 2

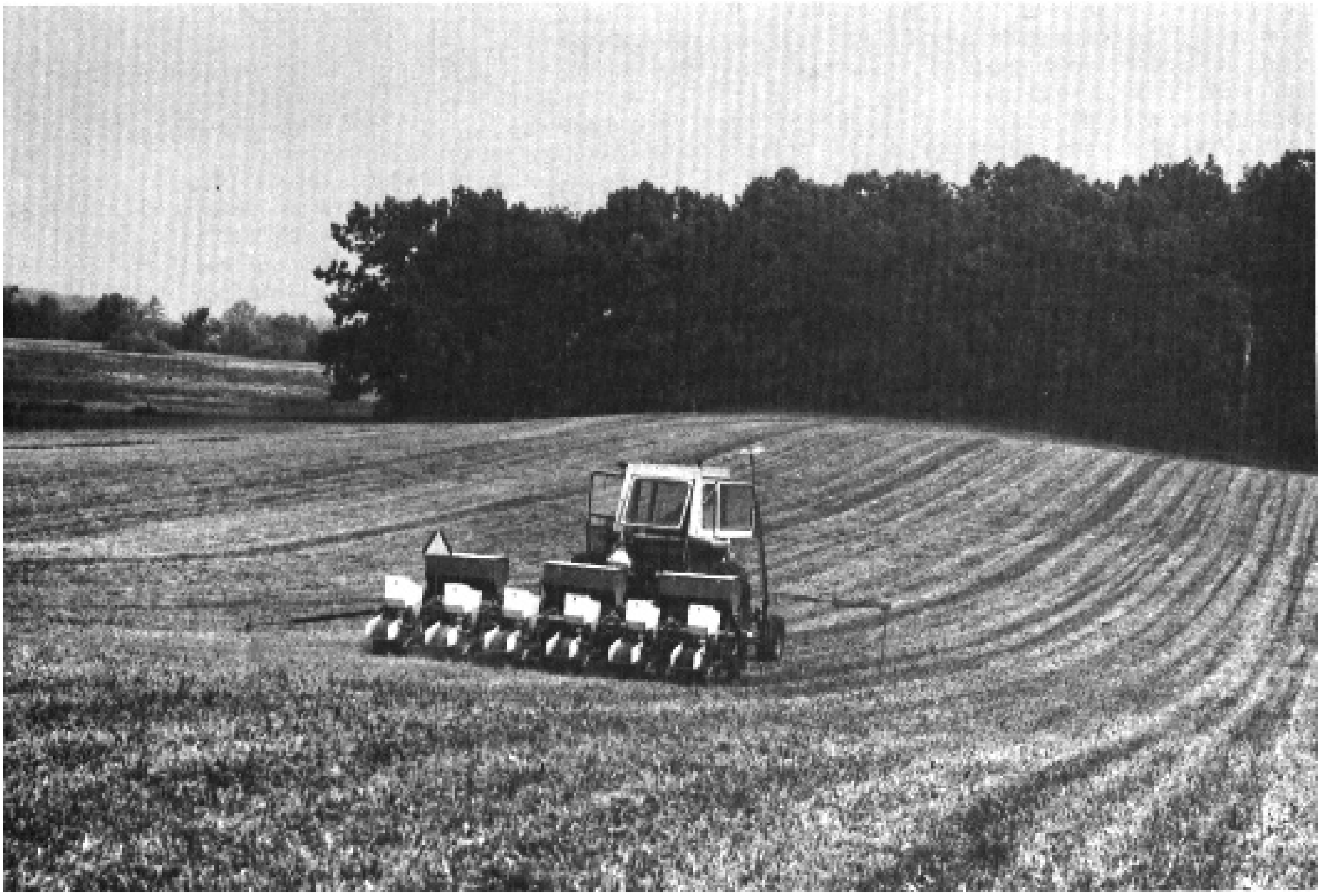

Figure 8.—No-till planting of corn in hay stubble on Glynwood loam, 6 to 12 percent slopes, eroded. This practice protects the soil against erosion when row crops are grown.

to 3 1/2 feet in winter, in spring, and in extended wet periods during fall and summer.

Much of the acreage is cropland and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain.

If this soil is cultivated, the hazard of erosion is severe. No-till conservation tillage that leaves crop residue on the surface, cover crops, grasses and legumes in the cropping system, and grassed waterways are used to reduce erosion and to maintain soil tilth (fig. 8). Incorporating crop residue into the soil and applying manure improve soil tilth, reduce surface crusting, and increase water intake. Tilling within the proper range of moisture content reduces soil compaction. This soil is susceptible to erosion if plowed in fall. Terraces, diversions, and stripcropping are difficult to use in most areas because of the short slopes.

Some areas are in pasture. This soil is well suited to hay and pasture. The hazard of erosion is severe if the soil is plowed or if the pasture is overgrazed. The use of cover crops or companion crops and the trash-mulch or no-till seeding methods help reduce erosion. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition.

Some areas are in native hardwoods. Seedling mortality and windthrow hazard are moderate for woodland. This soil is well suited to trees that are tolerant of fairly high clay content in the subsoil. Competing vegetation can be controlled or removed by good site preparation and by spraying, mowing, or girdling. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to buildings without basements than to buildings with basements. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements. Buildings need to be designed to conform to the natural slope of the land. Installing distribution lines in septic tank absorption fields on the contour of the slope reduces seepage of effluent to the soil surface. Increasing the size of septic tank absorption fields increases the absorption of effluent. Local streets and roads can be improved by using suitable fill material and by artificially draining to reduce damage from frost action and to improve soil strength. The runoff and erosion that increase during construction can be reduced by maintaining plant cover where possible.

The land capability classification is IIIe; the woodland ordination symbol is 2c.

HnA—Haskins loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is on slight rises and low knolls of outwash plains, terraces, low beach ridges, moraines, and lake plains. Most areas are long and narrow or oval. They range from 3 acres to about 40 acres.

Typically, the surface layer is dark grayish brown, very friable loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is dark yellowish brown, mottled, friable clay loam. The middle part is grayish brown, mottled, friable gravelly clay loam. The lower part is dark yellowish brown, very firm clay. The substratum to a depth of about 60 inches is brown, very firm, calcareous clay loam. In some areas the surface layer is sandy loam, and in others it is darker colored.

Included with this soil in mapping are narrow strips of very poorly drained Mermill soils in drainageways and depressions. Also included are small areas of somewhat poorly drained Blount and Nappanee soils formed in glacial till. Blount soils are on moraines, and Nappanee soils are on lake plains. These included soils make up about 10 percent of most areas.

Permeability in this Haskins soil is moderate in the upper and middle parts of the subsoil and is slow or very slow in the lower part and in the substratum. Available water capacity is moderate, and surface runoff is slow. Organic matter content is moderate. Reaction in the subsoil is strongly acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part. The seasonal high water table is at a depth of 1 to 2 1/2 feet during extended wet periods.

Most of the acreage is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and some specialty crops.

If this soil is used as cropland, artificial drainage is needed. A subsurface drainage system can be used to lower the seasonal high water table. The soil is well suited to irrigation. Erosion is a hazard on the more sloping soil. Returning crop residue to the soil, planting cover crops, and applying barnyard manure or other organic material to the soil increase the organic matter, maintain tilth, reduce erosion, and increase water infiltration. This soil is soft and sticky when wet. It becomes compacted if it is tilled or harvested when soft and sticky.

Some areas are used for pasture. Most of these areas are on end moraines and stream terraces. This soil is well suited to pasture and hay. The soil is soft and sticky when wet. Grazing when the soil is soft and sticky and overgrazing cause compaction, reduced growth of plants, decreased infiltration rates, and poor tilth. Proper stocking rates, selection of adapted species for planting, deferment of grazing, pasture rotation, and weed control help keep the pasture and soil in good condition.

This soil is well suited to trees. Species that tolerate some wetness need to be planted. Seedlings of adapted species grow well if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness, buildings without basements are better suited to this soil than buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Installing the distribution lines of septic tank absorption fields in elevated mounds of moderately permeable or moderately rapidly permeable soil material increases the capacity to absorb effuent. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce the damage from frost action and seasonal wetness.

The land capability classification is IIw; the woodland ordination symbol is 2o.

Ho—Hoytville clay loam. This deep, level and nearly level soil is very poorly drained. It is adjacent to the beach ridges on lake plains. The soil is subject to ponding. Slope is 0 to 2 percent. Areas are long and narrow or moderately wide. They range from 10 to 75 acres.

Typically, the surface layer is very dark brown, firm clay loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is dark gray, mottled, firm clay. The lower part is olive gray and dark gray, mottled, firm clay and silty clay. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, very firm clay loam and clay. In some areas the subsoil is more sandy.

Included with this soil in mapping are small areas of the somewhat poorly drained Nappanee and Haskins soils on slight rises. Also included are areas where the surface layer is clay and has poor tilth. These inclusions make up about 15 percent of most areas.

Permeability in this Hoytville soil is slow, and available water capacity is moderate. Surface runoff is very slow, or the soil is ponded. Organic matter content is high. Reaction in the subsoil is neutral or mildly alkaline. The seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage of this soil is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and specialty crops if it is adequately drained. Artificial drainage improves plant growth. Fieldwork is easier because the soil dries out earlier in spring and following rains. Surface and subsurface drains are used to improve drainage.

Conservation tillage that leaves crop residue on the surface and cover crops are good management practices. Returning crop residue or other organic material to the soil increases water infiltration and improves tilth and fertility. This soil compacts if worked when wet and sticky. Tillage and harvesting are best performed at optimum moisture levels and with the kind of equipment that minimizes soil compaction.

This soil is well suited to pasture or hay. It is poorly suited to grazing early in spring. This soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction, poor tilth, decreased infiltration, and reduced growth. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, and weed control help keep the pasture and soil in good condition.

A few areas are in native hardwoods. Equipment limitations and seedling mortality are severe for woodland. Windthrow hazard is moderate. The use of harvesting equipment is limited by wetness. Planting and logging can be done during the drier part of the year. This soil is moderately well suited to trees adapted to wetness. Species need to be tolerant of prolonged wetness and high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is poorly suited as a site for buildings but is generally not suited to septic tank absorption fields. It is better suited to houses without basements than to houses with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are added protection against damage from shrinking and swelling. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling of the soil and help prevent wet basements. Coating the exterior of basement walls also helps prevent wet basements. Local roads and streets can be improved by using a suitable base material and by artificially draining to reduce the damage from frost action, ponding, low soil strength, and shrinking and swelling of the soil. Constructing roads on raised, well compacted fill material protects them from ponding. This soil is a good site for pond reservoirs.

The land capability classification is IIw; the woodland ordination symbol is 3w.

Hv—Hoytville clay. This deep, level and nearly level soil is very poorly drained. The soil is on lake plains. It is on broad flats and in long, narrow areas along drainageways (fig. 9). Slope is 0 to 2 percent. Most areas range from 25 acres to several hundred acres.

Typically, the surface layer is very dark gray, firm clay about 9 inches thick. The subsoil is about 31 inches thick. It is olive gray and gray, mottled, firm and very firm clay. The substratum to a depth of about 60 inches is brown, mottled, very firm clay. In some areas the surface layer and upper part of the subsoil are more sandy, and in others the surface layer is clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Nappanee and Haskins soils on low rises. The included soils make up about 15 percent of most areas.

Permeability in this Hoytville soil is slow, and available water capacity is moderate. Surface runoff is very slow, or the soil is ponded. Organic matter content is high. Reaction in the subsoil is neutral or mildly alkaline. The seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage of this soil is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and some specialty crops if it is adequately drained.

Artificial drainage is needed to grow crops. A combination of surface and subsurface drains is commonly used. Artificial drainage improves plant growth. Fieldwork is easier because the soil dries out earlier in spring and following rains. This soil becomes compacted and cloddy if worked when wet and sticky. Restricting tillage to a limited range of moisture content is important.

Conservation tillage that leaves crop residue on the surface, planting on tilled ridges, and planting cover crops are good management practices (fig. 10). Returning crop residue or other organic matter to the soil increases water infiltration and improves tilth and fertility. These practices also reduce crusting and improve contact of seed with the soil.

This soil is well suited to pasture and hay. It is poorly suited to grazing early in spring. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction, poor tilth, reduced growth of plants, and decreased infiltration. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, and

Figure 9.—Hoytville clay, on broad flats of the lake plain, is well suited to row crops, small grain, and some specialty crops.

Figure 10.—Tilled ridges on Hoytville clay. Planting row crops on these ridges reduces damage from ponding and wetness.

weed control help keep the pasture and soil in good condition.

A few areas are in native hardwoods. Equipment limitations and seedling mortality are severe for woodland. Windthrow hazard is moderate. The use of harvesting equipment is limited by wetness. Planting and logging can be done during the drier part of the year. This soil is moderately well suited to trees adapted to wet sites. Species need to be tolerant of prolonged wetness and high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

Even though this soil is used as a site for buildings, it is poorly suited to this purpose. It is generally not suited to septic tank absorption fields. This soil is best suited to houses without basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water from the foundation. Poured concrete walls, steel reinforced and stiffened with pilasters, are added protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps prevent wet basements. Local roads and streets can be improved by using a suitable base material and by artificially draining to reduce damage from frost action, ponding, low soil strength, and the shrinking and swelling of the soil. Constructing roads on raised, well compacted fill material protects them from ponding. This soil is a good site for pond reservoirs.

The land capability classification is IIw; the woodland ordination symbol is 3w.

KfA—Kibbie loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is in areas of outwash material on lake plains. It is commonly on slight rises and long, low ridges. Most areas are oval or long and narrow, but some on flats are moderately broad. Most areas range from 3 to 35 acres.

Typically, the surface layer is dark grayish brown, mottled, friable loam about 9 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is about 27 inches thick. It is brown, mottled, friable fine sandy loam, silty clay loam, and silt loam. The substratum to a depth of about 60 inches is light brownish gray and gray and is mottled. It is friable, stratified fine sandy loam and silt loam and very friable loamy fine sand. In some areas the surface layer is fine sandy loam, and in others the subsoil and substratum have more clay. In a few areas the surface layer is darker. In some areas the soil is better drained.

Included with this soil in mapping are small areas of the very poorly drained Colwood soils in narrow strips along drainageways and in depressions. The included soils make up about 10 percent of most areas.

Permeability in this Kibbie soil is moderate, available water capacity is high, and runoff is slow. Organic matter content is moderate. Reaction in the subsoil is medium acid to neutral. The seasonal high water table is at a depth of 1 to 2 feet during extended wet periods.

Most of the acreage of this soil is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and specialty crops.

If this soil is used as cropland, artificial drainage is needed. The soil is well suited to irrigation. More intensive drainage is required for specialty crops than for other crops. A subsurface drainage system is used to lower the seasonal high water table. Incorporating crop residue into the soil, applying barnyard manure or other organic material to the soil, and planting cover crops increase organic matter, maintain tilth, and increase water infiltration.

This soil is well suited to pasture and hay. Overgrazing or grazing when the soil is soft and wet causes compaction. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, and weed control help keep the pasture and soil in good condition.

This soil is well suited to trees. Species need to be planted that can tolerate some wetness. Plant competition can be reduced by disking, spraying, girdling, or mowing.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls also help keep basements dry. If drains around foundations connect to a sump, the pump needs to be large enough to handle rather large volumes of water. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Local roads and streets can be improved by using a suitable base material and by draining to reduce damage from frost action and seasonal wetness. Sloughing is a hazard in excavations, especially when the soil is wet.

The land capability classification is IIw; the woodland ordination symbol is 2o.

Lb—Landes fine sandy loam, occasionally flooded. This deep, level and nearly level soil is well drained and moderately well drained. It is on slight rises of flood plains. Most areas are long and narrow or are moderately wide strips. They range from 15 to 40 acres.

Typically, the surface layer is very dark grayish brown, friable fine sandy loam about 11 inches thick. The subsoil is about 34 inches thick. It is brown, dark yellowish brown, and dark brown fine sandy loam that is friable. The subsoil is mottled between depths of about 11 and 15 inches and 25 and 37 inches. The substratum to a depth of about 72 inches is brown and dark brown, loose, stratified loamy fine sand and fine sandy loam. In some areas the surface layer is loamy fine sand, and in others the surface layer and subsoil are weakly calcareous or more silty.

Included with this soil in mapping are narrow strips of somewhat poorly drained Shoals soils in slightly lower positions. This inclusion makes up about 10 percent of most areas.

Permeability in this Landes soil is rapid, available water capacity is moderate, and surface runoff is slow. The organic matter content is moderately low. Reaction in the subsoil ranges from slightly acid to mildly alkaline. Tilth is good, and the soil is easy to work. A seasonal high water table is at a depth of 4 to 6 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and grasses and legumes for pasture. Winter small grain is normally not grown because of flood damage. The soil is droughty during extended dry periods. It is suited to irrigation. Planting cover crops and returning crop residue to the soil maintain the organic matter content and protect the surface in areas that are subject to scouring during floods. Dikes help prevent flooding in some areas. The surface layer can be worked through a wide range of moisture content.

Some areas are woodland. This soil is well suited to trees. Plant competition can be reduced by girdling, disking, spraying, or mowing.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of the flooding hazard. Constructing roads on raised, well compacted fills provides protection from flooding. Fills for roads should not block the flow of floodwaters. This soil is well suited to paths and trails and picnic areas.

The land capability classification is IIIw; the woodland ordination symbol is 1o.

Lc—Latty silty clay. This deep, level and nearly level soil is very poorly drained. The soil is on lake plains. It is generally on broad flats and in long, narrow depressions. The depressional areas are mostly along drainageways. Slope is 0 to 2 percent. This soil is subject to ponding. Most areas range from 25 to several hundred acres.

Typically, the surface layer is dark grayish brown, firm silty clay about 7 inches thick. The subsoil is about 33 inches thick. It is gray, mottled, firm and very firm silty clay. The substratum to a depth of about 60 inches is gray, mottled, very firm silty clay. In some areas the surface layer is darker. In some areas the subsoil has less clay, or the soil has more clay throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Fulton and Nappanee soils on slight rises. These included soils make up about 10 percent of most areas.

Permeability in this Latty soil is very slow, and available water capacity is moderate. Surface runoff is very slow, or the soil is ponded. Organic matter content is moderate. Reaction in the subsoil is neutral or mildly alkaline. The seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage of this soil is cropland and is used for cash-grain farming. Some areas are used for specialty crops. This soil is moderately well suited to corn, soybeans, and small grain (fig. 11).

If this soil is used as cropland, artificial drainage is needed. More intensive drainage is required for specialty crops. A combination of surface and subsurface drains is commonly used to improve drainage. Artificial drainage improves plant growth. Fieldwork is made easier because the soil dries out and warms up earlier in spring. This soil becomes compacted and cloddy if worked when wet and sticky. Restricting tillage to a limited range of moisture content is important. Minimizing tillage and planting cover crops are good management practices. Incorporating crop residue or other organic matter into the surface layer increases water infiltration and improves tilth and fertility. These practices also reduce crusting and improve contact of the seed with the soil. Stands of wheat and oats are poor in some years where the soil is inadequately drained. Some soil blowing occurs in winter where the soil has been plowed in the fall. The soil is frozen and the surface is dried by the wind.

This soil is moderately well suited to pasture or hay. It is poorly suited to grazing early in spring. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky and overgrazing cause compaction, poor tilth, reduced growth, and decreased water infiltration. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, artificial drainage, and weed control help keep the pasture and soil in good condition.

Some areas are in native hardwoods. This soil is moderately well suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. Using harvesting equipment is limited by ponding. Logging can be done during the drier parts of the year. Plant competition can be reduced by cutting, spraying, girdling, or mowing. Using seedlings that have been transplanted once reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

Even though areas are used as sites for buildings, this soil is poorly suited to this use. It is generally not suited to septic tank absorption fields. This soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Poured concrete walls, steel reinforced and stiffened with pilasters, are added protection against damage from shrinking and swelling. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from the shrinking and swelling of the soil and help prevent wet basements. Coating the exterior of basement walls also helps prevent wet basements. Local roads and streets can be improved by using suitable base material and by artificially draining to reduce damage from low soil strength, ponding, and the shrinking and swelling of the soil. Constructing roads on well compacted fill material raises them above high, ponded water levels. This soil is a good site for pond reservoirs.

The land capability classification is IIIw; the woodland ordination symbol is 3w.

Lf—Lenawee silty clay loam. This deep, level and nearly level soil is very poorly drained. It is on broad flats and in long, narrow depressions on lake plains. Areas on the flats are irregularly shaped. This soil is subject to ponding. Slope is 0 to 2 percent. Most areas are 5 to 100 acres or more.

Typically, the surface layer is very dark grayish brown, firm silty clay loam about 9 inches thick. The subsoil is about 39 inches thick. It is grayish brown and gray, mottled, firm and very firm silty clay and silty clay loam. The substratum to a depth of about 66 inches is gray and light olive brown, mottled, stratified, friable silt loam and silty clay loam. In some areas the surface layer is loam, and in others the lower part of the subsoil and the substratum are sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Del Rey and Kibbie soils on slight rises. These included soils make up about 5 percent of most areas.

Figure 11.—Harvesting wheat on Latty silty clay. Major crops grown on this soil are wheat, soybeans, and corn.

Permeability in this Lenawee soil is moderately slow, and available water capacity is high. Surface runoff is very slow, or the soil is ponded. Organic matter content is moderate. Reaction in the subsoil is slightly acid to mildly alkaline. The seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage of this soil is cropland and is used for cash-grain farming. Some areas where the soil has good artificial drainage are used for specialty crops. This soil is well suited to corn, soybeans, small grain, and specialty crops.

If this soil is used for crops, artificial drainage is needed. More intensive drainage is needed for specialty crops. A combination of surface and subsurface drains is common. In places subsurface drains are the main means of artificially draining. Artificial drainage improves plant growth. Fieldwork is made easier because the soil dries out and warms up earlier in spring. The soil compacts and clods if it is worked when wet and sticky. The surface layer crusts after hard rains. Minimizing tillage and planting cover crops are good management practices. Returning crop residue or other organic matter to the soil increases water infiltration and improves tilth and fertility.

This soil is well suited to pasture and hay. The soil is poorly suited to grazing early in spring. It is soft and sticky when wet. Grazing when the soil is soft and sticky and overgrazing cause compaction, poor tilth, decreased water infiltration, and reduced growth of plants. Proper stocking rates, selection of adapted species for planting, deferment of grazing, artificial drainage, pasture rotation, and weed control help keep the pasture and soil in good condition.

Some areas are in native hardwoods. This soil is well suited to trees. Equipment limitations and seedling mortality are severe for woodland. The windthrow hazard is moderate. Use of harvesting equipment is limited by wetness. Logging can be done during the drier parts of the year. Plant competition can be reduced by spraying, mowing, or disking. Seedling mortality can be reduced by using trees that have been transplanted once and by selecting trees that are tolerant of wetness. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

Even though areas are used as sites for buildings, this soil is poorly suited to this purpose. It is generally not suited to septic tank absorption fields. This soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Using drains at the base of footings and coating the exterior of basement walls also help keep basements dry. Local roads and streets can be improved by using suitable base material and by installing subsurface drains and establishing side ditches. These practices help reduce damage from ponding and frost action and improve soil strength. Constructing roads on raised, well compacted fill material helps to prevent the damage caused by ponding.

The land capability classification is IIw; the woodland ordination symbol is 2w.

Md—Mermill loam. This deep, level and nearly level soil is very poorly drained. The soil is on stream terraces, on outwash plains, and near beach ridges of lake plains. It is on broad flats and in long and narrow drainageways. Slope is 0 to 2 percent. This soil is subject to ponding. Areas range from 5 to 50 acres or more.

Typically, the surface layer is very dark gray, friable loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is grayish brown, mottled, friable loam. The middle part is grayish brown, mottled, firm clay loam. The lower part is gray, mottled, firm clay. The substratum to a depth of about 60 inches is gray, mottled, very firm clay. In some areas the surface layer is clay loam. In other areas the dark surface layer is thicker. In some places the subsoil has more sand in the upper and middle parts. In other places the soil is more than 40 inches deep to glacial till or lacustrine material.

Included with this soil in mapping are small areas of the somewhat poorly drained Haskins soils on slight rises. These included soils make up about 10 percent of most areas.

Permeability in this Mermill soil is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part and in the substratum. Available water capacity is moderate. Surface runoff is very slow, or the soil is ponded. Organic matter content is high. Reaction ranges from medium acid to neutral in the upper and middle parts of the subsoil and from neutral to moderately alkaline in the lower part. The seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage is cropland and is used for cash-grain farming. Where it is adequately drained, this soil is well suited to corn, soybeans, small grain, and specialty crops.

Drainage is needed if this soil is used as cropland. A subsurface drainage system is used to lower the seasonal high water table. This soil is well suited to irrigation. Returning crop residue to the soil, applying barnyard manure or other organic material, and planting cover crops help maintain the organic matter content and tilth, increase water infiltration, and control erosion. The soil is soft and sticky when it is wet. It compacts if tillage or harvesting is done when it is soft and sticky. Unless the soil is adequately drained, stands of wheat and oats are poor in wet years. Subsurface drains are more effective if they are placed on or above the slowly permeable or very slowly permeable glacial till or lacustrine material in the lower part of the soil.

Some areas are in pasture. This soil is well suited to pasture or hay. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes surface compaction, decreased infiltration rates, reduced growth, and poor tilth. Deferment of grazing, pasture rotation, proper stocking rates, and weed control help keep the pasture and soil in good condition.

A few areas are woodland. This soil is well suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. Wetness limits the use of planting and harvesting equipment. Logging can be done during the drier parts of the year. Species that tolerate wetness need to be planted. Seedlings of adapted species grow well if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing. Using seedlings that have been transplanted once reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is poorly suited as a site for buildings and is generally not suited to septic tank absorption fields. Ponding and slow permeability or very slow permeability severely limit these uses. This soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil also helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements. If these drains are connected to a sump, the pump needs to handle rather large volumes of water. Artificially draining and using a suitable base material under local roads and streets reduce damage from ponding and frost action. Elevating roads above high water levels protects against ponding. Excavations are limited during winter and spring because of ponding.

The land capability classification is IIw; the woodland ordination symbol is 2w.

Mh—Millgrove loam. This deep, level and nearly level soil is very poorly drained. The soil is on stream terraces, on outwash plains, and in low lying areas between beach ridges on lake plains. It is on broad flats and in long, narrow areas along drainageways. Slope is 0 to 2 percent. This soil is subject to ponding. Most areas are 5 to 40 acres.

Typically, the surface layer is very dark grayish brown, friable loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 25 inches thick. The upper part is grayish brown, mottled, friable sandy clay loam. The middle and lower parts are grayish brown, mottled, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is grayish brown, friable and loose gravelly sandy loam. In some areas the surface layer is clay loam, and in others the lower part of the subsoil and the substratum are clay. In a few areas the soil has more sand throughout. In some areas the substratum is stratified silt and fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Digby soils on slight rises. Also included are areas on low stream terraces that are subject to flooding. The included soils make up about 10 percent of most areas.

Permeability and available water capacity in this Millgrove soil are moderate. Runoff is very slow, or the soil is ponded. Organic matter content is high. Reaction in the subsoil ranges from slightly acid to mildly alkaline. The seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and specialty crops.

If this soil is used as cropland, artificial drainage is needed. A subsurface drainage system is used to lower the seasonal high water table. This soil is well suited to irrigation. Returning crop residue to the soil and applying barnyard manure or other organic material help improve the organic matter content. These practices and planting cover crops help maintain tilth, increase water infiltration, and control erosion. The soil is soft and sticky when it is wet. It compacts if tillage or harvesting is done when it is soft and sticky. In places stands of wheat and oats are poor in wet years unless the soil is adequately drained.

This soil is well suited to pasture and hay. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky and overgrazing cause surface compaction, decreased water infiltration, reduced growth of plants, and poor tilth. Pasture rotation, deferment of grazing, proper stocking rates, artificial drainage, and weed control help keep the pasture and soil in good condition.

A few areas are in native hardwoods. This soil is well suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. Use of harvesting equipment is severely limited by wetness. Logging can be done during the drier parts of the year. Using seedlings that have been transplanted once reduces seedling mortality. Species that can tolerate wetness need to be planted. Seedlings of adapted species grow well if competing vegetation is controlled or removed by disking, spraying, mowing, and girdling. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is poorly suited as a site for buildings and is generally not suited to septic tank absorption fields. Ponding severely limits these uses. This soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements. If drains around foundations are connected to a sump, the pump needs to be large enough to handle rather large volumes of water. Artificially draining and using a suitable base material under local roads and streets reduce damage from ponding and frost heaving. Elevation of the roadway also protects against ponding. Excavations are limited during winter and spring because of ponding and sloughing of banks. Areas of included soils on low stream terraces are subject to flooding and are generally not suited to buildings and septic tank absorption fields.

The land capability classification is IIw; the woodland ordination symbol is 2w.

MrD2—Morley clay loam, 12 to 18 percent slopes, eroded. This deep, moderately steep soil is well drained. Erosion has removed part of the original surface layer. Subsoil material that has a higher clay content has been tilled into the surface layer. The soil is on short slopes along the sides of valleys and on the more hilly parts of end moraines. Areas are mostly long and narrow. They range from 2 to 20 acres.

Typically, the surface layer is brown, friable clay loam about 9 inches thick. The subsoil is about 25 inches thick. It is brown, mottled, firm clay and clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm clay loam. In some areas where the soil is less eroded, the surface layer is loam.

Included with this soil in mapping are severely eroded soils that have poor tilth. In places these soils are calcareous at the surface. Also included are narrow areas where slopes are 18 to 25 percent. These included soils make up about 15 percent of most areas.

Permeability in this Morley soil is slow or moderately slow. Available water capacity is moderate. The soil is droughty during extended dry periods because water is lost as runoff. Runoff is very rapid. Reaction in the subsoil is strongly acid or medium acid in the upper part and neutral to moderately alkaline in the lower part. Organic matter content is moderately low.

Some areas are used as cropland. This soil is suited to small grain and is poorly suited to growing row crops continuously. Row crops can be grown occasionally under good management if erosion is controlled. The slopes cause some problems in operating machinery and in installing erosion control practices. Because this soil has been eroded, it can be worked only in a narrow range of moisture content. If plowed when sticky and wet, the soil becomes cloddy. It puddles and crusts easily. Using conservation tillage that leaves crop residue on the surface, planting cover crops, and using grassed waterways reduce runoff and soil loss. Returning crop residue or other organic matter to the soil increases water infiltration and improves tilth and fertility. These practices also reduce crusting and improve the contact of seed with the soil. Erosion control practices, such as terraces, diversions, and stripcropping, have very limited application because most areas have short slopes.

Many areas are used for pasture. This soil is suited to grasses and legumes for hay and pasture. The hazard of erosion is very severe if the soil is plowed or if the pasture is overgrazed. During seeding the use of cover crops or companion crops and the trash-mulch or no-till seeding methods help control erosion. Timely deferment of grazing, pasture rotation, and proper stocking rates help keep the pasture and soil in good condition.

Many areas are woodland. Some areas are in native hardwoods. This soil is well suited to trees. The erosion hazard and equipment limitations are moderate for woodland. The slope limits the use of equipment. Locating logging roads and skid trails on or near the contour and using erosion control practices, such as water bars, reduce erosion. Plant competition can be reduced by disking, spraying, girdling, or mowing.

This soil is poorly suited as a site for buildings and septic tank absorption fields because of slope and slow permeability or moderately slow permeability. Buildings need to be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Septic tank absorption fields can be improved by enlarging the absorption field and installing the distribution lines on the contour. Local roads and streets can be improved by using suitable fill material to improve soil strength. The runoff and erosion that increase during construction can be reduced by maintaining plant cover where possible.

The land capability classification is IVe; the woodland ordination symbol is 2r.

NnA—Nappanee loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is on slightly elevated rises of lake plains. Most areas are irregularly shaped or long and narrow. They range from 2 to 30 acres.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 30 inches thick. It is brown, grayish brown, and dark grayish brown, mottled clay that is firm and very firm. The substratum to a depth of about 60 inches is grayish brown and brown, mottled, very firm clay and clay loam. In some areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of the very poorly drained Hoytville soils in drainageways and depressions. Also included are small areas of Haskins soils, which have more sand in the upper part of the subsoil. The Haskins soils and this soil are on similar positions. These included soils make up about 15 percent of most areas.

Permeability in this Nappanee soil is slow, available water capacity is moderate, and surface runoff is slow. Organic matter content is moderately low. Reaction in the subsoil is strongly acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part. The seasonal high water table is at a depth of 1 to 2 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. Tomatoes, sugar beets, and other specialty crops are grown in some areas where the soil has been intensively drained. This soil is moderately well suited to corn, soybeans, and small grain.

If this soil is used as cropland, artificial drainage is needed. In some areas surface drains are used to remove excess water. A subsurface drainage system is used to lower the seasonal high water table. Tillage and harvesting operations are best performed at optimum moisture content with equipment that minimizes soil compaction. Planting cover crops and returning crop residue to the soil maintain tilth and increase water infiltration.

This soil is moderately well suited to pasture and hay. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky and overgrazing cause surface compaction, reduced growth, and decreased water infiltration. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, and weed control help keep the pasture and soil in good condition.

Some areas are in native hardwoods. This soil is moderately well suited to trees. Seedling mortality and windthrow hazard are severe for woodland. Species need to be tolerant of a high clay content in the subsoil and some seasonal wetness. Using seedlings that have been transplanted or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings and is poorly suited to septic tank absorption fields. Because of seasonal wetness, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls help prevent wet basements. Using these drains and backfilling along basement walls with a coarser textured material reduce damage from shrinking and swelling of this soil. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are added protection against damage from shrinking and swelling. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields also increases the absorption of effluent. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce damage from seasonal wetness, shrinking and swelling, and low soil strength. This soil is a good site for pond reservoirs.

The land capability classification is IIIw; the woodland ordination symbol is 3c.

NpA—Nappanee silty clay loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is on the broad, slightly elevated rises of lake plains. Most areas are irregularly shaped or long and narrow. They range from 2 to 50 acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 8 inches thick. The subsoil is about 24 inches thick. It is dark grayish brown and brown, mottled, very firm clay. The substratum to a depth of about 60 inches is grayish brown, mottled, very firm clay. In places the surface layer is loam.

Included with this soil in mapping are small areas of the very poorly drained Hoytville soils in drainageways and depressions. Also included are small areas of Haskins soils, which have more sand in the surface layer and upper part of the subsoil. The Haskins soils and this Nappanee soil are on similar positions. These included soils make up about 10 percent of most areas.

Permeability in this Nappanee soil is slow, available water capacity is moderate, and surface runoff is slow. Organic matter content is moderately low. Reaction in the subsoil is strongly acid to slightly acid in the upper part and is slightly acid to mildly alkaline in the lower part. The seasonal high water table is at a depth of 1 to 2 feet during extended wet periods.

Most of the acreage of this soil is cropland and is used for cash-grain farming. Specialty crops are occasionally grown in areas that have been intensively drained. This soil is moderately well suited to corn, soybeans, and small grain.

If this soil is used as cropland, artificial drainage is needed. Subsurface drains are generally used to lower the seasonal high water table. Surface drains are used in low spots to remove excess surface water. This soil becomes compacted and cloddy if worked when wet and sticky. Tilling at optimum moisture content is important to maintain good soil structure. The surface crusts after heavy rains. Leaving crop residue on the surface hinders seedling emergence. Conservation tillage and returning crop residue or other organic matter to the soil improve tilth and fertility and increase water infiltration. These practices also reduce crusting and improve the contact of seed with the soil.

This soil is moderately well suited to pasture or hay. It becomes soft and sticky when wet. Grazing when the soil is soft and sticky or overgrazing causes surface compaction, reduced growth, and decreased water infiltration. Pasture rotation, deferment of grazing, proper stocking rates, plant selection of adapted species for planting, and weed control help keep the pasture and soil in good condition.

Some areas are in native hardwoods. This soil is moderately well suited to trees. Seedling mortality and windthrow hazard are severe for woodland. Species need to be tolerant of high clay content in the subsoil and some seasonal wetness. Using seedlings that have been transplanted once or mulching reduces seedling mortality. Plant competition can be reduced by spraying, mowing, disking, or girdling. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings and is poorly suited to septic tank absorption fields. Because of seasonal wetness, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank abosrption fields need to be landscaped to drain water away from the foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. Using these drains and backfilling along basement walls with a coarser textured material reduce damage from shrinking and swelling of this soil. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are added protection against damage from shrinking and swelling. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields increases the absorption of effluent. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce damage from seasonal wetness, shrinking and swelling, and low soil strength. This soil is a good site for pond reservoirs.

The land capability classification is IIIw; the woodland ordination symbol is 3c.

OsB—Oshtemo sandy loam, 2 to 6 percent slopes. This deep, gently sloping soil is well drained. It is on beach ridges, stream terraces, and outwash plains. Most areas are long and narrow. They range from 5 to 50 acres.

Typically, the surface layer is dark brown, very friable sandy loam about 9 inches thick. The subsoil is about 46 inches thick. The upper part is brown, friable sandy loam and gravelly sandy loam. The lower part is brown and dark brown, friable gravelly sandy loam and gravelly sandy clay loam. The substratum to a depth of about 60 inches is pale brown, loose gravelly loamy sand. In some areas the subsoil has more clay. In a few areas the solum is thinner, and the substratum is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Bronson soils on slight rises and flats. In some small areas very droughty, sloping soils have sand throughout. Also included are small areas of a soil that has a surface layer of loamy sand. This soil is subject to severe soil blowing. The included soils make up about 20 percent of most areas.

Permeability in this Oshtemo soil is moderately rapid in the subsoil and very rapid in the substratum, available water capacity is moderate, and surface runoff is slow. Reaction in the subsoil ranges from medium acid to neutral. Organic matter content is moderately low.

Most of the acreage is cropland and is used for cash-grain farming. A few areas are in apple and peach orchards. Because of droughtiness, this soil is moderately well suited to small grain, corn, and soybeans. It is better suited to earlier maturing crops than to those that mature later in the summer. The soil dries early in spring so it is well suited to early tillage and planting. Droughtiness and soil blowing are the main management concerns. The soil is well suited to irrigation. Using conservation tillage that leaves crop residue on the soil surface and planting winter cover crops help prevent excessive soil loss. Returning crop residue or other organic material to the soil helps reduce soil blowing, delay surface drying, and increase the organic matter content. Plant nutrients are leached from this soil at a moderately rapid rate; consequently, this soil generally responds better to smaller, more frequent or timely applications of fertilizer than to one large application.

This soil is moderately well suited to hay and pasture. It is well suited to grazing early in spring. Shallow rooted plants grow poorly during extended periods of below normal rainfall.

This soil is moderately well suited to trees. Trees need to be tolerant of some droughtiness.

This soil is well suited as a site for buildings and is moderately well suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. Lawns dry up during periods of low rainfall in summer. New seedings need to be mulched and watered. Soil blowing is a hazard during construction. Maintaining a vegetative cover on the site as much as possible during construction helps reduce soil blowing. Sloughing is a hazard in excavations.

The land capability classification is IIIs; the woodland ordination symbol is 3o.

OtB—Ottokee loamy fine sand, 1 to 6 percent slopes. This deep, nearly level and gently sloping soil is moderately well drained. It is on long, narrow beach ridges and on low ridges. It is in areas of outwash materials on lake plains. Some areas are on sand dunes. Most areas range from 5 to 40 acres.

Typically, the surface layer is very dark grayish brown, very friable loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown, very friable fine sand about 21 inches thick. It is mottled below a depth of about 22 inches. The subsoil is about 26 inches thick. It is pale brown and gray, mottled, loose fine sand. It has very thin bands of very friable loamy fine sand. The substratum to a depth of about 60 inches is grayish brown, mottled, loose fine sand. In some areas the surface layer is fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Tedrow soils on flats and the very poorly drained Gilford and Wauseon soils in drainageways and depressions. Small areas of soils that have clay in the lower part are included. Also included are small areas of well drained Oshtemo soils on the steeper slopes. These included soils make up about 15 percent of most areas.

Permeability in this Ottokee soil is rapid, available water capacity is low, and surface runoff is slow. Reaction in the subsoil ranges from medium acid to neutral. Organic matter content is low. A seasonal high water table is at a depth of 2 to 3 1/2 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain. It is better suited for earlier maturing crops than to those that mature later in the summer because of droughtiness. This soil dries early in spring and is well suited to tillage early in spring. It is suited to irrigation, but water retention is low. If this soil is cultivated, erosion and soil blowing are hazards before crops are large or dense enough to protect the soil. Droughtiness, erosion, and soil blowing are major management concerns. Conservation tillage that leaves crop residue on the surface and planting winter cover crops help prevent excessive soil loss. Returning crop residue or other organic material to the soil helps reduce soil blowing, delay surface drying, and increase the organic matter content. Plant nutrients are leached from this soil at a rather rapid rate; consequently, this soil generally responds better to smaller, more frequent or timely applications of fertilizer.

This soil is moderately well suited to hay and pasture. Pasture can be grazed early in spring. Shallow rooted plants grow poorly when rainfall is below normal for extended periods.

This soil is moderately well suited to trees. Seedling mortality is a moderate limitation. Trees need to be tolerant of droughtiness to reduce seedling mortality. Using seedlings that have been transplanted once or mulching also reduces seedling mortality.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. Because of seasonal wetness, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. If drains around foundations are connected to a sump, the pump needs to be large enough to handle rather large volumes of water. Local roads and streets can be improved by artificially draining to reduce damage from wetness. Soil blowing is a hazard during construction. Maintaining a vegetative cover on the site during construction reduces soil blowing. Sloughing is a hazard in excavations. Lawns dry up during periods of low rainfall in summer. New seedlings need to be mulched and watered.

The land capability classification is IIIs; the woodland ordination symbol is 3s.

Pa—Paulding clay. This deep, level and nearly level soil is very poorly drained. The soil is on lake plains. It is generally on broad flats and is occasionally in long, narrow areas along drainageways. Slope is 0 to 2 percent. The soil is subject to ponding. Most areas range from 10 acres to several hundred acres.

Typically, the surface layer is dark gray, very firm clay about 7 inches thick. The subsoil is about 26 inches thick. It is dark grayish brown, very firm clay that is mottled in the upper part. The substratum to a depth of about 60 inches is dark grayish brown, mottled, firm clay. In some areas the subsoil and substratum are more silty, and in others the surface layer is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Roselms, Haskins, and Rimer soils on slight rises. These included soils make up about 15 percent of most areas.

Permeability in this Paulding soil is very slow, and available water capacity is low or moderate. Surface runoff is very slow, or the soil is ponded. Organic matter content is moderate. Reaction in the subsoil is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. The seasonal high water table is near or above the surface during extended wet periods.

Much of the acreage of this soil is cropped to soybeans and small grain. This soil is moderately well suited to these crops. Some areas are used for corn, but corn is not commonly grown on this soil. Corn production is increasing, however, as yields increase because such measures as narrow row planting and ridge tillage are used.

If this soil is used as cropland, artificial drainage is needed (fig. 12). Surface drains remove excess surface water. Subsurface drains remove free water from the subsoil very slowly, so they have been used sparingly in the past. Ponding is reduced by leveling land over low spots. This soil becomes compacted and cloddy if worked when wet and sticky. Restricting tillage within a limited range of moisture content is important. Minimizing tillage and planting cover crops are good management practices. Incorporating crop residue or other organic matter into the surface layer increases water infiltration and improves tilth and fertility. These practices also reduce crusting and improve the contact of seed with the soil. Stands of wheat and oats are damaged by ponding where the soil is inadequately drained. In fall-plowed areas, soil blowing is a hazard in winter. It occurs when the soil is frozen and the surface dries from the wind.

This soil is moderately well suited to pasture or hay. It is poorly suited to grazing early in the spring. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction, decreased infiltration, poor tilth, and reduced growth. Artificial drainage, proper stocking rates, selection of adapted species for planting, deferment of grazing, pasture rotation, and weed control help keep the pasture and soil in good condition.

A few areas are in native hardwoods. This soil is moderately well suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. The use of planting and harvesting equipment is severely limited by wetness. These operations can be performed during the drier parts of the year. Plant competition can be reduced by cutting, spraying, girdling, or mowing. Species need to be tolerant of prolonged wetness and very high clay content in the soil. Using seedlings that have been transplanted once also reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is poorly suited as a site for buildings and generally is not suited to septic tank absorption fields. Because of ponding and high shrink-swell potential, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, protect against damage from shrinking and swelling of the soil.

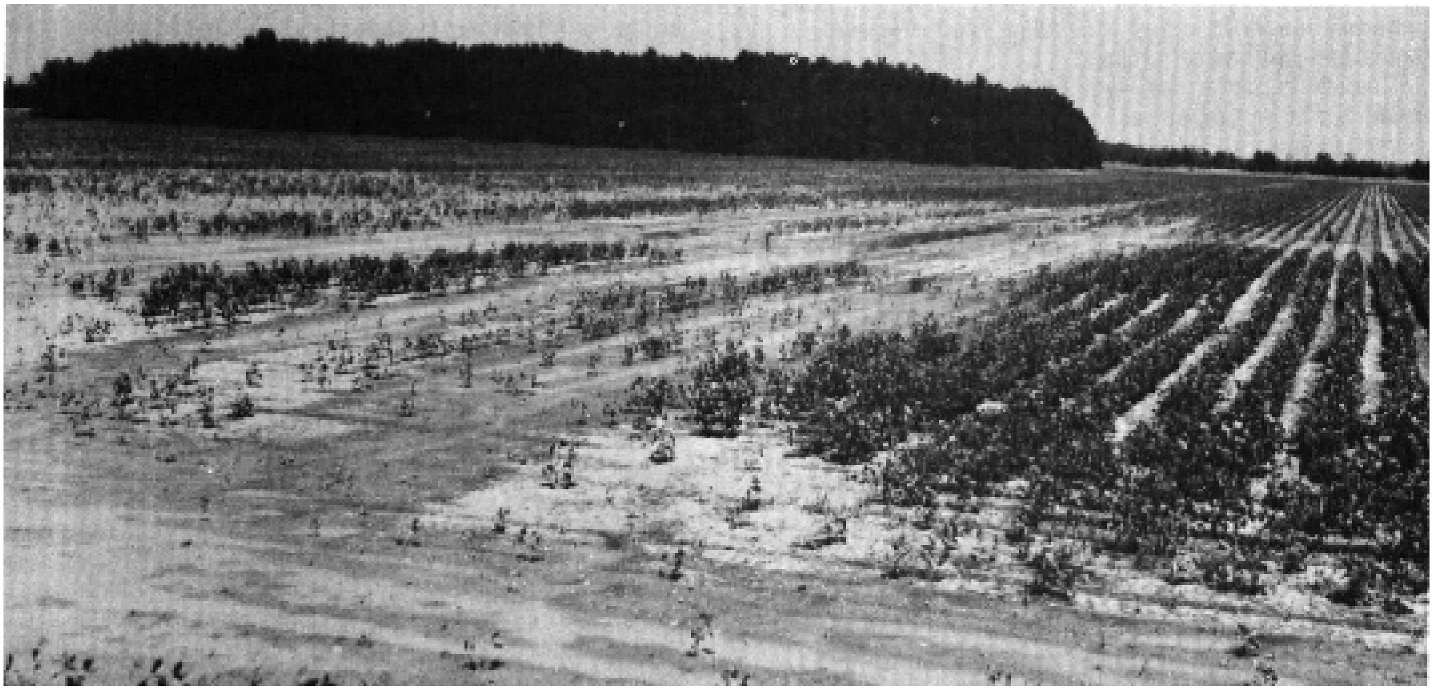

Figure 12.—This very poor stand of soybeans on Paulding clay was cuased by ponding.

Backfilling along foundations with a coarser textured material and using drains at the base of footings also reduce damage from shrinking and swelling of the soil and help prevent wet basements. Coating the exterior of basement walls also helps prevent wet basements. Local roads and streets can be improved by using suitable base material and by artificially draining to reduce the damage from ponding, shrinking and swelling, and low soil strength (fig. 13). Constructing roads on well compacted fill material raises them above high, ponded water levels. This soil is a good site for pond reservoirs.

The land capability classification is IIIw; the woodland ordination symbol is 3w.

Pm—Pewamo silty clay loam. This deep, level and nearly level soil is very poorly drained. The soil is in oval and irregularly shaped depressions or in long, narrow areas along drainageways. Slope is 0 to 2 percent. The soil is subject to ponding. Most areas range from 2 to 50 acres.

Typically, the surface layer is very dark grayish brown, firm silty clay loam about 11 inches thick. The subsoil is about 44 inches thick. It is gray, mottled, firm clay loam. The substratum to a depth of about 60 inches is grayish brown, mottled, very firm clay loam. In some areas the surface layer and upper part of the subsoil are more sandy, and in others the surface layer is loam.

Included with this soil in mapping are small areas of somewhat poorly drained Blount and Haskins soils on low rises. Also included are very small areas of the Wallkill Variant soils in the lower part of depressions. In the Wallkill Variant soils, muck is at a depth of 16 to 40 inches. These included soils make up about 15 percent of most areas.

Permeability in this Pewamo soil is moderately slow, and available water capacity is high. Surface runoff is very slow, or the soil is ponded. Reaction is slightly acid or neutral in the upper part of the subsoil and neutral or mildly alkaline in the lower part. Organic matter content is high. The seasonal high water table is near or above the surface during extended wet periods.

Much of the acreage of this soil is cropland and is used for cash-grain farming. A few areas of intensively drained soils are used for specialty crops. This soil is well suited to corn, soybeans, and small grain.

If this soil is used as cropland, artificial drainage is needed. Surface and subsurface drains are commonly used to remove excess water. This soil becomes compacted and cloddy if worked when wet and sticky. Restricting tillage within a limited range of moisture content is important. Conservation tillage that leaves crop residue on the surface, returning crop residue or other organic matter into the soil, and using cover crops help maintain tilth, increase water infiltration, and improve fertility. These practices also reduce crusting and improve the contact of seed with the soil. In ponded areas, stands of wheat and oats are drowned in most years. Grassed waterways are needed in areas that receive runoff from higher, adjacent soils.

Some areas are in pasture. This soil is well suited to pasture and hay. It is poorly suited to grazing early in spring. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky and overgrazing cause surface compaction, reduced growth of plants, poor tilth, and decreased water infiltration. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, and weed control help keep the pasture and soil in good condition.

Some areas are in native hardwoods. This soil is well suited to trees adapted to wetness. Equipment limitations are severe for woodland. Seedling mortality and windthrow hazard are moderate. Wetness is the main limitation to growing and harvesting trees. Logging can be done during drier parts of the year. Seedlings grow well if competing vegetation is controlled or removed by spraying, disking, girdling, or mowing. Using seedlings that have been transplanted once reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is used as a site for buildings, but it is poorly suited to this purpose. It is generally not suited to septic tank absorption fields. Areas of this soil often serve as drainageways that receive runoff from higher, adjacent soils. Diversions, terraces, surface drains, or subsurface

Figure 13.—Damage to a local road on Paulding clay is caused by ponding and by the low strength and shrinking and swelling of the soil.

drains that have surface inlets are used to remove the water. Because of seasonal wetness and ponding, this soil is better suited to houses without basements than houses with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Using drains at the base of foundations and coating the exterior of basement walls help prevent wet basements. Backfilling along foundations with a coarser textured material reduces damage from shrinking and swelling of the soil. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are added protection against shrink-swell damage. Local roads and streets can be improved by using a suitable base material and by artificially draining to reduce the damage from frost action, ponding, and low soil strength. Constructing roads on well compacted fill material raises the roads above high water levels. This soil is a good site for pond reservoirs.

The land capability classification is IIw; the woodland ordination symbol is 2w.

Pt—Pits, gravel. Gravel pits are surface mined areas from which gravel and sand have been removed. Gravel pits in outwash terraces are near Boyer, Oshtemo, Bronson, Digby, and Millgrove soils. Those in beach ridges are near Belmore, Oshtemo, and Digby soils. Most pits range from 2 to 10 acres, but some pits are twice or three times this size. Actively mined pits are continually being enlarged. Most pits have high walls on one or more sides. Pits vary in depth. Most pits in beach ridges are between 4 and 8 feet deep. Those in outwash terraces are 20 to 30 feet or more. Many of the larger pits contain water, and some of these are used for fishing and other recreational purposes.

Layers of gravel and sand of varying thickness and orientation are mined. The kind and grain size of aggregates are generally fairly uniform within any one layer but commonly differ from layer to layer. Some layers have a considerable content of fines of silt and clay. Selectivity in removing material is feasible on the outwash terraces but is more difficult on the beach ridges.

The stripped soil material in the spoil banks varies in thickness and composition within short distances. It is gravelly and sandy, has poor physical properties, commonly is droughty, and is poorly suited to the growth of plants. Spoil banks are subject to erosion and are a potential source of siltation of nearby streams. Establishing a plant cover on abandoned gravel pits reduces the hazards of erosion and siltation. Only grasses and trees that tolerate droughtiness and somewhat unfavorable soil properties should be selected for seeding and plantings. In places, wetness is the main limitation to establishing plant cover. Some areas are subject to ponding and are difficult to revegetate. Some locations have all the gravel and sand removed to underlying calcareous clay. These areas are generally wet and difficult to vegetate.

Some gravel pits that are no longer in use support weeds, sedges, and trees. These areas could be improved as habitat for openland and woodland wildlife. Some pits contain shallow water and could be developed as habitat for wetland wildlife. Some pits have been used for disposal of trash. Disposal of wastes in these pits can result in pollution of underground water supplies. Some pits have been smoothed and returned to crop production.

Not assigned to a capability classification or woodland ordination symbol.

RmB—Rawson sandy loam, 2 to 6 percent slopes. This deep, gently sloping soil is moderately well drained and well drained. The soil is on low ridges of stream terraces and on beach ridges and outwash plains. Some areas are on end moraines. Most areas are long and narrow or oval. They range from 2 to 20 acres.

Typically, the surface layer is dark grayish brown, very friable sandy loam about 9 inches thick. The subsoil is about 31 inches thick. The upper and middle parts are dark brown, friable sandy clay loam that has mottles in the upper 6 inches. The lower part is grayish brown, mottled, very firm clay. The substratum to a depth of about 60 inches is grayish brown and dark brown, mottled, very firm clay loam. In some areas the surface layer is loam. In others sand and gravel are in the substratum. Included with this soil in mapping are small areas of the somewhat poorly drained Haskins soils which are nearly level and on the lower part of slopes. Also included are soils which are on the side slopes of ridges and which have slopes of 6 to 12 percent. These included soils make up about 10 percent of most areas.

Permeability in this Rawson soil is moderate in the upper and middle parts of the subsoil and very slow or slow in the lower part and in the substratum. Available water capacity is moderate, and runoff is medium. Reaction is medium acid or slightly acid in the upper part of the subsoil and neutral or mildly alkaline in the lower part. Organic matter content is moderately low. A seasonal high water table is at a depth of 2 1/2 to 4 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, some specialty crops, and orchards.

The surface layer dries early in spring and is well suited to tillage and grazing early in spring. This soil is suited to irrigation. Water erosion and soil blowing are the main hazards to cropping. Practices such as conservation tillage that leaves crop residue on the surface and cover crops reduce erosion, conserve moisture, and maintain the organic matter content and tilth. Randomly spaced subsurface drains are used in the wetter included soils and in seep spots to control wetness.

This soil is well suited to hay and pasture. Shallow rooted plants grow little during extended periods of below normal rainfall. Forage crops on this soil can be grazed most of the time.

A few areas are in woodland. This soil is well suited to trees. Plant competition can be reduced by spraying, mowing, disking, or girdling.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and moderate shrink-swell potential in the lower part of the subsoil and in the substratum, it is better suited to buildings without basements than to buildings with basements. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are added protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Installing the distribution lines of septic tank absorption fields in elevated mounds of moderately permeable or moderately rapidly permeable soil material increases the capacity of the soil to absorb effluent. Local roads and streets can be improved by using a suitable base material and by artificially draining to reduce damage from frost action and seasonal wetness.

The land capability classification is IIe; the woodland ordination symbol is 2o.

RnA—Rimer loamy fine sand, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is on slight rises and low ridges of stream terraces and in areas of outwash materials on lake plains. Some areas are on moraines. Most areas are oval or oblong. They range from 3 to 40 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 11 inches thick. The subsurface layer is yellowish brown and grayish brown, mottled, loose loamy fine sand about 18 inches thick. The subsoil is about 17 inches thick. It is yellowish brown, mottled, friable fine sandy loam in the upper part and gray, mottled, very firm clay loam in the lower part. The substratum to a depth of about 60 inches is grayish brown, mottled, very firm silty clay loam. In some areas the surface layer is fine sand.

Included with this soil in mapping are small areas of the Haskins soils that have more clay in the upper part of the soil. Also included are areas of the moderately well drained Seward soils in slightly higher positions and the very poorly drained Wauseon soils in low spots and along drainageways. These included soils make up about 15 percent of most areas.

Permeability in this Rimer soil is rapid in the upper part of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum. Available water capacity is low or moderate, and surface runoff is slow. Reaction in the subsoil is medium acid to neutral in the upper part and neutral or mildly alkaline in the lower part. Organic matter content is moderately low. A seasonal high water table is at a depth of 1 to 2 1/2 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. Specialty crops are grown in a few areas where the soil has been intensively drained. This soil is well suited to corn, soybeans, and small grain.

If this soil is used for crop production, artificial drainage is needed. A subsurface drainage system is commonly used to lower the seasonal high water table. Subsurface drains are more effective if placed above the slowly permeable or very slowly permeable glacial till or lacustrine material that is in the lower part of the soil. These drains can become filled with fine sand. A fiber envelope installed during manufacturing or a gravel or crushed stone filter around the drain lessens the possibility of subsurface drains filling with fine sand. Tillage and harvesting can be performed over a wide range of soil moisture content without compaction of the soil. Soil blowing is a hazard. Conservation tillage that leaves crop residue on the surface and planting winter cover crops help reduce soil loss. Returning crop residue or other organic material to the soil helps reduce soil blowing, delay surface drying, and increase the organic matter content.

This soil is well suited to hay and pasture. It is poorly suited to grazing early in spring. Deferment of grazing, pasture rotation, selection of adapted species for planting, and weed control help keep the pasture in good condition. Shallow rooted plants grow poorly during extended periods of below normal rainfall.

Some areas are in woodland. This soil is well suited to trees. Seedling mortality is a moderate limitation. Species that tolerate droughtiness need to be selected for new plantings. Seedlings of adapted species grow well if competing vegetation is controlled or removed by disking, spraying, girdling, or mowing. Using seedlings that have been transplanted once or mulching reduces seedling mortality.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential in the lower part of the subsoil and in the substratum, the soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are added protection against damage from shrinking and swelling. Backfilling along foundations with a coarser textured material, using drains at the base of footings, and coating the exterior of basement walls reduce damage from shrinking and swelling of the soil and help prevent wet basements.

Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Some type of filtering material around subsurface drains is needed to reduce the movement of fine sand into the drains. Septic tank absorption can also be improved by installing the distribution lines in mounds of suitable fill material. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce the damage from frost action.

The land capability classification is IIw; the woodland ordination symbol is 2s.

RrA—Roselms loam, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. The soil is on lake plains. It is on slight rises and along drainageways. Most areas are oval, irregularly shaped, or long and narrow. They range from 3 to 40 acres.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is about 23 inches thick. It is grayish brown, brown, and gray, mottled clay that is firm and very firm. The substratum to a depth of about 60 inches is gray, yellowish brown and light olive brown, mottled clay that is very firm. In some areas the subsoil and substratum are more silty, and in others the surface layer or surface layer and subsoil are more sandy.

Included with this soil in mapping are narrow strips of the very poorly drained Paulding soils along drainageways and in small depressions. Also included are small areas of the moderately well drained Broughton soils on slopes along drainageways. These included soils make up about 5 percent of most areas.

Permeability in this Roselms soil is very slow, available water capacity is low, and runoff is slow. Organic matter content is moderate. Reaction in the subsoil ranges from strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the middle and lower parts. The seasonal high water table is at a depth of 1 to 2 1/2 feet during extended wet periods.

Much of the acreage is planted to soybeans and small grain. This soil is moderately well suited to these crops. Some areas are used for corn, but this crop has not been commonly grown on this soil. Corn production is increasing as yields increase because such measures as narrow row planting and ridge tillage are used.

If this soil is used as cropland, artificial drainage is needed. Surface drains are commonly used to remove excess surface water. Land is leveled to fill in low spots. Subsurface drains remove water very slowly from the subsoil, so they have been used very sparingly. Stands of wheat and oats are poor where the soil is inadequately drained, especially in years with excessive wetness. Even though tilth is good, tillage and harvesting are best performed at optimum moisture content with equipment that minimizes soil compaction.

Some areas are in pasture. This soil is moderately well suited to pasture and hay. It is poorly suited to grazing early in the spring. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky and overgrazing cause surface compaction, decreased water infiltration, poorer tilth, and reduced growth of forage plants. Proper stocking rates, selection of adapted species for planting, deferment of grazing, pasture rotation, artificial drainage, and weed control help keep the pasture and soil in good condition.

Some areas are in woodland. This soil is moderately well suited to trees. Equipment limitation is moderate for woodland. Seedling mortality and windthrow hazard are severe. Logging can be done during the drier parts of the year. Species need to be tolerant of a clayey subsoil and substratum and some seasonal wetness. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are added protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Using subsurface drains around septic tank absorption fields helps lower the seasonal high water table. Increasing the size of septic tank absorption fields increases the absorption of effluent. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce damage from the high shrink-swell potential and improve soil strength.

The land capability classification is IIIw; the woodland ordination symbol is 4c.

RsA—Roselms silty clay, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. The soil is on lake plains. It is on slight rises and slopes along drainageways. Most areas are long and narrow, moderately wide, oval, or irregularly shaped. They range from 3 to 50 acres.

Typically, the surface layer is dark grayish brown, firm silty clay about 9 inches thick. The subsoil is about 23 inches thick. It is yellowish brown, brown, and gray, mottled clay that is firm and very firm. The substratum to a depth of about 60 inches is gray, yellowish brown, and light olive brown, mottled clay that is very firm and calcareous. In some areas the surface layer or surface layer and subsoil are more sandy. In other areas the subsoil and substratum are more silty.

Included with this soil in mapping are narrow strips of the very poorly drained Paulding soils along drainageways and in small depressions. Also included are small areas of the moderately well drained Broughton soils on slopes along drainageways. These included soils make up about 5 percent of most areas.

Permeability in this Roselms soil is very slow, available water capacity is low, and surface runoff is slow. Organic matter content is moderate. Reaction in the subsoil ranges from strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the middle and lower parts. The seasonal high water table is at a depth of 1 to 2 1/2 feet during extended wet periods.

Much of the acreage is in soybeans and small grain and is used for cash-grain farming. This soil is moderately well suited to these crops. Some areas are used for corn, but this crop is not commonly grown on this soil. Corn production is increasing as yields increase when such measures as narrow row planting and ridge tillage are used.

If this soil is used as cropland, artificial drainage is needed. Surface drains are commonly used to remove excess surface water. Land is leveled to fill in low spots. Subsurface drains remove water very slowly from the subsoil, so they have been used very sparingly. Stands of small grain are poor where the soil is inadequately drained, especially in years with excessive wetness. This soil becomes compacted and cloddy if worked when wet and sticky. Restricting tillage within a limited range of moisture content is important. Minimizing tillage and planting cover crops are good management practices. Returning crop residue or other organic matter to the soil increases water infiltration and improves tilth and fertility. These practices also reduce crusting and improve the contact of seed with the soil.

Some areas are used for pasture. This soil is moderately well suited to pasture and hay. It is poorly suited to grazing early in the spring. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing results in compaction, poor tilth, decreased infiltration, and reduced growth of forage plants. Deferment of grazing, pasture rotation, selection of adapted species for planting, proper stocking rates, artificial drainage, and weed control help keep the pasture and soil in good condition.

Some areas are in woodland. This soil is moderately well suited to trees. Equipment limitations are moderate for woodland. Seedling mortality and windthrow hazard are severe. The operation of equipment is limited because the surface layer is sticky and slippery when wet. Logging can be done during the drier parts of the year. Species need to be tolerant of clayey soil and some seasonal wetness. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are added protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Using subsurface drains around septic tank absorption fields helps lower the seasonal high water table. Increasing the size of septic tank absorption fields increases the absorption of effluent. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce damage from the high shrink-swell potential and to improve soil strength.

The land capability classification is IIIw; the woodland ordination symbol is 4c.

Ru—Ross silt loam, occasionally flooded. This deep, level and nearly level soil is well drained. The soil is on narrow to broad flood plains. It commonly is on the highest part of the flood plain. Slope is 0 to 2 percent. Most areas range from 2 to 40 acres.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 29 inches thick. It is very dark grayish brown, dark brown, and brown silt loam that is friable. The substratum to a depth of about 60 inches is dark yellowish brown, friable loam. In some areas the surface layer is loam, and in others the soil is slightly wetter and has mottles in the lower part.

Included with this soil in mapping are small areas of somewhat poorly drained Shoals soils in slightly lower positions than Ross soils. These included soils make up about 15 percent of most areas.

Permeability in this Ross soil is moderate, available water capacity is high, and surface runoff is slow. Organic matter content is high. Reaction in the subsoil is slightly acid to mildly alkaline. A seasonal high water table is at a depth of 4 to 6 feet during extended wet periods.

Most of the acreage is cropland and is used for cash-grain farming. This soil is well suited to corn and soybeans. Winter small grain is not generally grown because of flood damage. Some areas are well suited to specialty crops.

This soil is suited to growing row crops continuously. Row crops can be planted and harvested during the nonflooding periods in most years. Dikes can be used to help prevent flooding. The surface layer crusts after hard rains. Conservation tillage that leaves crop residue on the surface, incorporating crop residue into the soil, and planting cover crops help maintain tilth, reduce crusting, and protect the surface in areas where the soil is subject to scouring during floods.

This soil is well suited to pasture. Flooding damages hay in some years. Pastures can be grazed during most of the growing season. This soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky and overgrazing cause compaction. Pasture rotation and deferment of grazing during wet periods help keep the pasture and the soil in good condition.

Some areas are in woodland. This soil is well suited to trees and shrubs. Spraying, mowing, or disking reduces plant competition.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of the flooding hazard. Constructing roads on raised, well compacted fill provides protection from flooding. Fills for roads should not block the flow of floodwaters. This soil is well suited to paths and trails and picnic areas. It is a good source of topsoil.

The land capability classification is IIw; the woodland ordination symbol is 1o.

SaB—St. Clair loam, 2 to 6 percent slopes. This deep, gently sloping soil is moderately well drained. The soil is on lake plains. It is adjacent to slope breaks along drainageways. Most areas are long and narrow. They range from 2 to 10 acres.

Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The subsoil is about 14 inches thick. It is brown and dark brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, mottled, firm clay. In some areas the surface layer is silty clay loam. In many areas the soil has less sand and coarse fragments throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained, less sloping Nappanee soils along drainageways. Also included are small areas of Rawson and Seward soils that have more sand and less clay in the upper part of the subsoil. These included soils make up about 10 percent of most areas.

Permeability in this St. Clair soil is slow or very slow, available water capacity is moderate, and runoff is medium. Reaction is medium acid or slightly acid in the upper part of the subsoil and slightly acid to mildly alkaline in the lower part. Organic matter content is moderate. A seasonal high water table is at a depth of 2 to 3 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain.

Erosion is the main hazard where this soil has been cultivated. Conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help reduce erosion. Including grasses and legumes in the cropping system also helps control erosion. Tilth is good, but crusting is a minor problem. Incorporating crop residue or other organic matter into the surface layer maintains tilth and fertility and increases water infiltration. These practices also improve the contact of seed with the soil. If this soil is tilled when soft and sticky from wetness, it becomes compacted.

Some areas are used for pasture. This soil is well suited to grasses and legumes for hay and pasture. The soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky and overgrazing cause some surface compaction, reduced plant growth, and increased runoff. Proper stocking rates, selection of adapted species for planting, pasture rotation, deferment of grazing, and weed control help keep the pasture and soil in good condition.

Some areas are in woodland. This soil is moderately well suited to trees. Seedling mortality and windthrow hazard are severe for woodland. Species need to be tolerant of a high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Poured concrete walls, steel reinforced and stiffened with pilasters, are added protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of septic tank absorption fields increases the absorption of effluent. Local streets and roads can be improved by using suitable fill material and by artificially draining to reduce the damage from shrinking and swelling and to improve soil strength.

The land capability classification is IIIe; the woodland ordination symbol is 3c.

SbC2—St. Clair silty clay loam, 6 to 12 percent slopes, eroded. This deep, sloping soil is moderately well drained. Erosion has removed part of the original surface layer. Subsoil material that has a higher clay content has been mixed into the present surface layer. The soil is on lake plains. It is in long, narrow areas on slope breaks along drainageways. Most areas range from 3 to 12 acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 8 inches thick. The subsoil is about 19 inches thick. It is yellowish brown and dark yellowish brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, very firm, calcareous clay. In some areas slopes are 2 to 6 percent. In some areas the soil is severely eroded and is moderately alkaline in the subsoil. In many areas it has less sand and coarse fragments throughout.

Included with this soil in mapping are long, narrow areas of Broughton soils that have less sand and coarse fragments throughout the soil. Generally, they are on the upper one-third of the slope. Also included are small areas of soils that have slopes of 12 to 18 percent. These included soils make up about 20 percent of most areas.

Permeability in this St. Clair soil is slow or very slow, available water capacity is moderate, and runoff is rapid. Reaction is medium acid or slightly acid in the upper part of the subsoil and slightly acid to mildly alkaline in the lower part. Organic matter content is moderately low. A seasonal high water table is at a depth of 2 to 3 feet during extended wet periods.

Some of the areas are cropland and are used for cash-grain farming. This soil is moderately well suited to small grain and row crops if the cropping system includes grasses and legumes.

The hazard of erosion is severe if this soil is cultivated. Including grasses and legumes in the cropping system helps control erosion. Because this soil has been eroded, it can only be worked in a narrow range of moisture content. Tilling within the optimum range of moisture content reduces compaction and clodding of the soil. Some of the smaller areas of this soil are managed with adjacent soils. The surface layer crusts after hard rains, which hinders seedling emergence. Conservation tillage that leaves crop residue on the surface, cover crops, returning crop residue to the soil, and grassed waterways help reduce erosion and crusting. Terraces, diversions, and stripcropping are difficult to use in most areas because of the short slopes.

Many areas are in hay and pasture. This soil is well suited to hay and pasture. The hazard of erosion is severe if the soil is plowed or if the pasture is overgrazed. During seeding, the use of cover crops or companion crops and the trash-mulch or no-till seeding method help control erosion. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition.

Some areas are in native hardwoods. This soil is moderately well suited to trees. Seedling mortality and windthrow hazard are severe for woodland. Species need to be tolerant of high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential, it is better suited to buildings without basements than to buildings with basements. Buildings need to be designed to conform to the natural slope of the land. Poured concrete walls, steel reinforced and stiffened with pilasters, are added protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Installing distribution lines of septic tank absorption fields on the contour reduces seepage of effluent to the soil surface. Local streets and roads can be improved by using suitable fill material and by artificially draining to reduce the damage from shrinking and swelling and to improve soil strength. The runoff and erosion that increase during construction can be reduced by maintaining plant cover where possible.

The land capability classification is IVe; the woodland ordination symbol is 3c.

SbE—St. Clair silty clay loam, 18 to 35 percent slopes. This deep, steep and very steep soil is well drained and moderately well drained. The soil is on lake plains. It is on short slope breaks along drainageways and along valley walls. Most areas are long and narrow. They range from 3 to 55 acres.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 2 inches thick. The subsurface layer is brown, firm silty clay loam about 5 inches thick. The subsoil is about 33 inches thick. It is brown, firm and very firm clay. It is mottled below a depth of about 25 inches. The substratum to a depth of about 60 inches is brown, mottled, very firm clay loam. In some areas the soil is eroded, and the surface layer is silty clay.

Included with this soil in mapping are long, narrow areas of Broughton soils. These soils are generally on the upper one-third of the slope. Broughton soils have less sand and coarse fragments throughout. Also included are small areas of soils that have slopes of 12 to 18 percent. These included soils make up about 20 percent of most areas.

Permeability in this St. Clair soil is slow or very slow, available water capacity is moderate, and runoff is very rapid. Reaction is medium acid or slightly acid in the upper part of the subsoil and slightly acid to mildly alkaline in the lower part. Organic matter content is moderately low. A seasonal high water table is at a depth of 2 to 3 feet during extended wet periods.

Some areas are in pasture. A few areas are occasionally used for hay. This soil is generally not suited to cropland. It is poorly suited to grasses and legumes for permanent pasture and hay. Unless adequate cover is maintained, erosion is a severe hazard. The trash-mulch method of reseeding helps control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition. Because water is lost as runoff, pasture plants grow less during dry periods in summer.

Most of the acreage is in native hardwoods. This soil is moderately well suited to trees. Erosion hazard and equipment limitation are moderate for woodland. Seedling mortality and windthrow hazard are severe. Locating logging roads and skid trails on or near the contour and using erosion control practices, such as water bars, reduce erosion. Slope limits the use of harvesting equipment. Good site preparation and spraying, cutting, or girdling reduce plant competition. Species need to be tolerant of high clay content in the subsoil. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of slope, high shrink-swell potential, seasonal wetness, and slow or very slow permeability. Local roads can be improved by using suitable fill material and by artificially draining to improve soil strength. The runoff and erosion that increase during construction can be reduced by maintaining soil cover where possible.

The land capability classification is VIIe; the woodland ordination symbol is 3c.

ScD3—St. Clair clay, 12 to 18 percent slopes, severely eroded. This deep, moderately steep soil is well drained and moderately well drained. Most of the original surface layer has been removed by erosion. Subsoil material with a higher clay content has been mixed into the present surface layer. The soil is on short slope breaks along valley sides. Areas of this soil are along streams that flow through lake plains. Most areas are long and narrow. They range from 3 to 30 acres.

Typically, the surface layer is dark grayish brown, firm clay about 5 inches thick. The subsoil is about 33 inches thick. The upper part is brown and dark yellowish brown, firm silty clay. The lower part is dark yellowish brown, mottled, firm silty clay. The substratum to a depth of about 60 inches is brown, mottled, firm silty clay. In some areas where the soil is less eroded, the surface layer is silty clay loam. In many areas this soil has less sand and coarse fragments throughout.

Included with this soil in mapping are a few small areas of Broughton soils that have higher clay content in the subsoil and substratum. These included soils make up about 10 percent of most mapped areas.

Permeability in this St. Clair soil is slow or very slow, available water capacity is moderate or low, and surface runoff is very rapid. Organic matter content is low. Reaction is medium acid or slightly acid in the upper part of the subsoil and slightly acid to mildly alkaline in the lower part. A seasonal high water table is at a depth of 2 to 3 feet during extended wet periods.

Most of the acreage is in pasture. Some areas are used for farming. This soil is generally not suited to corn, soybeans, and small grain. It is poorly suited to grasses and legumes for hay and pasture.

The hazard of erosion is very severe if this soil is plowed or if pastures are overgrazed. During seeding, the use of cover crops or companion crops and trash-mulch or no-till seeding methods help control erosion. The soil is droughty during extended dry periods because water is lost by runoff. The soil becomes compacted and cloddy if worked when wet and sticky. Tillage within a limited range of moisture content is important. The soil crusts after hard rains. Restricted grazing during wet periods, pasture rotation, and proper stocking rates help keep the pasture and soil in good condition.

Some areas are in woodland. Erosion hazard and equipment limitation are moderate for woodland. Seedling mortality and windthrow hazard are severe. Locating logging roads and skid trails on or near the contour and using erosion control practices, such as water bars, reduce erosion. This soil is moderately well suited to trees that are tolerant of high clay content in the root zone. Controlling erosion and controlling or removing competing vegetation reduce seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is poorly suited as a site for buildings and generally is not suited to septic tank absorption fields because of slope, high shrink-swell potential, seasonal wetness, and slow or very slow permeability. Buildings need to be designed to conform to the natural slope of the land. Poured concrete walls, steel reinforced and stiffened with pilasters, reduce damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Local roads and streets can be improved by using suitable fill material and by artificially draining to reduce damage from the shrinking and swelling and to improve

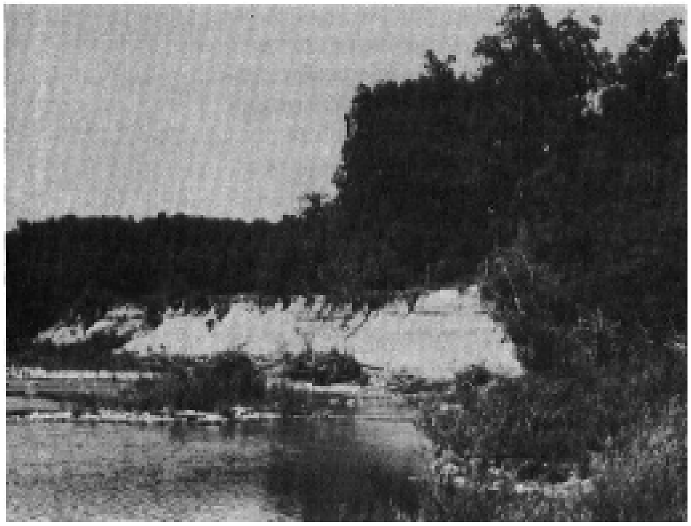

Figure 14.—Severe erosion of St. Clair soils, which are on very steep breaks to uplands. Vegetative cover is needed to reduce erosion.

soil strength. The runoff and erosion that increase during construction can be reduced by maintaining plant cover where possible.

The land capability classification is VIIe; the woodland ordination symbol is 3c.

ScE3—St. Clair clay, 18 to 35 percent slopes, severely eroded. This deep, steep and very steep soil is well drained and moderately well drained. The soil is on lake plains. It is on short slope breaks along drainageways and valley walls. Most of the original surface layer has been removed by erosion (fig. 14). Subsoil material with higher clay content has been mixed into the present surface layer. Streambank erosion is severe in some areas. Most areas are long and narrow. They range from 2 to 48 acres.

Typically, the surface layer is dark grayish brown, firm clay about 3 inches thick. The subsoil is about 19 inches thick. It is brown, firm clay that is mottled in the upper part. The substratum to a depth of about 60 inches is brown, mottled, very firm clay. In some areas the soil is so severely eroded that the calcareous substratum is at the surface. In a few areas the soil has less sand and coarse fragments throughout.

Included with this soil in mapping are long, narrow areas of Broughton soils. These soils are generally on the upper one-third of the slope. They have less sand and coarse fragments throughout. Also included are small areas of soils that have slope of 12 to 18 percent. These included soils make up about 15 percent of most areas.

Permeability in this St. Clair soil is slow or very slow, available water capacity is moderate or low, and runoff is very rapid. The soil is droughty during extended dry periods because water is lost as runoff. Reaction is medium acid or slightly acid in the upper part of the subsoil and slightly acid to mildly alkaline in the lower part. Organic matter content is low. A seasonal high water table is at a depth of 2 to 3 feet during extended wet periods.

Much of the acreage of this soil is in pasture. This soil is generally not suited to cropland and is poorly suited to grasses and legumes for permanent pasture. Erosion is a severe hazard in areas where the soil is not protected by vegetative cover or mulch. The trash-mulch method reduces erosion during seeding. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help keep the pasture and soil in good condition. Pasture plants grow less during dry periods in summer.

Some areas are woodland that has been grazed. A few areas are reverting to woodland. Erosion and equipment limitations are moderate for woodland. Seedling mortality and windthrow hazard are severe. Locating logging roads and skid trails on or near the contour and using erosion control practices, such as water bars, reduce erosion. Slope limits the use of planting and logging equipment. This soil is moderately well suited to trees that are tolerant of high clay content in the root zone. Using seedlings that have been transplanted once or mulching reduces seedling mortality. Good site preparation also reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of slope, high shrink-swell potential, seasonal wetness, and slow or very slow permeability. Local roads can be improved by using suitable fill material and by artificially draining to improve soil strength. The runoff and erosion that increase during construction can be reduced by maintaining soil cover where possible. Establishing and maintaining vegetative cover on this eroded soil are difficult, especially in areas disturbed during construction.

The land capability classification is VIIe; the woodland ordination symbol is 3c.

SdB—Seward loamy fine sand, 1 to 6 percent slopes. This deep, nearly level and gently sloping soil is moderately well drained. This soil is on low knolls and ridges of stream terraces. It is also in areas of outwash material and on beach ridges of lake plains. Some areas of this soil are on moraines. Most areas are oval or long and narrow. They range from 3 to 15 acres.

Typically, the surface layer is very dark grayish brown, very friable loamy fine sand about 8 inches thick. The subsurface layer is yellowish brown and brown, loose and very friable loamy fine sand about 15 inches thick. It is mottled in the lower part. The subsoil is about 23 inches thick. The upper part is brown, mottled, very friable loamy fine sand. The middle part is brown, mottled, friable fine sandy loam. The lower part is gray, mottled, very firm silty clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, very firm clay. In some areas the surface layer and the subsoil are more silty. In other areas the surface layer is fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Rimer soils, at the base of slopes or in small depressions, and small areas of the Ottokee soils, which do not have glacial till or lacustrine sediment in the lower part of the soil. These included soils make up about 10 percent of most areas.

Permeability in this Seward soil is rapid in the upper part of the soil and slow or very slow in the lower part. Available water capacity is low or moderate, and surface runoff is slow. Organic matter content is moderately low. Reaction ranges from strongly acid to neutral in the upper part of the soil. It increases with depth to slightly acid to mildly alkaline in the lower part of the subsoil. A seasonal high water table is at a depth of 3 to 6 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. Specialty crops are grown in some areas. This soil is well suited to corn, soybeans, and small grain.

Because of droughtiness, this soil is better suited to early maturing crops than to those that mature late in the summer. It dries fairly early in the spring. It is well suited to tillage and grazing early in the growing season. Droughtiness, soil blowing, and erosion hazard are the main management concerns. This soil is suited to irrigation. Planting cover crops, returning crop residue to the soil, and using conservation tillage that leaves crop residue on the surface reduce soil blowing, delay drying of the surface, and increase the organic matter content. Plant nutrients are leached from the upper part of the soil at a rapid rate; consequently, the soil generally responds better to smaller, more frequent or timely applications of fertilizer.

This soil is well suited to hay and pasture. Growth of plants is limited by droughtiness during dry periods. Pastures and meadows on this soil can be grazed much of the time.

Some areas are in woodland. This soil is well suited to trees. Seedling mortality is moderate for woodland. Trees need to be tolerant of droughtiness. Using seedlings that have been transplanted once or mulching reduces seedling mortality. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. Because of seasonal wetness and high shrink-swell potential in the lower part of the soil, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, protect against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Some type of filtering material needs to be used around the subsurface drains to reduce the movement of sand into them. Septic tank absorption fields can be improved by installing distribution lines in mounds of suitable fill material. Local streets and roads can be improved by using suitable base material and by artificially draining to reduce the damage from frost action.

The land capability classification is IIe; the woodland ordination symbol is 2s.

Sh—Shoals silt loam, frequently flooded. This deep, level and nearly level soil is somewhat poorly drained. It is in narrow strips near slope breaks to uplands and terraces and in slight depressions in wide flood plains. Areas of this soil make up the entire flood plain along many of the smaller streams. Slope is 0 to 2 percent. Areas are long and narrow. They range from 2 to 125 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The substratum to a depth of about 60 inches is brown, grayish brown, and light brownish gray and is mottled. It is friable silt loam and very friable loam and fine sandy loam. In some areas the surface layer and substratum have more sand.

Included with this soil in mapping are small areas of the very poorly drained Sloan soils in drainageways and in the lowest positions of the wide flood plains. Also included are small areas of Defiance soils that have more clay throughout. These included soils make up about 20 percent of most areas.

Permeability in this Shoals soil is moderate, available water capacity is high, and surface runoff is very slow. Reaction in the root zone is commonly slightly acid to mildly alkaline. Organic matter content is moderate. A seasonal high water table is at a depth of 1 to 3 feet during extended wet periods.

Much of the acreage along major streams is cropland and is used for cash-farming. This soil is well suited to corn and soybeans. Winter small grain is normally not grown because of the hazard of flooding. Flooding during the growing season commonly damages soybeans more than corn. The suitability of this soil for these uses is affected by the amount of flooding and by the extent to which the drainage of this soil has been improved. Outlets for subsurface drains generally are difficult to locate. If outlets are available, a subsurface drainage system can be used to lower the seasonal high water table. Flooding may delay planting in the spring.

Most of the acreage along small streams is in pasture. This soil is well suited to pasture, but maintaining soil tilth and desirable forage stands is difficult unless the soil is drained and grazing is controlled. This soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods help keep the pasture and soil in good condition.

Small scattered areas are in native hardwoods, commonly on narrow flood plains along the smaller streams. This soil is well suited to trees. Plant competition can be controlled or removed by good site preparation and by spraying, cutting, or girdling.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of the flooding hazard and wetness. It can be used for such recreation uses as hiking trails during the drier parts of the year. Constructing roads on raised, well compacted fills, using a suitable base material, and artificially draining help protect roads from flooding and help reduce frost damage. Fills for roads should not block the flow of floodwaters.

The land capability classification is IIw; the woodland ordination symbol is 2o.

So—Sloan silty clay loam, frequently flooded. This deep, level and nearly level soil is very poorly drained. The soil is on narrow to wide flood plains. It is commonly in depressions near slope breaks to terraces and uplands and in the lowest positions on wide flood plains. Areas of this soil make up the entire flood plain along some of the smaller streams. Flooding is more frequent on the narrow flood plains than on the wide flood plains. Most areas are long and narrow. They range from 3 to 100 or more acres.

Typically, the surface layer is very dark grayish brown, mottled, friable silty clay loam about 12 inches thick. The subsoil is about 33 inches thick. The upper part is dark gray, mottled, firm silty clay loam. The lower part is gray, mottled, firm clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm clay loam. In some areas the surface layer is silt loam or loam. In a few areas the soil has more clay throughout. The dark surface layer is less than 10 inches thick in some areas. In some areas the soil is subject to ponding.

Included with this soil in mapping are somewhat poorly drained Shoals soils in slightly higher positions than the Sloan soil. These included soils make up about 10 percent of most areas.

Permeability in this Sloan soil is moderate or moderately slow. Available water capacity is high, and surface runoff is very slow. Reaction is neutral or mildly alkaline in the upper part of the subsoil and neutral to moderately alkaline in the lower part. Organic matter content is high. The seasonal high water table is near the surface during extended wet periods.

Most of the areas along the major streams are cropland and are used for cash-grain farming. Some areas along smaller streams are used as cropland. This soil is moderately well suited to corn and soybeans. Winter small grain is normally not grown because of the flooding hazard. Flooding during the growing season commonly damages soybeans more than corn. The suitability of this soil for crop production is affected by the amount of flooding and by the extent to which the drainage of this soil has been improved. A subsurface drainage system lowers the seasonal high water table, but good drainage outlets must be available. Good outlets are not available in some areas because of the water level in adjacent streams. Surface drains are used in a few areas to remove excess surface water following floods. Flooding may delay planting in the spring. It deposits logs, branches, and other debris that damage crops or interfere with planting and harvesting. The soil becomes compacted and cloddy if worked when wet and sticky. Tillage at optimum moisture content, minimizing tillage, returning crop residue to the soil, and planting cover crops help maintain tilth, reduce crusting, and protect the surface in areas that are subject to scouring during floods.

Areas along small streams are commonly used for pasture. This soil is moderately well suited to pasture. Maintaining soil tilth and desirable forage stands is difficult unless the soil is drained and grazing is controlled. This soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods help keep the pasture and the soil in good condition.

Many areas along small streams are used as woodland. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. Planting and logging can be done during the drier parts of the year. This soil is well suited to trees adapted to wetness. Seedlings of adapted species survive and grow well if competing vegetation is controlled or removed by spraying, mowing, or disking. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of the flooding hazard, wetness, and moderate or moderately slow permeability. Constructing roads on raised, well compacted fills, using a suitable base material, and artificially draining protect roads from flooding and reduce damage from wetness and low soil strength. Fills for roads should not block the flow of floodwaters.

The land capability classification is IIIw; the woodland ordination symbol is 2w.

TdA—Tedrow loamy fine sand, 0 to 3 percent slopes. This deep, nearly level soil is somewhat poorly drained. It is in long, narrow areas on low beach ridges, stream terraces, and outwash plains. Most areas range from 3 to 20 acres.

Typically, the surface layer is brown, very friable loamy fine sand about 7 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown and dark yellowish brown, mottled, very friable fine sand and loamy fine sand. The lower part is pale brown, mottled, loose fine sand. The substratum to a depth of about 60 inches is light brownish gray, loose fine sand. In some areas the surface layer is fine sand. In some areas glacial till or lacustrine sediment is in the lower part of the soil.

Included with this soil in mapping are small areas of the moderately well drained Ottokee soils on the top of knolls and in higher positions than the Tedrow soil. The very poorly drained Gilford soils are in drainageways and low wet spots. These included soils make up about 15 percent of most areas.

Permeability in this Tedrow soil is rapid, available water capacity is low, and surface runoff is slow. Reaction in the subsoil is slightly acid or neutral. Organic matter content is moderate. The seasonal high water table is at a depth of 1 to 2 feet during extended wet periods.

Much of the acreage is cropland and is used for cash-grain farming. This soil is moderately well suited to corn, soybeans, and small grain. Specialty crops are grown in some areas that have been intensively drained.

Droughtiness, seasonal wetness, and soil blowing are the main management concerns. A subsurface drainage system is used to lower the seasonal high water table. Drainage outlets are difficult to establish in some areas. Subsurface drains become filled with fine sand unless some type of filter is used. A fiber envelope installed during manufacturing or a gravel or crushed stone filter around the drain lessens the possibility of the subsurface drain filling with fine sand. Conservation tillage that leaves crop residue on the surface and planting winter cover crops help reduce soil blowing. Returning crop residue or other organic material to the soil helps reduce soil blowing, delays surface drying, and increases the organic matter content.

This soil is moderately well suited to hay and pasture. Hay and pasture protect the soil against soil blowing. Because of seasonal wetness, the soil is poorly suited to grazing early in spring. Shallow rooted plants grow poorly during extended periods of below normal rainfall. Deferment of grazing, pasture rotation, selection of adapted species for planting, and weed control help keep the pasture and the soil in good condition.

Some areas are in native hardwoods. This soil is moderately well suited to trees. Seedling mortality is moderate for woodland. Species that tolerate droughtiness and some seasonal wetness are needed for new plantings. Plant competition can be reduced by disking, spraying, girdling, or mowing. Using seedlings that have been transplanted once or mulching reduces seedling mortality.

This soil is moderately well suited as a site for buildings but is poorly suited to septic tank absorption fields. When the seasonal high water table is lowered, effluent from septic tank absorption fields drains freely; however, pollution is a hazard to streams, lakes, ponds, and underground water supplies. Because of seasonal wetness, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Basements can be installed in built-up mounds. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. If drains around foundations connect to a sump, the pump needs to be large enough to handle rather large volumes of water. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Some type of filtering material needs to be used around subsurface drains to reduce their filling with fine sand. Lawns dry up during periods of low rainfall in summer. New seedings of lawns need mulching and watering during dry periods. Local roads and streets can be improved by using suitable base material and artificial drainage to reduce the damage from frost action and seasonal wetness. Soil blowing is a hazard during construction. A vegetative cover maintained on the site during construction reduces soil blowing. Sloughing is a hazard in excavations.

The land capability classification is IIIs; the woodland ordination symbol is 3s.

Tn—Toledo silty clay loam. This deep, level and nearly level soil is very poorly drained. The soil is on lake plains. It is on broad flats and in long, narrow depressions. Some areas are along drainageways and small streams. Slope is 0 to 2 percent. This soil is subject to ponding. Most areas are from 2 acres to a few hundred acres.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is about 35 inches thick. It is dark gray and gray, mottled, firm and very firm silty clay. The upper part of the substratum is yellowish brown, mottled, firm silty clay. The lower part to a depth of about 60 inches is brown, very firm silty clay. In some areas the surface layer and upper part of the subsoil have more sand and fine gravel. Some areas have a thicker, dark surface layer. In a few areas the subsoil and the substratum have more silt.

Included with this soil in mapping are small areas of the somewhat poorly drained Fulton and Del Rey soils on small, oval knolls and narrow ridges. These included soils make up about 10 percent of most areas.

Permeability in this Toledo soil is slow, and available water capacity is moderate. Surface runoff is very slow, or the soil is ponded. Reaction in the subsoil is commonly slightly acid or neutral. A seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage of this soil is cropland and is used for cash-grain farming. A few acres are used for specialty crops. This soil is moderately well suited to corn, soybeans, and small grain.

If this soil is used for crops, artificial drainage is needed. More intensive drainage is needed for specialty crops than for other row crops. A combination of surface and subsurface drains is commonly used to improve drainage. Artificial drainage improves plant growth and facilitates fieldwork by allowing the soil to dry out and warm up earlier in spring. If this soil is worked when wet and sticky, it becomes compacted and cloddy. Minimizing tillage and planting cover crops are good management practices. Incorporating crop residue or other organic matter into the surface layer increases water infiltration and improves tilth and fertility. These practices also reduce crusting and improve the contact of seed with the soil. Where the soil is inadequately drained, stands of wheat and oats are poor in some years. Some soil blows in winter in areas that have been plowed in the fall. This soil blowing occurs when the soil is frozen and the surface dries from the wind.

This soil is moderately well suited to pasture or hay. It is poorly suited to grazing early in the spring or during other periods of wetness. The soil is soft and sticky when wet. Grazing when the soil is soft and sticky or overgrazing causes compaction, poor tilth, reduced growth of plants, and decreased water infiltration. Selection of adapted species for planting, pasture rotation, proper stocking rates, deferment of grazing, artificial drainage, and weed control help keep the pasture and soil in good condition.

A few areas are in native hardwoods. This soil is moderately well suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are severe for woodland. The use of planting and harvesting equipment is limited by ponding. Logging can be done during the drier parts of the year. Competing vegetation can be controlled or removed by cutting, spraying, girdling, or mowing. Species need to be tolerant of prolonged wetness. Using seedlings that have been transplanted once reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

Even though areas of this soil are used as sites for buildings, the soil is poorly suited to this use. It is generally not suited to septic tank absorption fields. Because of ponding and high shrink-swell potential, this soil is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Poured concrete walls, steel reinforced and stiffened with pilasters, are protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Local roads and streets can be improved by using suitable base material and by artificially draining to reduce the damage from low soil strength, ponding, and frost action. Constructing roads on well compacted fill material raises them above high, ponded water. This soil is a good site for pond reservoirs.

The land capability classification is IIIw; the woodland ordination symbol is 3w.

TsB—Tuscola very fine sandy loam, 2 to 6 percent slopes. This deep, gently sloping soil is moderately well drained. It is on stream terraces and on deltas and in outwash areas of lake plains. Areas are commonly long and narrow on low ridges. Most areas range from 2 to 20 acres.

Typically, the surface layer is dark grayish brown, very friable very fine sandy loam about 9 inches thick. The subsoil is about 35 inches thick. The upper part is brown and dark yellowish brown, friable and firm loam. The middle part is brown and dark yellowish brown, mottled, friable, stratified very fine sandy loam and loam. The lower part is brown, mottled, very friable, stratified silty clay loam and loamy fine sand. The substratum to a depth of about 60 inches is dark grayish brown and light brownish gray, very friable, stratified very fine sand and loamy fine sand. Some areas have more sand in the subsoil and more gravel throughout the soil. In a few areas the soil is somewhat poorly drained, so the subsoil has more gray mottles.

Included with this soil in mapping are small areas of the more sandy Ottokee soils on beach ridges. These included soils make up about 10 percent of most areas.

Permeability in this Tuscola soil is moderate, available water capacity is high, and surface runoff is medium. Reaction ranges from medium acid to neutral in the upper part of the subsoil and from slightly acid to mildly alkaline in the lower part. Organic matter content is moderately low. The seasonal high water table is at a depth of 2 to 3 1/2 feet during extended wet periods.

Most of the acreage of this soil is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and specialty crops. It is well suited to crops planted early in spring.

Soil blowing and water erosion are the main hazards to growing crops. Conservation tillage that leaves crop residue on the surface, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue or other organic material to the plow layer improves fertility, delays surface drying, reduces soil blowing, and increases the organic matter content. Natural drainage is generally adequate for farming. Random subsurface drains are needed in some wet spots along drainageways and in depressions.

This soil is well suited to pasture and hay. It can be used for pasture during much of the growing season. Selection of adapted species for planting, pasture rotation, weed control, and proper stocking rates help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition can be reduced by disking, spraying, girdling, or mowing.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of the seasonal wetness, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites and septic tank absorption fields need to be landscaped to drain water away from foundations and absorption fields. Backfilling along foundations with a coarser textured material and using drains at the base of footings reduce damage from shrinking and swelling of the soil and help prevent wet basements. Coating the exterior of basement walls also helps keep basements dry. Using subsurface drains around septic tank absorption fields lowers the seasonal high water table. Some type of filter can be used around subsurface drains to prevent sand from filling them. Local roads and streets can be improved by using suitable base material and by artificially draining to reduce the damage from frost action and seasonal wetness. Sloughing is a hazard in excavations.

The land capability classification is IIe; the woodland ordination symbol is 1o.

Ud—Udorthents, rolling. These areas consist of cut and fill. They are deep, dominantly loamy soils that are well drained to somewhat poorly drained. The areas include highway interchanges, industrial sites, sanitary landfills, and a few borrow pits. In most places the soils have been radically altered or mixed with trash and industrial waste. Generally, the original land surface has been modified. In places the higher soils have been cut away and used to fill in depressions. Slope is dominantly 5 to 15 percent but ranges from 3 to 25 percent. Most areas are 3 to 70 acres.

Typically, the upper 60 inches is clay loam, silty clay loam, or loam. It is a mixture of the soil material from the substratum and subsoil and a small amount of surface soil. These soils are in poor physical condition. Many of the areas are calcareous at the surface. Available water capacity is quite variable, and organic matter content is usually very low. A seasonal high water table is evident in some areas, particularly in depressed or bowl shaped areas where water accumulates.

Included with these soils in mapping are sanitary landfills that have not been covered and areas that are partially covered with bricks, glass, and chunks of concrete. Also included are areas of soils that have more clay or sand throughout.

Most areas have only sparse vegetation and are open lots. The surface layer crusts following hard rains. This reduces the infiltration of water and restricts the emergence and growth of seedlings. Erosion is a hazard in most places. In some places this unit is subject to gullying and is commonly a source of sediment. Stands of grasses or legumes could be improved by mulching, fertilizing, and seeding. The root zone can be improved by resurfacing the area with topsoil to aid revegetation. Plants selected for planting need to be adapted to alkaline conditions.

The suitability of these soils as sites for buildings depends on how long the soil materials have been in place and such characteristics as compaction, permeability, and texture. These soils are generally not suitable as a site for septic tank absorption fields. Onsite investigations are needed to determine the suitability for specific land use.

Not assigned to a capability classification or woodland ordination symbol.

Ur—Urban land. This map unit consists mainly of areas covered by streets, parking lots, buildings, and other structures. A few areas are smoothed or uneven accumulations of concrete and general refuse. The accumulations are principally construction material or piles of mold sand that contain metal parts. The soils in these areas are so altered or obscured that identification is not feasible. Very little natural soil remains. Slopes range from 0 to 6 percent. Most areas are 5 acres or more.

Most areas of this map unit have been artificially drained by storm sewers and surface drains. The soils have a very low infiltration rate and a high amount of runoff. Where natural drainage has not been improved, wet spots are around or under the urban structures. Frost action in these wet spots commonly causes damage to pavements, patios, walkways, and other structures. In low areas basements commonly are flooded during intensive storms. Onsite investigation is needed to determine the suitability and limitation of this land for any proposed use.

Not assigned to a capability classification or woodland ordination symbol.

Wa—Wabasha silty clay loam, frequently flooded. This deep, level and nearly level soil is very poorly drained. It is on narrow to moderately wide flood plains. In many areas it is in depressions near slope breaks to terraces and uplands. Slope is 0 to 2 percent. Areas are commonly long and narrow. They range from 5 to about 100 acres.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 9 inches thick. The subsoil is about 43 inches thick. It is dark gray and gray, mottled, firm silty clay. The substratum to depth of about 60 inches is light olive gray, mottled, firm silty clay. In some areas the surface layer is silty clay. In a few areas reaction is medium acid or strongly acid in the upper part of the subsoil. In other areas layers in the subsoil are more silty or are better drained. In places layers of sandy alluvium are in the substratum. Some areas are subject to ponding.

Permeability in this Wabasha soil is slow, available water capacity is moderate or high, and surface runoff is very slow. Reaction in the subsoil is slightly acid to mildly alkaline. Organic matter content is high. A seasonal high water table is near the surface during extended wet periods.

Some areas are used for cash-grain farming. This soil is moderately well suited to corn and soybeans. Winter small grain is normally not grown because of the hazard of flooding. Flooding during the growing season commonly damages soybeans more than corn. The suitability of this soil for crop production is affected by the amount of flooding and by the extent to which the drainage of this soil has been improved. A subsurface drainage system can be used to lower the water table, but water is removed slowly. In some areas outlets for subsurface drains are not available because of the water level in adjacent streams. Surface drains remove excess surface water. Flooding often delays planting in the spring. It deposits logs, branches, and other debris that interfere with planting and harvesting. This soil becomes compacted and cloddy if worked when wet and sticky. Tillage at optimum moisture content, minimizing tillage, incorporating crop residue into the soil, and planting cover crops help maintain tilth, reduce crusting, and protect the surface in areas that are subject to scouring during floods.

Many areas are in pasture. This soil is moderately well suited to pasture. Maintaining soil tilth and desirable forage stands is difficult unless the soil is drained and grazing is controlled. This soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods help keep the pasture and soil in good condition.

Many areas are in woodland. This soil is moderately well suited to trees. Equipment limitation is severe for woodland. Seedling mortality and windthrow hazard are moderate. Plant competition can be controlled or removed by spraying, mowing, or disking. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of the flooding hazard, wetness, high shrink-swell potential, and slow permeability. Constructing roads on raised, well compacted fill, using a suitable base material, and artificially draining help protect roads from flooding and reduce damage from wetness and low soil strength.

The land capability classification is IIIw; the woodland ordination symbol is 3w.

Wd—Wallkill Variant silty clay. This deep, level and nearly level soil is very poorly drained. The soil is in depressions on end moraines. It is in and around the margins of depressions. Slope is 0 to 2 percent. This soil is subject to ponding. Most areas are irregularly shaped. They range from 1 to 15 acres.

Typically, the surface layer is very dark grayish brown, firm silty clay about 9 inches thick. The subsoil is about 46 inches thick. The upper part is very dark gray, mottled, firm clay. The middle part is mixed dark gray, firm clay and very dark gray, friable muck. The lower part is very dark gray, friable muck. The substratum to a depth of about 70 inches is dark brown and dark olive gray, friable sedimentary peat. In some areas the surface layer is silty clay loam, loam, or silt loam.

Included with this soil in mapping are small areas of Carlisle soils that have muck in the upper part of the soil. The Carlisle soils are in the center of some mapped units. Small areas of Bono, Mermill, and Pewamo soils that do not have muck in the lower part of the soil are included on the periphery of mapped units. Also included are narrow strips of soils that are subject to flooding. These inclusions make up about 15 percent of most areas.

Permeability in this Wallkill Variant soil is slow or very slow in the upper part and moderately rapid or rapid in the lower part. Available water capacity is very high. Runoff is very slow, or this soil is ponded. Reaction in the subsoil ranges from medium acid to neutral. Organic matter content is high. The seasonal high water table is near or above the surface during extended wet periods.

Some of the acreage of this soil is used as cropland and is used for cash-grain farming where the soil has been drained. Undrained areas are bogs in their original condition or are cleared and in pasture. This soil is moderately well suited to corn and soybeans.

Artificial drainage of this soil is needed for crop production. Surface and subsurface drainage can lower the water table, but outlets are difficult to establish in some areas. Subsurface drains installed in the organic material are difficult to maintain on grade. Winter grain is not commonly grown because of damage from ponding. This soil becomes compacted and cloddy if worked when wet and sticky. Tillage at optimum moisture conditions, minimizing tillage, and returning crop residue or other organic material to the soil maintain tilth, reduce crusting, and improve the contact of seed with the soil.

Some areas are used for pasture. This soil is moderately well suited to pasture. Maintaining soil tilth and desirable forage stands is difficult unless the soil is drained and grazing is controlled. This soil is soft and sticky when it is wet. Grazing when the soil is soft and sticky or overgrazing causes compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to trees. Equipment limitation, seedling mortality, and windthrow hazard are severe for woodland. Competing vegetation can be controlled or removed by mowing, spraying, disking, or girdling. Wetness limits planting and harvesting. Logging can be done during the drier parts of some years. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting. Undrained areas provide good habitat for ducks, muskrats, and other wetland wildlife.

This soil is generally not suited as a site for buildings and septic tank absorption fields because of ponding, low soil strength, high shrink-swell potential, and slow or very slow permeability. The organic part of the soil needs to be removed and replaced with a suitable, well compacted fill material if the soil is used for local roads. Providing side ditches and culverts that have good outlets help protect roads from ponding. This soil is a source of peat, but the quality is limited.

The land capability classification is IIIw; the woodland ordination symbol is 4w.

Wf—Wauseon fine sandy loam. This deep, level and nearly level soil is very poorly drained. The soil is on lake plains. It is on toe slopes of beach ridges and between beach ridges. Slope is 0 to 2 percent. The soil is subject to ponding. Most areas are irregularly shaped and on broad flats or are in long, narrow strips adjacent to beach ridges. Most areas range from 2 to 25 acres.

Typically, the surface layer is black, very friable fine sandy loam about 12 inches thick. The subsurface layer is very dark gray, mottled, friable fine sandy loam about 6 inches thick. The subsoil is about 12 inches thick. It is dark gray, mottled, very friable fine sandy loam and loamy fine sand. The substratum to a depth of about 60 inches is gray and dark grayish brown and is mottled. It is friable silt loam and firm clay loam. In places the surface layer is loamy fine sand. In some areas the subsoil has free carbonates. In some areas the lower part of the subsoil and the substratum are coarse textured. In other areas the subsoil has more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Rimer and Tedrow soils on low rises. The included soils make up about 15 percent of most areas.

Permeability in this Wauseon soil is rapid in the subsoil and very slow in the substratum. Available water capacity is moderate. Surface runoff is very slow, or the soil is ponded. Reaction is neutral or mildly alkaline in the subsoil. Organic matter content is high. The seasonal high water table is near or above the surface during extended wet periods.

Most of the acreage is cropland and is used for cash-grain farming. This soil is well suited to corn, soybeans, small grain, and many specialty crops.

Row crops can be grown continuously if the soil is well managed. Ponding damages small grain in some years. Very intensive drainage is needed for specialty crops. A subsurface drainage system is commonly used to lower the seasonal high water table. These drains are more effective if placed above the very slowly permeable substratum. Subsurface drains become filled with fine sand unless some type of filter is used. Examples are a fiber envelope installed during manufacturing or a gravel or crushed stone filter installed around the drain prior to backfilling the trench. These filters lessen the possibility of the subsurface drain filling with fine sand. Soil blowing is a hazard. Conservation tillage that leaves crop residue on the surface reduces soil blowing in row cropped areas. This soil is suited to irrigation.

This soil is well suited to hay and pasture. It is poorly suited to grazing early in spring. Deferment of grazing, pasture rotation, proper plant selection, and weed control help keep the pasture and soil in good condition.

This soil is moderately well suited to trees. Equipment limitation, seedling mortality, and windthrow hazard are severe for woodland. Planting and harvesting can be done during the drier parts of the year. Plant competition can be reduced by spraying, mowing, or disking. Using seedlings that have been transplanted once or mulching reduces seedling mortality. The windthrow hazard can be reduced by harvesting techniques, such as even cutting.

This soil is poorly suited as a site for buildings and generally is not suited to septic tank absorption fields. Because of ponding and high shrink-swell potential in the substratum, it is better suited to buildings without basements than to buildings with basements. Not placing basements so deep into the soil helps prevent wet basements. Building sites need to be landscaped to drain water away from foundations. Using drains at the base of footings and coating the exterior of basement walls also help prevent wet basements. Poured concrete walls, steel reinforced and stiffened with pilasters as needed, are protection against damage from shrinking and swelling of the soil. Backfilling along foundations with a coarser textured material and using drains at the base of footings also reduce damage from shrinking and swelling. If drains around foundations connect to a sump, the pump needs to be large enough to handle rather large volumes of water. Artificial draining and using a suitable base material under local roads and streets reduce damage from ponding and frost action. Elevation of the roadway also protects against ponding. Sloughing is a hazard in excavations.

The land capability classification is IIIw; the woodland ordination symbol is 3w.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. The supply of high quality farmland is limited, and the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the use of our Nation's prime farmland with wisdom and foresight.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when it is treated and managed using acceptable farming methods. 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 may now be in crops, pasture, woodland, or other land, but not urban and built-up land or water areas. It must either be used for producing food or fiber or be available for these uses.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. It also has favorable temperature and growing season, acceptable acidity or alkalinity. It has few or no rocks and is permeable to water and air. Prime farmland 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. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

About 181,098 acres, or nearly 69 percent of Defiance County, meets the soil requirements for prime farmland. Most of this acreage is used for soybeans, corn, wheat, hay, and oats. All of the soil associations on the general soil map are dominantly prime farmland, except for association 1 in the central part of the county and association 9 in the northwestern part.

A recent trend in land use in some parts of the county has been the loss of some prime farmlands to industrial and urban uses but not to the extent that has occurred in some other parts of the state. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and difficult to cultivate, and usually less productive.

Soil map units that make up prime farmland in Defiance County 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 in the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Soils that have limitations, such as a high water table, may qualify for prime farmland if this limitation is overcome by such measures as drainage. In table 5, the measures used to overcome the limitations, if any, are shown in parentheses after the map unit name. Onsite evaluation is necessary to see if 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 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 A. McCluskey, district conservationist, Soil Conservation Service, and William F. Rohrs, county extension agent, Cooperative Extension Service, helped in the preparation of 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.

About 174,900 acres, or 66 percent of the county, was used for soybeans, corn, wheat, oats, and hay in 1980 (*14*). Crops that are grown to a lesser extent include tomatoes, cucumbers, and potatoes. Only about 3 percent of the acreage of farmland is in permanent pasture. Acreage in crops and pasture in this county has not been affected by the use of land for urban development and other uses as it has in other parts of the state.

The soils in Defiance County vary in their suitability for specific crops, and they require widely different management. Certain basic management practices, however, such as maintaining an adequate level of fertility, improving drainage, controlling erosion, and maintaining or improving soil tilth are needed on most of the soils in the county.

Fertility is naturally low or medium in the sandy soils and in more rolling soils. It is medium or high in many of the loamy and clayey soils. The soils that have a sandy surface layer and a dominantly sandy subsoil are those in the Ottokee, Rimer, Seward, and Tedrow series. They retain only a small amount of plant nutrients; therefore, more frequent additions of fertilizer are needed.

Available phosphorus and potash levels are naturally low in many of the light colored soils, especially those on rolling topography, that are eroded. Fertilizer should be applied on the basis of soil tests, the needs of the crop, and the desired level of yield. The Cooperative Extension Service can help in determining the kind and amount of fertilizer to apply.

Many of the light colored soils on uplands are naturally strongly acid or very strongly acid. If they have never been limed, they require applications of ground limestone to raise the pH level sufficiently for alfalfa and other crops.

Soil drainage is the major management need of about 91 percent of the cropland (*12*). Ponding and excessive wetness impede growth of crops on the very poorly drained and somewhat poorly drained soils. Because these soils dry out and warm up slowly in spring, tillage and planting are delayed. Artificial drainage is necessary to improve growth on these soils.

The design of surface and subsurface drainage systems varies with the kind of soil. Surface drainage removes excess water from the surface of the soil. It generally is most effective on soils that have a clayey subsoil. These soils have relatively slow permeability.

Subsurface drainage removes excess water from within the soil. Its effectiveness is dependent on the permeability of the soil and on the availability of suitable outlets. A combination of surface drainage and subsurface drainage is needed on many of the very poorly drained soils used for intensive row cropping.

Subsurface drains are most effective in soils that have a fairly high or high sand content in the surface layer and subsoil, such as Gilford, Rimer, Tedrow, and Wauseon soils. They are also effective in soils that have a more loamy subsoil, such as Colwood, Mermill, Millgrove, Kibbie, and Haskins soils. Subsurface drains are least effective in soils that have a fairly high clay content in the surface layer and subsoil, such as Blount, Bono, Del Rey, Fulton, Latty, and Toledo soils. The subsurface drains are infrequently used in Roselms and Paulding soils because of their excessively high clay content in the surface layer and subsoil and very slow permeability. Small areas of wetter soils along drainageways and in swales are commonly included in areas of moderately well drained Glynwood soils. Artificial drainage is needed in some of these wetter areas. Finding adequate outlets for subsurface drainage systems is difficult in many areas of Bono, Carlisle, Defiance, Shoals, Sloan, and Wabasha soils and the Wallkill Variant. If drains are placed in soils that have a fairly high or high sand content in the subsoil, such as Gilford, Rimer, Tedrow, and Wauseon soils, they become blocked by soil material. Because the sands flow when they are saturated, the subsurface drain must be protected. Protective measures suitable for use are a fiber envelope installed during manufacturing or a gravel or crushed stone filter around and over the drain.

Organic soils, such as Carlisle soils, oxidize and subside when the pore space is filled with air. Therefore, special drainage systems are needed to control the depth and the period of drainage. Oxidation and subsidence of organic soils are minimized by keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year.

Erosion control practices are needed on about 75 percent of the cropland in the county (*14*). Water erosion is a hazard on soils that have slopes of more than 3 percent. It varies in severity with particle sizes of surface soil material and soil permeability. The loss of the surface layer reduces soil productivity and lowers the available water capacity of the soil. As a result of erosion, finer textured subsoil material commonly is mixed into the surface layer by plowing and this generally causes tilth to deteriorate. Soils, such as Glynwood, Morley, and St. Clair soils, are subject to severe soil erosion. Conservation tillage that leaves crop residue on the soil surface, no-till planting, planting cover crops, and using grassed waterways and diversions can help reduce erosion.

The steeper soils, such as Glynwood, Morley, and St. Clair, have such short and irregular slopes that contour tillage or terracing is difficult to apply or is not practical. On these soils, cropping systems that provide substantial vegetative cover or conservation tillage systems that leave crop residue on the surface are needed to control erosion. Terraces and diversions shorten the length of slopes and slow runoff and reduce erosion. Most soils in the county are not suited to terracing or diversions because of irregular slopes, excessive wetness in the terrace channels, and the clayey subsoil that would be exposed in terrace channels.

Minimizing tillage and using conservation tillage increase water infiltration and reduce the hazard of runoff and erosion. These practices are adapted to many of the soils in the survey area, but they are more difficult to use successfully on eroded soils. No-till planting of corn is effective in reducing erosion on gently sloping and sloping soils. It can be used on many of the soils in the survey area.

Grassed waterways are natural or constructed outlets or waterways protected by grass cover. Natural drainageways make the best locations for waterways and often require minimum shaping to produce a good channel. They should be designed to be wide and flat so farm machinery can cross them easily.

Contouring and stripcropping are useful erosion control practices, but they are best adapted to soils with smooth uniform slopes. Their use is limited in Defiance County, because the slopes are generally irregular and short. Some areas of gently sloping and sloping Glynwood and Morley soils may allow practical use of contouring and even stripcropping.

Soil blowing is a hazard on the sandy soils and on some of the loamy soils. If winds are strong and the soils are dry and bare of vegetation or surface mulch, these soils or young seedlings growing on them can be damaged in a few hours. Maintaining a cover of vegetation or surface mulch or keeping the surface rough by proper tillage can help reduce soil blowing. Field windbreaks and temporary barriers of rye or wheat strips also reduce soil blowing and damage to plants.

Controlling water erosion and soil blowing minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Soil tilth affects the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous. The surface layer of the soils in

Defiance County ranges from loamy fine sand to clay. Soils that have a surface layer of sandy loam or a texture that is coarser than sandy loam include the Boyer, Bronson, Oshtemo, Ottokee, Rawson, Rimer, Seward, and Tedrow soils. These soils can safely be tilled within a wide range of moisture content. Some of these soils, including Rimer and Tedrow soils, have poor trafficability when they are wet. They are not seriously damaged, however, if they are tilled when wet.

Soils that have a surface layer of sandy loam or coarser can be tilled within a wide range of moisture content. Soils that have a silty clay loam or finer textured surface layer have the narrowest range in optimum moisture content for tillage. Because of the high clay content in the surface layer, these soils clod if tilled when wet or flow and seal when very wet.

Several of the soils used for crops in the survey area have a silt loam or finer textured surface layer that is light in color and moderate or moderately low in content of organic matter. Intense rainfall compacts the surface of these soils. Upon drying, a crust forms that is hard and nearly impervious to water. Once the crust forms, it reduces infiltration, increases runoff, and impedes seedling emergence. Regular additions of crop residue, manure, and other organic material can improve soil structure and reduce the likelihood of crusting.

Fall plowing is generally not a good practice on the soils that have a light colored surface layer and silt loam or finer textures. Many of these soils that are plowed in fall are nearly as dense and hard at planting time as they were before they were plowed. In addition, gently sloping and steeper soils, and even some areas of nearly level and level soils, are subject to erosion after they are plowed in the fall.

Fall plowing of the fine textured surface layer of Hoytville and Paulding clay and Latty and Roselms silty clay, however, results in good tilth in spring. Erosion of the bare soil by water and wind moves fine clays into ditches and streams, which adversely affects water quality. Tillage and planting methods on these fine textured soils are shifting. Tillage equipment is being used that produces ridges. Row crops are planted on the ridges. Conservation tillage that leaves crop residue on the soil surface is increasing.

Pasture is a minor land use in Defiance County. Permanent pasture comprises about 3 percent of the acreage in farms. This low percentage is partly caused by the drastic reduction in the number of livestock over the last 50 years. Some soils used for pasture have potential for crops. Other soils that are used as pasture have steep slopes and are subject to erosion. These soils commonly have been eroded and have poor tilth. In many of the pastures, the soils need to be artificially drained for maximum growth of plants. Erosion control, drainage, additions of lime and fertilizer, and brush control are needed to manage pasture. In addition, surface compaction needs to be reduced, and, on the sandier soils, the plant population needs to be maintained or increased.

The specialty crops grown commerically in Defiance County include vegetable and fruit crops. These crops require a high level of management for optimum yield. Information on management practices, fertilization rates, and seed varieties for specialty crops is available at the local offices of the Cooperative Extension Service and the Soil Conservation Service.

The main specialty crop in the county is tomatoes. Drained areas of Colwood, Hoytville, Kibbie, Latty, Lenawee, Mermill, Millgrove, and Toledo soils are well suited to this crop. Much of the acreage is on the finer textured, very poorly drained soils. New varieties of tomatoes are being developed that are adaptable to more soils in the county.

Sweet corn, potatoes, and cucumbers are other specialty crops in the county. These crops are grown on various kinds of soils, but the earlier maturing varieties are grown mainly on the coarser textured soils, which warm up early in the spring. These are the Belmore, Boyer, Bronson, Oshtemo, and Ottokee soils. Crops can generally be planted and harvested earlier on these soils than on other soils in the survey area. Soil blowing, which damages tender plants, is a hazard on these soils if the vegetation is too short to reduce wind velocity.

Where adequately drained, the muck soils in the county are well suited to a wide range of vegetable crops. The Carlisle muck makes up about 684 acres in the survey area.

Most orchards in the county are on the medium and coarse textured soils, mainly the Belmore, Bronson, and Oshtemo soils. These soils are on the beach ridges in the eastern and western parts of the survey area. A few orchards are on Mermill, Hoytville, and other dark, finer textured soils. The acreage used for apple, peach, and other fruit crops could be increased if economic conditions are favorable. Fruit crops are limited in this area by the length of the growing season. Early frosts and freezing are hazards.

If economic conditions are favorable, the acreage used to grow vegetables and small fruit could be increased on soils which have good natural drainage and which warm up early in the spring.

Field crops suited to the soils and climate of the survey area include many that are not commonly grown. Rye, barley, buckwheat, sunflowers, grain sorghum, and flax could be grown, and grass seed could be produced from bromegrass, fescue, orchardgrass, timothy, and bluegrass. Also, legume seed from red clover and alsike clover could be produced.

Irrigation is needed in some areas of Defiance County. Rainfall generally is adequate for most crops but is not always timely or well distributed. Extended dry periods can occur between May and September.

A number of the soils of the survey area are suited to irrigation. Where irrigation water is available, these soils can be irrigated profitably. Features that affect the suitability of the soil for irrigation are available water capacity, slope, water intake rate, and drainage. A fine and medium textured surface layer and subsoil have a high available water capacity and generally have a slow intake rate. A coarse textured surface layer and subsoil have a lower available water capacity and a rapid intake rate.

Water sources for irrigation are wells, streams, and reservoirs. The Maumee River and its tributaries are sources of water. Surface water can be stored by pumping it from drainage ditches and small streams into reservoirs and lakes.

Yields Per Acre

The average yields per acre that can be expected of the principal crops and pasture under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those in the table because of variations in rainfall and other climatic factors.

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 insures 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 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 (*11*). 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 limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, 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, rangeland, 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."

Woodland Management and Productivity

Nearly all of Defiance County was forest at the time of settlement. The southern part of the county is included in the Great Black Swamp, which supported a heavy forest in which elm was an important species (*7*). The woodland of this part of the county is classified as Elm-Ash Swamp Forest. Species varied in this nearly level area of the lake plains because of slight changes in topography that created wet and not-so-wet sites. The elm-ash swamp forest grew in the low-lying flats. It included white elm, black ash or white ash, silver maple and red maple, and in especially wet areas, cottonwood and sycamore. On the better drained slight rises, bur oak, shellbark hickory, red oak, and basswood were common. Other species frequently included swamp white oak, pin oak, white oak, black walnut, and yellow-poplar.

The woodland in the northern part of the county is classified as Beech Forest. Beech and sugar maple are important species. Other common species are red oak, white ash, white oak, and some basswood, shagbark hickory, and black cherry.

As a result of clearing the acreage, woodland has been drastically reduced from the dense early forest. Most of the remaining acreage is in small farm woodlots or in narrow strips on slope breaks along larger streams valleys and on the flood plains adjacent to streams. Much of this woodland has been cut over, and much of it has been grazed.

Compared to the returns from the sale of other farm products, the sale of wood products is a small income producer for landowners. Hardwood trees are being fairly steadily harvested by local buyers. Some good quality logs of oak and black walnut are cut from the better managed woodlands. Some of the lumber produced locally is used for rough construction and the production of pallets. Also, farm woodlots provide windbreaks, scenery, wood for fireplaces, and edible fruits and nuts.

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 important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Several windbreaks have been planted in Defiance County (fig. 15). Some well established ones have 20 to 30 years of growth. Many of these have grown well.

Some have not grown so well because of improper spacing between trees or selection of the wrong species for the soil conditions.

Planting windbreaks has increased in recent years. Many of these have been well spaced, and species have been carefully selected for soil conditions.

Some trees have been planted to enhance the environment. Most of these are around ponds or lakes. A number of areas in Defiance County have potential for environmental plantings, especially those areas that lack access or are so steep that they are generally not suited to more intensive use.

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 from soil blowing and crops from winds, 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 insure plant survival, a healthy planting stock

Figure 15.—The windbreak and other trees around this homestead are on Fulton soils. They provide protection from wind and snow.

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; the Ohio Department of Natural Resources, Division of Forestry; or the Cooperative Extension Service or from a nursery.

Recreation

The Maumee and Auglaize Rivers are the basis of much of the water related recreation of Defiance County. Boating and fishing are the principal activities. The state of Ohio has boat launching facilities at Independence State Park, downstream from the city of Defiance. Independence State Park has picnic and shelter facilities and camping facilities. The Oxbow Lake, a state wildlife area, provides fishing, hunting, and hiking.

The water level of the Maumee River upstream from the city of Defiance is maintained by Independence Dam. The Power Dam on the Auglaize River maintains the water level from the dam to the Paulding County line. Occasionally, the water level is lowered. This usually occurs during the off-season. A number of summer cottages have been built along the banks of the Auglaize River.

In Defiance City and many of the towns in the county, parks have baseball and softball diamonds, tennis courts, and playground equipment. There are a few golf courses. These recreational areas are on a variety of soils.

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 mild 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 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

Defiance County has many upland acres, and some wetland acres, that could be managed for wildlife. Most of the upland areas are on steeper soils in woods or in shrubs, grass, and weeds. Farm woodlots also are a source of habitat. Some areas along the smaller streams also provide good habitat. Intensive cropping systems, fall plowing, and urbanization seriously affect wildlife populations. Land managed with wildlife as a primary or secondary consideration would greatly benefit wildlife in Defiance County. For example, upland habitat for pheasants can be provided by border plantings, legume-grass areas, and management techniques designed to provide nesting habitat and to reduce competition. Such practices can be very successful in providing wildlife habitat even when the primary use is agricultural.

Defiance County has some acreage of wetlands, especially in the northwestern part of the county. These wetlands are in undrained, organic bogs and along the larger streams, in oxbows of standing water (fig. 16). The rivers provide large areas of open water. Oxbow Lake, a state area, also provides habitat for wetland wildlife and fish. Waterfowl are common but not numerous. Opportunities exist for improvement of wetland habitat. Nesting boxes and plantings of grain for food would encourage nesting and provide a more complete waterfowl habitat.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. 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 (*1*). 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, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, ragweed, and fescue.

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, wild cherry, beech, maple, hawthorn, dogwood, hickory, black walnut, and hackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, and cedar.

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 duckweed, willows, reed canarygrass, 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 shallow ponds.

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, and mink.

Engineering

This section provides information for planning land uses related to urban development and to water

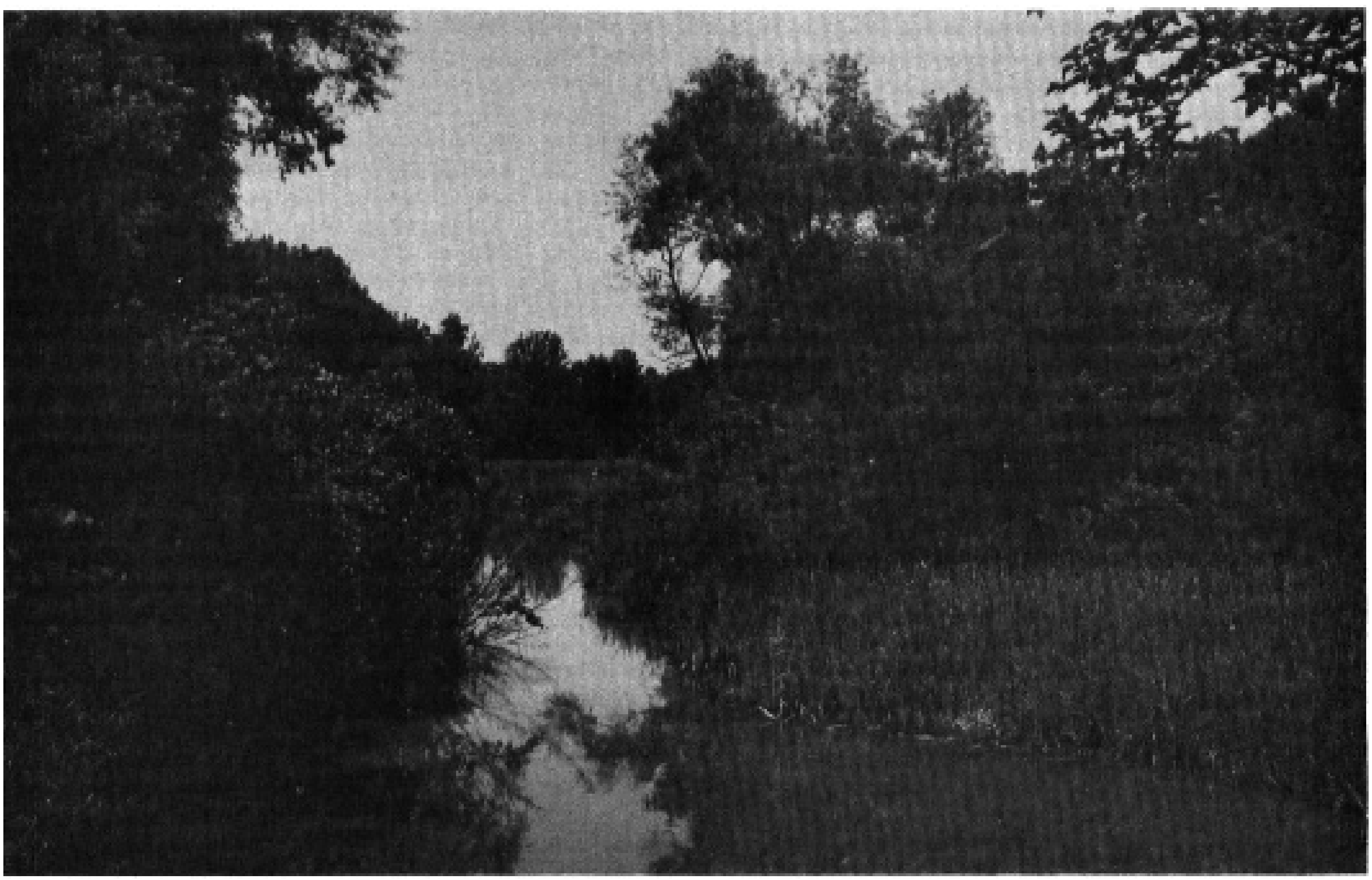

Figure 16.—Good habitat for wetland wildlife along a stream. The Sloan and Shoals soils are on flood plains near this area.

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 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, 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 (fig. 17), 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, 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

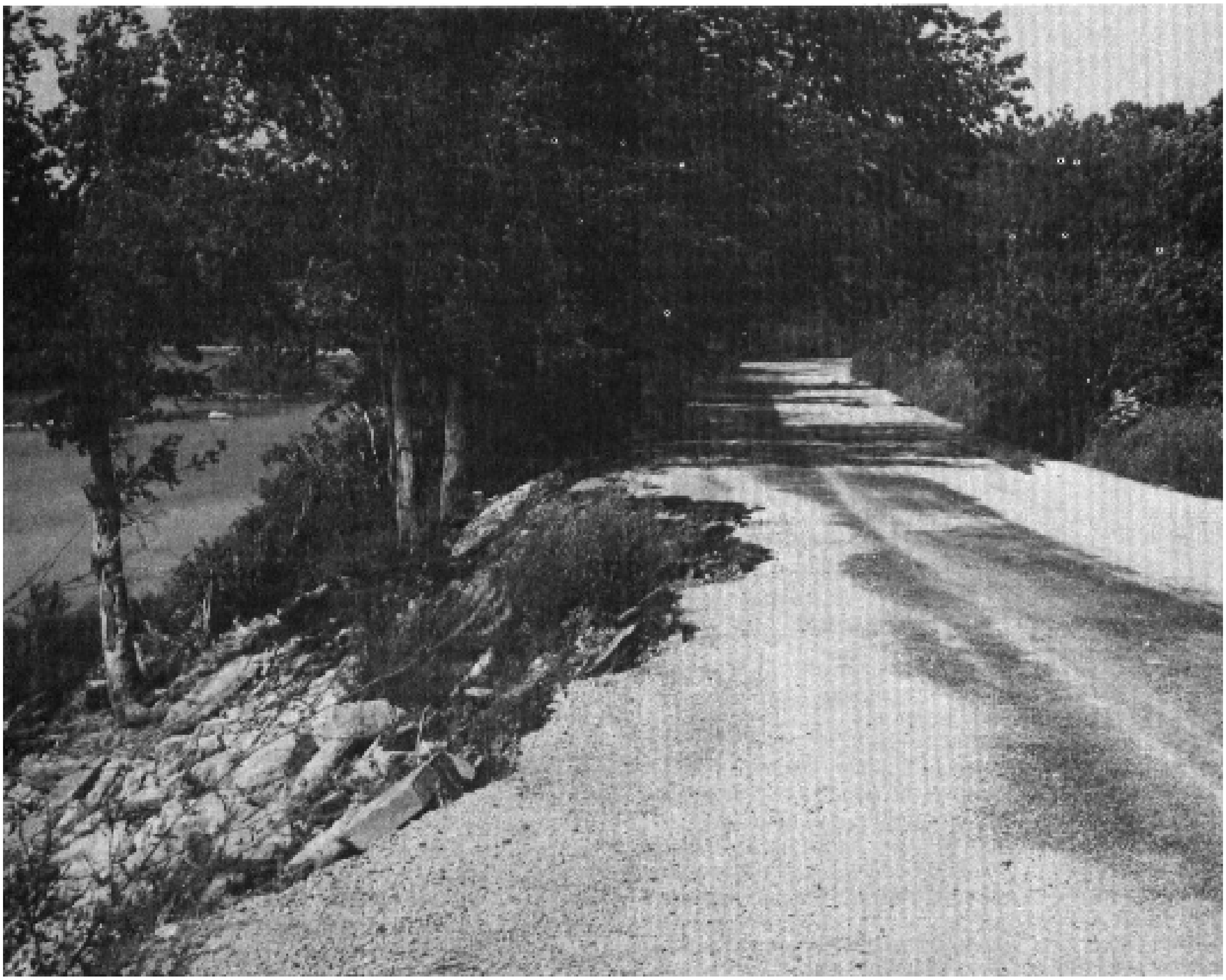

Figure 17.—The erosion of the streambank caused the slippage of this road, which is on St. Clair soils.

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 soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 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; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

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

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to 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. "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 or 20 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officiais (*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, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 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.

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 and the amount of soil lost. 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 18 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 18 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.

In table 18, some soils are assigned to two hydrologic groups. The first letter is for drained areas, and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 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, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal 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—that is perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 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. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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.

Physical and Chemical Analyses of Selected Soils

Several of the soils in Defiance County were sampled and laboratory data determined by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained on most samples include particle size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in the classification and correlation of these soils and in evaluating their behavior under various land uses. Among these data, four of the profiles were selected as representative for the respective series and are described in the section "Soil Series and Their Morphology" of this publication. These series and their laboratory identification numbers are: Broughton (DF-29), Paulding (DF-2), Roselms (DF-33), and Toledo (DF-30).

In addition to the Defiance County data, laboratory data are also available from nearby counties, in northwestern Ohio, that have many of the same soils. These data and the Defiance County data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Several of the soils in Defiance County were analyzed for engineering properties by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section. In addition to the Defiance County data, engineering test data are also available from nearby counties that have many of the same soils. These data and the Defiance County data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

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 Inceptisol.

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 Aquept (*Aqu*, meaning water, plus *ept*, from Inceptisol).

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 Haplaquepts (*Hapl*, meaning minimal horizonation, plus *aquept*, the suborder of the Inceptisols that have 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 Haplaquepts.

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 very-fine, illitic, nonacid, mesic Typic Haplaquepts.

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* (*10*). 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."

Belmore Series

The Belmore series consists of deep, well drained soils on beach ridges. These soils formed in medium textured or moderately fine textured material that is 22 to 50 inches deep to stratified, calcareous coarse textured and moderately coarse textured deposits. Permeability is moderately rapid in the solum and rapid in the substratum. Slope ranges from 2 to 6 percent.

Belmore soils are commonly adjacent to Digby and Millgrove soils and are similar to Boyer, Bronson, Oshtemo, and Rawson soils. Boyer and Oshtemo soils have less clay in the subsoil than the Belmore soils.

Bronson, Digby, and Millgrove soils are wetter, and gray dominates or is in mottles in the subsoil. Millgrove and Digby soils are on broad flats and along drainageways. Millgrove soils have a mollic epipedon. Contrasting fine textured or moderately fine textured glacial till or lacustrine material is in the lower part of the Rawson soils.

Typical pedon of Belmore loam, 2 to 6 percent slopes, 0.5 mile north of the village of Ayersville; in an area of Highland Township 2,442 feet south and 106 feet east of the northwest corner of sec. 3, T. 3 N., R. 5 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; 2 percent fine gravel; neutral; abrupt smooth boundary.

Bt1—6 to 12 inches; brown (7.5YR 4/4) sandy clay loam; weak fine subangular blocky structure; friable; common fine roots; thin patchy dark brown (10YR 4/3) clay films on vertical faces of peds and some bridges between sand grains; 2 percent fine gravel; neutral; gradual smooth boundary.

2Bt2—12 to 18 inches; brown (7.5YR 4/4) gravelly sandy clay loam; weak fine and medium subangular blocky structure; firm; common fine roots; thin patchy dark brown (10YR 4/3) clay films on faces of peds and some bridges between sand grains; 30 percent fine gravel; neutral; clear smooth boundary.

2Bt3—18 to 25 inches; brown (7.5YR 4/3) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds and common clay bridges between sand grains; 27 percent fine gravel; the bottom 2 inches of this horizon is dark brown (7.5YR 3/2); neutral; abrupt irregular boundary.

2C1—25 to 33 inches; dark brown (10YR 4/3) gravelly sandy loam; single grained; loose; 35 percent fine gravel; few fine roots; few light gray (10YR 7/2) calcium carbonate coatings; brown (7.5YR 4/3) gravelly sandy clay loam tongues 2 to 5 inches wide from 2Bt3 horizon; strong effervescence; mildly alkaline; clear wavy boundary.

2C2—33 to 60 inches; brown (10YR 5/3) very gravelly sand; single grained; loose; 40 percent fine gravel; common to many white (10YR 8/1) calcium carbonate coatings on pebbles; brown (7.5YR 4/3) gravelly sandy clay loam tongues 2 to 5 inches wide from 2Bt3 horizon extending to a depth of 50 inches.

The solum ranges from 22 to 50 inches in thickness. Coarse fragments make up 2 to 15 percent of the A and Bt horizon and 15 to 40 percent of the 2Bt and 2C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Where the Ap horizon is limed, reaction ranges from medium acid to neutral. A thin E horizon is present in some pedons. The Bt and 2Bt horizons have hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. The Bt horizon is sandy clay loam, loam, or clay loam. Reaction in the Bt horizon ranges from medium acid to neutral. The 2Bt horizon is gravelly or very gravelly analogs of sandy clay loam, loam, or clay loam. It ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is commonly stratified gravelly or very gravelly sandy loam, sand, or loamy sand.

Blount Series

The Blount series consists of deep, somewhat poorly drained soils that are slowly permeable or moderately slowly permeable. These soils formed in moderately fine textured glacial till on moraines. Slope ranges from 0 to 3 percent.

Blount soils are commonly adjacent to Glynwood, Morley, and Pewamo soils and are similar to Del Rey and Nappanee soils. Del Rey soils have less sand and coarse fragments in the lower part of the solum than the Blount soils and formed in lacustrine deposits. Glynwood and Morley soils are better drained and have fewer, low-chroma mottles in the subsoil. They are on knolls, ridges, and side slopes along drainageways. Nappanee soils have more clay in the lower part of the B horizon and in the C horizon than the Blount soils. Pewamo soils are very poorly drained and have a mollic epipedon. They are in depressions and along drainageways.

Typical pedon of Blount loam, 0 to 3 percent slopes, about 5 miles north-northwest of the village of Hicksville; in an area of Milford Township 1,254 feet east and 1,056 feet north of the southwest corner of sec. 30, T. 5 N., R. 1 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; bottom 3 inches of the horizon has some yellowish brown (10YR 5/4) and brown (7.5YR 4/4) clay loam mixed in; neutral; abrupt smooth boundary.

B/E—9 to 12 inches; dark yellowish brown (10YR 4/4) clay loam (B); about 25 percent pale brown (10YR 6/3) loam; common fine faint light gray (10YR 6/1) mottles; weak fine and medium subangular blocky structure; friable; common fine roots; silt coatings on vertical faces of peds; medium acid; clear smooth boundary.

Btg1—12 to 18 inches; light brownish gray (10YR 6/2) clay; many fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; thin patchy brown (10YR 5/3) clay films on vertical and horizontal faces of peds; common fine roots; common fine black (10YR 2/1) iron and manganese stains; 3 percent coarse fragments; medium acid; gradual smooth boundary.

Btg2—18 to 24 inches; grayish brown (10YR 5/2) clay; common fine faint gray (10YR 5/1), yellowish brown (10YR 5/4), and brown (10YR 5/3) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; thin patchy grayish brown (10YR 5/2) clay films on vertical and horizontal faces of peds; some very dark gray (10YR 3/1) organic coatings in root channels; few fine black (10YR 2/1) concretions (iron and manganese oxides); 4 percent coarse fragments; mildly alkaline; clear wavy boundary.

Bt—24 to 31 inches; brown (10YR 5/3) clay; common fine distinct gray (10YR 5/1) mottles; moderate medium angular blocky structure; very firm; common fine roots; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds; common fine and medium distinct light gray (10YR 7/2) calcium carbonate coatings; few black (10YR 2/1) concretions (iron and manganese oxides); 5 percent coarse fragments; strong effervescence; moderately alkaline; diffuse wavy boundary.

BC—31 to 44 inches; pale brown (10YR 6/3) and brown (10YR 5/3) clay loam; common fine distinct gray (10YR 6/1) and yellowish brown (10YR 5/4) mottles; moderate fine angular blocky structure; very firm; few fine roots; thin very patchy gray (10YR 5/1) clay films on faces of peds; common fine black (10YR 2/1) concretions (iron and manganese oxides); many medium and coarse light gray (10YR 7/2) calcium carbonate coatings; 5 percent coarse fragments; strong effervescence; moderately alkaline; diffuse wavy boundary.

C1—44 to 52 inches; yellowish brown (10YR 5/4) and brown (10YR 5/3) clay loam; weak fine and medium angular blocky structure; very firm; grayish brown (10YR 5/2) clay films on faces of peds; many medium distinct light gray (10YR 7/2) calcium carbonate coatings; 6 percent coarse fragments; strong effervescence; moderately alkaline; diffuse wavy boundary.

C2—52 to 60 inches; brown (10YR 5/3) clay loam; massive; some vertical cleavage planes; very firm; thick patchy olive gray (5Y 5/2) coatings on cleavages; common fine distinct light gray (10YR 7/2) calcium carbonate coatings; 5 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 22 to 45 inches in thickness. Carbonates range in depth from 22 to 40 inches. Coarse fragments make up 0 to 8 percent of the upper part of the solum and 2 to 10 percent of the lower part and the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2. Reaction ranges from neutral to medium acid. A thin E horizon is present in some pedons. The Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It is clay loam, clay, or silty clay loam. Reaction generally increases with depth and is strongly acid or medium acid in the upper part and medium acid to moderately alkaline in the lower part. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is clay loam or silty clay loam.

Bono Series

The Bono series consists of deep, very poorly drained soils in depressions on moraines. These soils formed in fine textured and moderately fine textured lacustrine sediment. Permeability is slow or very slow. Slope is 0 to 2 percent.

Bono soils are commonly adjacent to Blount and Glynwood soils and are similar to Toledo soils. Blount and Glynwood soils have an ochric epipedon, are better drained, and do not have dominantly low-chroma colors in the subsoil. Toledo soils have a thinner, dark surface layer than that of the Bono soils.

Typical pedon of Bono silty clay loam, 5 miles south of the village of Edgerton; in an area of Milford Township 1,056 feet north and 396 feet west of the southeast corner of sec. 15, T. 5 N., R. 1 E.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

BAg—6 to 12 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; few fine distinct dark brown (7.5YR 4/4) mottles; weak coarse prismatic structure parting to moderate coarse angular blocky; firm; common fine roots; few coarse very dark gray (10YR 3/1) krotovinas; few pressure faces; slightly acid; clear smooth boundary.

Bg1—12 to 23 inches; dark grayish brown (10YR 4/2) silty clay; common fine faint brown (10YR 4/3) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; common fine roots; few coarse very dark gray (10YR 3/1) krotovinas; few pressure faces; dark gray (5Y 4/1) coatings on faces of peds; few light gray (10YR 7/2) snail shells; neutral; gradual wavy boundary.

Bg2—23 to 32 inches; dark gray (5Y 4/1) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; some pressure faces; few coarse very dark grayish brown (10YR 3/2) krotovinas; mildly alkaline; gradual smooth boundary.

Bg3—32 to 38 inches; dark gray (10YR 4/1) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; few light gray (10YR 7/1) snail shells; few pressure faces; mildly alkaline; abrupt wavy boundary.

Cg—38 to 60 inches; gray (10YR 5/1) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure grades to massive with depth; very firm; common light gray (10YR 7/1) snail shells; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 25 to 50 inches. The mollic epipedon ranges from 10 to 18 inches in thickness.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. These colors extend into the upper part of the B horizon in many pedons. Some pedons have an AB horizon. Reaction is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 1. It is silty clay, clay, or silty clay loam. Reaction is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay, clay, or silty clay loam. Evidence of stratification is in many pedons.

Boyer Series

The Boyer series consists of deep, well drained soils on stream terraces. A few areas are on beach ridges. These soils formed in moderately coarse textured and coarse textured material over calcareous, coarse textured material. Permeability is moderately rapid in the solum and very rapid in the substratum. Slope ranges from 1 to 6 percent.

Boyer soils are commonly adjacent to Bronson and Oshtemo soils and are similar to Belmore and Oshtemo soils. Belmore soils have more clay in the subsoil. Bronson soils are on low ridges and less elevated parts of beach ridges. They have mottles of low chroma in the upper 10 inches of the argillic horizon. Oshtemo soils are on stream terraces and beach ridges. They have a thicker solum than the Boyer soils.

Typical pedon of Boyer loamy sand, 1 to 6 percent slopes, 2 3/4 miles southwest of the village of Edgerton; in an area of Milford Township 2,310 feet south and 580 feet east of the northwest corner of sec. 5., T. 5 N., R. 1 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, pale brown (10YR 6/3) dry; moderate fine granular structure; very friable; many fine roots; 5 percent fine gravel; medium acid; abrupt smooth boundary.

BE—9 to 16 inches; brown (7.5YR 4/4) gravelly sandy loam; weak fine and medium subangular blocky structure; friable; common fine roots; 20 percent fine pebbles and few medium pebbles; medium acid; clear smooth boundary.

Bt1—16 to 23 inches; brown (7.5YR 4/4) gravelly sandy loam; weak coarse and medium subangular blocky structure; friable; common fine roots; thin patchy clay films on faces of peds and bridging between sand grains; 20 percent fine pebbles and some medium pebbles; slightly acid; gradual smooth boundary.

Bt2—23 to 27 inches; brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium and coarse subangular blocky structure; firm; common fine roots; thin patchy clay films on faces of peds and some bridging between sand grains; tongues 6 to 12 inches wide extend to a depth of 48 to 58 inches or deeper; 18 percent fine pebbles and a few medium pebbles; slightly acid; abrupt irregular boundary.

2C1—27 to 53 inches; pale brown (10YR 6/3) very gravelly sand; single grained; loose; few fine roots; 35 percent fine and medium pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—53 to 60 inches; light brownish gray (10YR 6/2) very gravelly sand; single grained; loose; 50 percent fine and medium pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 22 to 36 inches. Coarse fragments make up 2 to 10 percent of the A horizon, 5 to 25 percent of the B horizon, and 10 to more than 50 percent of individual strata in the C horizon.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Reaction ranges from medium acid to neutral. A thin E horizon is present in some pedons. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 5. It is sandy loam, fine sandy loam, sandy clay loam, or loamy sand and the gravelly analogs. Reaction in the B horizon ranges from medium acid to neutral. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It usually is stratified sand, gravelly sand, very gravelly sand, or sand and gravel. Effervescence is slight or strong.

Bronson Series

The Bronson series consists of deep, moderately well drained soils on beach ridges, stream terraces, and outwash plains. These soils formed in moderately coarse textured and coarse textured materials. Permeability is moderately rapid in the solum and rapid in the substratum. Slope ranges from 1 to 6 percent.

Bronson soils are commonly adjacent to Digby and Millgrove soils and are similar to Rawson and Tuscola soils. Digby and Millgrove soils are wetter than the Bronson soils. They have colors of dominantly low chroma in the matrix or on faces of peds in the subsoil. Digby soils are on ridges and low knolls. Millgrove soils are on broad flats and in long, narrow areas along drainageways. They have a mollic epipedon. Rawson soils have contrasting fine textured or moderately fine textured glacial till or lacustrine material in the substratum. Tuscola soils have more clay in the subsoil than the Bronson soils and less gravel throughout the soil.

Typical pedon of Bronson sandy loam, 1 to 6 percent slopes, about 1 mile north-northwest of the hamlet of Farmer; in an area of Farmer Township 2,240 feet west and 1,080 feet south of the northeast corner of sec. 16, T. 5 N., R. 2 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine and very fine roots; few fine pores; 1 percent coarse fragments, mostly fine pebbles; neutral; abrupt smooth boundary.

Bt1—8 to 14 inches; dark yellowish brown (10YR 4/4) loam; few medium faint brown (7.5YR 4/4) mottles; weak medium and fine subangular blocky structure; friable; few fine roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds and bridging between sand grains; 8 percent coarse fragments of mostly fine gravel; neutral; clear wavy boundary.

Bt2—14 to 23 inches; dark yellowish brown (10YR 4/4) sandy loam; few fine distinct brown (7.5YR 5/4) and common medium distinct grayish brown (10YR 5/2) and gray (10YR 5/1) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few fine pores; thin patchy brown (7.5YR 4/4) clay films on faces of peds and bridging between sand grains; 12 percent coarse fragments, mostly fine pebbles; medium acid; clear wavy boundary.

Bt3—23 to 39 inches; dark yellowish brown (10YR 4/4) sandy loam; common medium faint brown (7.5YR 4/4) and common medium distinct grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; friable; common very dark grayish brown (10YR 3/2) organic stains on faces of peds; thin patchy brown (7.5YR 4/4) clay films on faces of peds and bridging between sand grains; few fine pores; 3 percent coarse fragments, mostly fine pebbles; neutral; clear wavy boundary.

C1—39 to 53 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; common medium faint brown (7.5YR 4/4) mottles; very weak medium subangular blocky structure grades to massive with depth; very friable; 25 percent coarse fragments, mostly fine pebbles; slight effervescence; mildly alkaline; abrupt smooth boundary.

C2—53 to 60 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; few fine faint brown (7.5YR 4/4) mottles; massive; very friable; 20 percent fine and medium pebbles; slight effervescence; mildly alkaline.

The solum ranges from 28 to 40 inches in thickness. Coarse fragments make up 0 to 15 percent of the A horizon and the upper part of the B horizon and 0 to 25 percent of the lower part of the B horizon and the upper part of the C horizon. Some subhorizons in the B and C horizons have little or no gravel.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Reaction ranges from medium acid to neutral. A thin E horizon is in some pedons. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam, sandy loam, or sandy clay loam and the gravelly analogs. Reaction in the B horizon ranges from medium acid to neutral. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is usually stratified or nonstratified fine sandy loam, sandy loam, loamy sand, or loamy fine sand and the gravelly analogs. Reaction is mildly alkaline or moderately alkaline.

Broughton Series

The Broughton series consists of deep, moderately well drained soils on the dissected parts of the lake plains. These soils formed in fine textured lacustrine sediment. Permeability is very slow. Slope ranges from 6 to 35 percent.

Broughton soils are commonly adjacent to Roselms and Paulding soils and are similar to St. Clair soils. Paulding and Roselms soils are wetter and have colors or mottles of dominantly low chroma immediately below the surface layer. Paulding soils are on broad flats and in drainageways, and Roselms soils are on slight rises. St. Clair soils have less than 60 percent clay in the subsoil and do not have mottles of low chroma in the upper 10 inches of the argillic horizon. St. Clair soils formed in glacial till. They have more sand and coarse fragments throughout the soil.

Typical pedon of Broughton silt loam, 12 to 35 percent slopes, 4.25 miles south of the village of Ayersville; in an area of Highland Township 270 feet west and 346 feet south of the northeast corner of sec. 33, T. 3 N., R. 5 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; many fine roots; few medium and coarse roots; few very fine dark brown (7.5YR 4/4) stains (iron oxides); slightly acid; abrupt smooth boundary.

E—3 to 7 inches; light yellowish brown (10YR 6/4) silt loam; weak medium and fine subangular blocky structure; friable; many fine roots; common medium and coarse roots; common very fine dark brown (7.5YR 4/4) stains (iron oxides); strongly acid; clear smooth boundary.

Bt1—7 to 12 inches; yellowish brown (10YR 5/4) silty clay; moderate fine and very fine subangular blocky structure; firm; common fine and medium roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—12 to 17 inches; brown (10YR 4/3) clay; common fine distinct gray (5Y 6/1) and dark yellowish brown (10YR 4/4) mottles; strong coarse subangular blocky structure parting to moderate medium angular blocky; some medium prismatic structure; very firm; common fine roots; few medium roots; thin patchy dark brown (10YR 3/3) clay films on faces of peds; common very fine black (10YR 2/1) stains (iron and manganese oxides); neutral; gradual smooth boundary.

Bt3—17 to 31 inches; brown (10YR 5/3) clay; few fine distinct gray (N 5/0), light gray (5Y 6/1), and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate coarse and medium angular blocky; very firm; common fine roots; few medium roots; thin patchy clay films on vertical faces of peds; dark grayish brown (10YR 4/2) coatings on faces of peds; common very fine black (10YR 2/1) stains (iron and manganese oxides); strong effervescence; moderately alkaline; clear wavy boundary.

C—31 to 60 inches; brown (10YR 5/3) clay; massive; some vertical cleavage planes; firm; few fine roots; dark grayish brown (10YR 4/2) coatings on vertical cleavage planes; few medium distinct greenish gray (5GY 6/1) mottles on cleavages; few spots of accumulated gypsum crystals; strong effervescence; moderately alkaline.

The solum ranges from 15 to 32 inches in thickness. The depth to free carbonates ranges from 12 to 20 inches. It is less where the soils are severely eroded.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is silt loam or clay. Reaction ranges from medium acid to neutral. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Reaction of the Bt horizon ranges from medium acid to moderately alkaline. The least acid reaction is in the lower subhorizons of most pedons. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It has a reaction of mildly alkaline or moderately alkaline.

Carlisle Series

The Carlisle series consists of deep, very poorly drained soils in depressions of end moraines. These soils formed in more than 51 inches of accumulated organic material. Permeability is moderately slow to moderately rapid. Slope is 0 to 2 percent.

Carlisle soils are commonly adjacent to Mermill and Pewamo soils. Mermill soils and Pewamo soils formed in mineral material and are on slightly higher positions than Carlisle soils.

Typical pedon of Carlisle muck, 2.2 miles south-southwest of the village of Edgerton; in an area of Milford Township 2,000 feet west and 370 feet north of the center of sec. 4, T. 5 N., R. 1 E.

Oa1—0 to 8 inches; very dark gray (10YR 3/1) broken face, very dark brown (10YR 2/2) rubbed sapric material; about 15 percent fibers, 1 percent rubbed; weak blocky structure parting to weak fine granular; friable; many fine roots; 20 percent mineral material; neutral; abrupt smooth boundary.

Oa2—8 to 16 inches; very dark gray (10YR 3/1) broken face, black (10YR 2/1) rubbed sapric material; about 5 percent fibers, 1 percent rubbed; weak medium granular structure; friable; many fine roots; 20 percent mineral; fibers principally sedges and weeds and a few woody fragments, 0 to 3/4 inch; medium acid; abrupt smooth boundary.

Oa3—16 to 28 inches; dark brown (7.5YR 4/3) broken face, very dark brown (10YR 3/2) rubbed sapric material; about 40 percent fibers, 2 percent rubbed; weak medium subangular blocky structure parting to weak medium granular; friable; common fine roots; fibers principally sedges; strongly acid; abrupt smooth boundary.

Oa4—28 to 48 inches; dark brown (7.5YR 4/3) broken face, very dark brown (10YR 2/2) rubbed sapric material; about 30 percent fibers, 5 percent rubbed; massive; friable; few fine roots; fibers principally sedges and a few woody fragments; medium acid; abrupt smooth boundary.

Oa5—48 to 60 inches; dark reddish brown (5YR 2/2) broken face, black (5YR 2/1) rubbed sapric material; about 15 percent fibers, 2 percent rubbed; massive; friable; fibers are principally sedges and very few woody fragments; medium acid.

The organic deposit is more than 51 inches thick. The unrubbed fiber content ranges from 5 to 40 percent to a depth of about 51 inches. The rubbed fiber content ranges from 0 to 8 percent. Reaction is medium acid to neutral in the surface tier, strongly acid to neutral in the subsurface tier, and strongly acid to mildly alkaline in the bottom tier.

The surface tier has rubbed hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 10 to 30 percent mineral material. The subsurface tier has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3. The bottom tier has hue of 5YR or 7.5YR, value of 2 to 4, and chroma of 1 to 3.

Colwood Series

The Colwood series consists of deep, very poorly drained soils. These soils are in areas of outwash materials on lake plains. They formed in medium textured and moderately fine textured materials 25 to 35 inches deep to stratified, calcareous, medium textured to coarse textured material. Permeability is moderate. Slope is 0 to 2 percent.

Colwood soils are commonly adjacent to Kibbie and Tuscola soils and are similar to Mermill and Millgrove soils. Kibbie and Tuscola soils are better drained than Colwood soils and do not have colors of dominantly low chroma in the subsoil. They are on low ridges and knolls. Millgrove and Mermill soils have an argillic horizon.

Typical pedon of Colwood loam, 4.5 miles east-northeast of the village of Hicksville; in an area of Mark Township 1,452 feet south and 370 feet east of the northwest corner of sec. 7, T. 4 N., R. 2 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure parting to moderate medium granular; friable; many fine roots; neutral; abrupt smooth boundary.

A—8 to 12 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; very few fine rounded pebbles; neutral; abrupt smooth boundary.

Bg1—12 to 17 inches; gray (5Y 5/1) loam; common fine and medium distinct dark brown (7.5YR 4/4) mottles; weak fine and very fine subangular blocky structure; friable; common fine roots; very few fine rounded pebbles; dark gray (10YR 4/1) coatings on faces of peds; common fine and medium pores; neutral; clear wavy boundary.

Bg2—17 to 24 inches; gray (5Y 6/1) loam; common fine and medium prominent yellowish brown (10YR 5/6) mottles; moderate medium and fine angular blocky structure; friable; common fine roots; olive gray (5Y 5/2) coatings on faces of peds; common very fine and fine pores; few fine black (5YR 2/1) concretions (iron and manganese oxides); very few fine rounded pebbles; neutral; gradual wavy boundary.

Bg3—24 to 34 inches; gray (5Y 6/1) loam; many medium and coarse prominent yellowish brown (10YR 5/6) mottles; moderate coarse and medium angular blocky structure; friable; few fine roots; gray (5Y 5/1) coatings on faces of peds; common fine and very fine pores; few fine black (5YR 2/1) concretions (iron and manganese oxides); very few fine rounded pebbles; neutral; clear wavy boundary.

Cg1—34 to 50 inches; gray (5Y 6/1) stratified silty clay loam, silt loam, and fine sandy loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; friable; few fine roots; gray (5Y 5/1) coatings on faces of peds; common very fine pores; mildly alkaline; gradual wavy boundary.

Cg2—50 to 60 inches; gray (5Y 5/1) and olive gray (5Y 5/2) stratified sandy loam and silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive, but has distinct bedding planes; friable; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 50 inches. Coarse fragments make up 0 to 2 percent of the upper and middle parts of the solum. The mollic epipedon ranges from 10 to 13 inches in thickness.

The Ap and A horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Reaction is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2. It is loam, silt loam, very fine sandy loam, sandy clay loam, or silty clay loam. Reaction in the B horizon is neutral or mildly alkaline. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. Some strata have higher chroma. The C horizon is stratified silt, very fine sand, silt loam, silty clay loam, fine sandy loam, and sandy loam. Reaction is mildly alkaline or moderately alkaline.

Defiance Series

The Defiance series consists of deep, somewhat poorly drained soils on flood plains. These soils formed dominantly in fine textured and moderately fine textured, recent alluvium. Permeability is slow. Slope is 0 to 2 percent.

Defiance soils are commonly adjacent to and are similar to Wabasha soils. Wabasha soils have a darker surface layer. They are very poorly drained soils in depressions.

Typical pedon of Defiance silty clay loam, frequently flooded, about 9 3/4 miles south-southeast of the city of Defiance; in an area of Highland Township 594 feet west and 924 feet north of the southeast corner of sec. 34, T. 3 N., R. 5 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, light gray (10YR 7/2) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; many fine and very fine roots; common fine pores; common very fine dark reddish brown (5YR 3/3) concretions (iron and manganese oxides); slightly acid; abrupt smooth boundary.

Bw—8 to 12 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct grayish brown (2.5Y 5/2) and few medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak fine and medium subangular blocky; firm; common very fine roots; common very fine pores; grayish brown (2.5Y 5/2) coatings on faces of peds; few black (10YR 2/1) stains (iron and manganese oxides); slightly acid; clear smooth boundary.

Bg1—12 to 18 inches; grayish brown (2.5Y 5/2) silty clay; many medium distinct brown (7.5YR 4/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; common very fine roots; common very fine pores; slightly acid; gradual smooth boundary.

Bg2—18 to 27 inches; grayish brown (2.5Y 5/2) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; common very fine roots; common very fine and fine pores; few fine black (10YR 2/1) concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.

Bg3—27 to 39 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; common fine and very fine pores; common fine and medium black (10YR 2/1) concretions (iron and manganese oxides); mildly alkaline; gradual smooth boundary.

Cg1—39 to 44 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4) and few medium distinct gray (5Y 6/1) mottles; massive; friable; few fine roots; few very fine pores; common fine black (10YR 2/1) concretions (iron and manganese oxides); spots of slight effervescence; mildly alkaline; gradual smooth boundary.

Cg2—44 to 55 inches; olive gray (5Y 5/2) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; slight effervescence; mildly alkaline; abrupt wavy boundary.

C—55 to 60 inches; brown (10YR 4/3) silty clay; common medium faint dark yellowish brown (10YR 4/4) mottles; massive; very firm; thin strata of grayish brown (10YR 5/2) friable loam; strong effervescence; moderately alkaline.

The solum ranges from 28 to 50 inches in thickness. Reaction in the solum is slightly acid or neutral in the upper part and slightly acid to mildly alkaline in the lower part.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam or silty clay. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 3. It is dominantly silty clay loam or silty clay. In places it is stratified with coarser textured lenses. Reaction is mildly alkaline or moderately alkaline.

Del Rey Series

The Del Rey series consists of deep, somewhat poorly drained soils on lake plains. A few areas are on moraines. These soils formed in medium textured to fine textured, stratified lacustrine sediment. Permeability is slow. Slope ranges from 0 to 3 percent.

Del Rey soils are commonly adjacent to Lenawee soils and are similar to Blount, Fulton, and Nappanee soils. Blount and Nappanee soils formed in glacial till and have more sand and coarse fragments in the lower part of the subsoil and in the substratum. Fulton and Nappanee soils have more clay or range to clay in the subsoil and substratum. Lenawee soils are very poorly drained, and colors of low chroma dominate the middle and upper parts of the subsoil. They are on broad flats and in long, narrow depressions.

Typical pedon of Del Rey silt loam, 0 to 3 percent slopes, about 2 miles southeast of the village of Hicksville; in an area of Hicksville Township 1,188 feet north and 198 feet east of the center of sec. 27, T. 4 N., R. 1 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak medium and fine subangular blocky structure parting to moderate medium granular; friable; many fine and few medium roots; common fine pores; medium acid; abrupt smooth boundary.

BE—8 to 12 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct gray (10YR 6/1) and pale brown (10YR 6/3) mottles; moderate medium and fine subangular blocky structure; firm; common fine and few medium roots; common fine and very fine pores; thin very patchy gray (10YR 5/1) clay films on faces of peds; thin patchy light gray (10YR 7/2) silt coatings on faces of peds; few fine black (10YR 2/1) concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Bt—12 to 17 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) silty clay; many fine distinct gray (10YR 6/1) mottles; moderate coarse and medium subangular blocky structure; firm; common fine roots; few medium roots; common fine and very fine pores; thin nearly continuous grayish brown (10YR 5/2) clay films on faces of peds; few fine black (10YR 2/1) concretions (iron and manganese oxides); neutral; clear smooth boundary.

Btg1—17 to 21 inches; gray (10YR 6/1) silty clay; many medium distinct dark yellowish brown (10YR 4/4) mottles; moderate coarse and medium subangular blocky structure; very firm; common fine and few medium roots; common fine and very fine pores; thin patchy gray (10YR 5/1) clay films on faces of peds; few fine black (10YR 2/1) concretions and stains (iron and manganese oxides); neutral; gradual wavy boundary.

Btg2—21 to 32 inches; gray (10YR 6/1) silty clay; common medium distinct brown (10YR 4/3) mottles; moderate medium subangular blocky structure; very firm; common fine roots; common very fine pores; dark gray (10YR 4/1) coatings on faces of peds;

thin very patchy clay films on vertical faces of peds; few medium distinct white (10YR 8/2) calcium carbonate coatings on faces of peds; spots of strong effervescence; mildly alkaline; gradual wavy boundary.

BCg—32 to 50 inches; gray (10YR 6/1) silty clay loam; common medium distinct brown (10YR 5/3) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very firm; few fine roots; common fine and very fine pores; common fine black (10YR 2/1) stains (iron and manganese oxides); common medium distinct white (10YR 8/1) calcium carbonate coatings on faces of peds; strong effervescence; moderately alkaline; diffuse wavy boundary.

C1—50 to 55 inches; brown (10YR 5/3) silty clay loam; common fine distinct gray (10YR 5/1) mottles; massive; firm; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—55 to 60 inches; brown (10YR 5/3) silt loam; massive, but has weak breaks along bedding planes; friable; some dark brown (7.5YR 4/4) faces on plates; strong effervescence; moderately alkaline.

The solum ranges from 28 to 50 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Reaction ranges from medium acid to neutral. A thin E horizon is in some pedons. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. Subhorizons have chroma of 5 or 6. The B horizon is silty clay loam or silty clay. Reaction ranges from strongly acid to neutral in the upper part and is neutral or mildly alkaline in the lower part. The BC horizon has colors similar to those of the B horizon and is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 to 3. It is either entirely silty clay or silty clay loam, or it is stratified silty clay, silty clay loam, or silt loam. Reaction is mildly alkaline or moderately alkaline.

Del Rey Variant

The Del Rey Variant consists of deep, somewhat poorly drained soils. These soils are on lake plains and on outwash plains adjacent to stream valleys. They formed in moderately fine textured and fine textured, stratified lacustrine sediment that is 24 to 40 inches deep to stratified, calcareous, moderately coarse textured or coarse textured deposits. Permeability is slow in the solum and rapid in the substratum. Slope ranges from 0 to 3 percent.

Del Rey Variant soils are commonly adjacent to Lenawee soils. Lenawee soils are very poorly drained, and colors of low chroma dominate in the upper and middle parts of the subsoil. The Lenawee soils are on broad flats and in long, narrow depressions.

Typical pedon of Del Rey Variant silt loam, 0 to 3 percent slopes, about 2 miles east-southeast of the village of Sherwood; in an area of Delaware Township 264 feet east and 66 feet south of the center of sec. 28, T. 4 N., R. 3 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium and fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

BE—7 to 11 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; many fine roots; thin patchy pale brown (10YR 6/3) silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt—11 to 21 inches; yellowish brown (10YR 5/4) silty clay loam; many fine distinct grayish brown (10YR 5/2) mottles; moderate medium and fine subangular blocky structure; firm; common fine roots; thin patchy brown (10YR 5/3) clay films on faces of peds; medium acid; gradual smooth boundary.

Btg—21 to 32 inches; grayish brown (10YR 5/2) silty clay loam; many fine and medium distinct yellowish brown (10YR 5/4) mottles; weak coarse and medium subangular blocky structure; firm; common fine roots; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; common fine black (10YR 2/1) concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

BCg—32 to 37 inches; gray (10YR 5/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; few fine roots; medium acid; abrupt wavy boundary.

2Cg1—37 to 44 inches; grayish brown (10YR 5/2) and brown (10YR 5/3) stratified sandy loam and loamy sand; common medium distinct strong brown (7.5YR 5/6) and gray (10YR 6/1) mottles; weak medium platy structure; very friable; neutral; abrupt wavy boundary.

2Cg2—44 to 60 inches; dark grayish brown (10YR 4/2) gravelly sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; thin lenses of sandy loam; neutral.

The solum ranges from 24 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. Reaction ranges from medium acid to neutral. An E or B/E horizon is in some pedons. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam or silty clay. Reaction is medium acid or slightly acid in the upper part and medium acid to mildly alkaline in the lower part. The 2C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is sandy loam or loamy sand and their gravelly analogs. In places the texture is silt or silt loam. Reaction is neutral to moderately alkaline.

Digby Series

The Digby series consists of deep, somewhat poorly drained soils on beach ridges, outwash plains, and stream terraces. These soils formed in medium textured and moderately coarse textured material and in the underlying stratified, calcareous, medium textured to coarse textured deposits. Permeability is moderate in the solum and rapid in the substratum. Slope ranges from 0 to 3 percent.

Digby soils are commonly adjacent to Millgrove and Rawson soils and are similar to Haskins and Kibbie soils. Haskins soils have contrasting, fine textured or moderately fine textured glacial till or lacustrine material in the substratum. Kibbie soils do not have the colors of low chroma on faces of peds throughout the argillic horizon that Digby soils have. Millgrove soils are very poorly drained and have colors of dominantly low chroma in the subsoil. The Millgrove soils have a mollic epipedon. They are on broad flats and in long, narrow areas along drainageways. Rawson soils are better drained and do not have mottles of low chroma in the upper part of the subsoil. They are on low ridges.

Typical pedon of Digby loam, 0 to 3 percent slopes, about 1 mile west-northwest of the village of Hicksville; in an area of Hicksville Township 840 feet south and 220 feet west of the center of sec. 17, T. 4 N., R. 1 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; common fine and very fine pores; neutral; abrupt smooth boundary.

Bt1—9 to 15 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; firm; common fine roots; common fine pores; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; 12 percent coarse fragments; medium acid; clear wavy boundary.

Bt2—15 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; many fine distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/4) mottles; moderate medium and fine subangular blocky structure; firm; common fine roots; few fine pores; dark grayish brown (10YR 4/2) coatings on faces of peds; medium continuous dark grayish brown (10YR 4/2) clay films on faces of peds; common fine distinct black (10YR 2/1) stains (iron and manganese oxides); 13 percent coarse fragments; slightly acid; clear wavy boundary.

Btg1—20 to 26 inches; grayish brown (10YR 5/2) gravelly clay loam; many medium distinct brownish yellow (10YR 6/6) mottles; moderate medium and fine subangular blocky structure; firm; common fine roots; common fine pores; dark grayish brown (10YR 4/2) coatings on faces of peds; medium continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 15 percent coarse fragments; neutral; gradual wavy boundary.

Btg2—26 to 35 inches; light brownish gray (2.5Y 6/2) gravelly loam; many fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak medium and fine subangular blocky structure; friable; few fine roots; few fine pores; grayish brown (10YR 5/2) ped faces; thin patchy dark grayish brown (10YR 4/2) clay films on vertical faces of peds; 23 percent coarse fragments; spotty strong effervescence; mildly alkaline; gradual wavy boundary.

2C1—35 to 44 inches; brown (10YR 5/3) very gravelly sandy loam; single grained; very friable; 35 percent coarse fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—44 to 60 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) stratified gravelly sandy loam and gravelly loamy sand; single grained; loose; 40 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 28 to 48 inches in thickness. Coarse fragments, mostly fine pebbles, make up 0 to 15 percent of the A horizon, 2 to 15 percent of the B horizon, and 15 to 40 percent of the 2B and 2C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is commonly loam but is sandy loam in some pedons. Reaction is slightly acid or neutral. Some pedons have an E horizon. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is sandy clay loam, fine sandy loam, or clay loam and strata of loam and sandy loam. Reaction ranges from medium acid to neutral. The 2B horizon is gravelly or very gravelly clay loam, loam, or sandy clay loam. Reaction is neutral or mildly alkaline. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is gravelly or very gravelly fine sandy loam, sandy loam, loamy fine sand, loamy sand, or sand and some thin layers of gravelly or very gravelly loam or silt loam. Reaction is mildly alkaline or moderately alkaline.

Fulton Series

The Fulton series consists of deep, somewhat poorly drained soils on lake plains. These soils formed in fine textured and moderately fine textured lacustrine sediment. Permeability is slow or very slow. Slope ranges from 0 to 3 percent.

Fulton soils are commonly adjacent to Toledo and Latty soils and are similar to Del Rey, Nappanee, and Roselms soils. Del Rey soils have less clay in the subsoil and substratum than Fulton soils. Latty and Toledo soils are wetter than Fulton soils. They are on flats and in long, narrow depressions. Gray is dominant in the subsoil. Toledo soils have a darker surface layer.

Nappanee soils have more sand and some coarse fragments throughout the soil.

Typical pedon of Fulton silty clay loam, 0 to 3 percent slopes, about 5.5 miles southwest of the village of Ayersville; in an area of Highland Township 2,100 feet south and 220 feet east of the northwest corner of sec. 31, T. 3 N., R. 5 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, light gray (10YR 7/2) dry; weak fine subangular blocky structure parting to weak fine granular; firm; some Bt material mixed in; many fine roots; medium acid; abrupt smooth boundary.

Bt—10 to 15 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct strong brown (7.5YR 5/8) mottles; moderate fine and very fine angular blocky structure; very firm; many fine roots; many fine pores; continuous coatings of grayish brown (2.5Y 5/2) on faces of peds; thin patchy clay films on vertical faces of peds; strongly acid; clear smooth boundary.

Btg1—15 to 20 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/8), and brown (10YR 4/3) mottles; moderate medium and fine angular blocky structure; very firm; common fine roots; thin patchy gray clay films on faces of peds; strongly acid; gradual wavy boundary.

Btg2—20 to 29 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct yellowish brown (10YR 5/8) and brown (10YR 4/3) mottles; moderate medium angular blocky structure; very firm; few fine roots; thin patchy gray clay films on faces of peds; slightly acid; gradual wavy boundary.

BCg—29 to 37 inches; grayish brown (2.5Y 5/2) clay; common fine and medium distinct dark yellowish brown (10YR 4/4) and brown (10YR 4/3) mottles; weak coarse and medium angular blocky structure; very firm; few fine roots; neutral; abrupt wavy boundary.

Cg—37 to 60 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; massive, but has weak distinct bedding planes; some vertical cleavage planes; very firm; some stratification; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 25 to 40 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Reaction ranges from medium acid to neutral. A thin E horizon is present in some pedons. The Bt horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 4. It is silty clay, clay, or silty clay loam and has thin bedding planes of silt loam or silt in some pedons. Reaction in the Bt horizon ranges from strongly acid to neutral. The least acid reaction is in lower subhorizons of most pedons. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silty clay, clay, or silty clay loam. Thin bedding planes of silt loam, loam, silt, or fine sand are in some pedons. The C horizon is mildly alkaline or moderately alkaline.

Genesee Series

The Genesee series consists of deep, well drained, moderately permeable soils on the higher parts of flood plains. These soils formed dominantly in medium textured and moderately fine textured recent alluvium. This alluvium washed from soils formed in calcareous glacial till or lacustrine sediment. Slope is 0 to 2 percent.

These soils have more silt and less sand in the control section than is definitive for Genesee series. They do not have free carbonates within a depth of 40 inches. These differences, however, do not alter the usefulness or behavior of the soils.

Genesee soils are commonly adjacent to Ross, Shoals, and Sloan soils and are similar to Ross soils. Ross and Genesee soils are in similar positions. Ross soils have a mollic epipedon more than 24 inches thick. Shoals and Sloan soils are wetter soils in lower positions on flood plains. They have mottles immediately below the surface layer. Sloan soils have a mollic epipedon.

Typical pedon of Genesee loam, occasionally flooded, south of the Auglaize River in the city of Defiance; in an area of Defiance Township 490 feet north and 1,490 feet east of the southwest corner of sec. 26, T. 4 N., R. 4 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few very dark grayish brown (10YR 3/2) stains on faces of peds; many fine roots; mildly alkaline; abrupt smooth boundary.

C1—10 to 17 inches; dark grayish brown (10YR 4/2) silt loam; weak medium and fine subangular blocky structure; friable; common fine roots; common very dark grayish brown (10YR 3/2) stains on faces of peds; mildly alkaline; clear smooth boundary.

C2—17 to 35 inches; dark grayish brown (10YR 4/2) silt loam; weak medium and fine subangular blocky structure; friable; common fine roots; common very dark grayish brown (10YR 3/2) stains on faces of peds; mildly alkaline; clear wavy boundary.

C3—35 to 50 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure in upper 7 inches, massive below; firm; few fine roots; some dark grayish brown (10YR 4/2) faces of peds; mildly alkaline; gradual wavy boundary.

C4—50 to 60 inches; brown (10YR 4/3) silt loam; massive; friable; some vertical cleavage planes; dark grayish brown (10YR 4/2) stains on faces of cleavage planes; moderately alkaline.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Reaction is neutral or mildly alkaline. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Gray mottles are below a depth of 20 inches in some pedons. The C horizon is silt loam, loam, clay loam, or silty clay loam. The lower subhorizons of some pedons have strata of sandy loam, loamy sand, or sand. Reaction of the C horizon is commonly slightly acid to mildly alkaline, but in places subhorizons are moderately alkaline and calcareous.

Gilford Series

The Gilford series consists of deep, very poorly drained soils on terraces and deltas and in areas of outwash material on lake plains. These soils formed in moderately coarse textured and coarse textured material. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Slope is 0 to 2 percent.

Gilford soils are commonly adjacent to Mermill, Millgrove, and Tedrow soils and are similar to Millgrove and Wauseon soils. Mermill and Millgrove soils are on similar positions. They have more clay in the subsoil than Gilford soils and have an argillic horizon. Mermill and Wauseon soils have glacial till or lacustrine material in the lower part of the soil. Tedrow soils are somewhat poorly drained and are on flats and slight rises. They are less gray in the subsoil.

Typical pedon of Gilford fine sandy loam, about 3.5 miles south-southeast of the hamlet of Farmer; in an area of Mark Township 2,560 feet south and 175 feet west of the northeast corner of sec. 3, T. 4 N., R. 2 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak medium and coarse subangular blocky structure parting to moderate fine granular; very friable; many fine roots; slightly acid; abrupt smooth boundary.

A—9 to 11 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak medium subangular blocky structure; very friable; many fine roots; neutral; abrupt wavy boundary.

Bg1—11 to 17 inches; gray (10YR 5/1) fine sandy loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak coarse and medium subangular blocky structure; very friable; common fine roots; common very dark gray (10YR 3/1) fillings in root and worm channels; mildly alkaline; clear smooth boundary.

Bg2—17 to 28 inches; light gray (10YR 6/1) fine sandy loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine and medium subangular blocky structure; friable; common fine roots; some dark gray (10YR 4/1) coatings on faces of peds; mildly alkaline; clear wavy boundary.

Bg3—28 to 34 inches; gray (10YR 6/1) fine sandy loam; common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse subangular blocky structure; friable; common fine roots; mildly alkaline; clear wavy boundary.

Bg4—34 to 39 inches; gray (10YR 6/1) loamy fine sand; common fine distinct yellowish brown (10YR 5/4) mottles; very weak coarse subangular blocky structure; very friable; few fine roots; spots of slight effervescence; mildly alkaline; clear wavy boundary.

Cg—39 to 60 inches; light gray (10YR 6/1) stratified fine sand and loamy fine sand; single grained; loose; thin lenses of light olive brown (2.5Y 5/4 and 5/6) sand 1/4 to 1 inch thick; few fine pebbles; strong effervescence; moderately alkaline.

The solum ranges from 30 to 44 inches in thickness.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is slightly acid or neutral. The Bg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is commonly fine sandy loam or sandy loam and thin lenses of sandy clay loam or loam. Subhorizons of loamy fine sand are in the lower part of many pedons. Reaction in the Bg horizon ranges from slightly acid to mildly alkaline. The least acid reaction is in lower subhorizons of most pedons. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is commonly stratified loamy fine sand, fine sand, or loamy sand. Strata of fine sandy loam are in some pedons. The C horizon is mildly alkaline or moderately alkaline.

Glynwood Series

The Glynwood series consists of deep, moderately well drained soils on moraines. These soils formed in moderately fine textured glacial till. Permeability is slow. Slope ranges from 2 to 12 percent.

Glynwood soils are commonly adjacent to Blount, Morley, and Pewamo soils, and they are similar to Morley and St. Clair soils. Blount and Pewamo soils are wetter than Glynwood soils and have more colors of low chroma in the subsoil. They are on slight rises, in depressions, and along drainageways. Pewamo soils have a mollic epipedon. Morley and St. Clair soils do not have mottles of low chroma in the upper part of the subsoil. Morley soils are along the sides of valleys and on the more hilly parts of end moraines. St. Clair soils are less acid in the solum.

Typical pedon of Glynwood loam, 2 to 6 percent slopes, 2.2 miles west-northwest of the village of Hicksville; in an area of Hicksville Township 2,460 feet north and 120 feet east of the southwest corner of sec. 18, T. 4 N., R. 1 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; weak medium and coarse subangular blocky structure parting to moderate medium granular; friable; many fine roots;

common very fine pores; 1 percent coarse fragments; slightly acid; abrupt smooth boundary.

E—7 to 9 inches; brown (10YR 4/3) loam; weak medium platy structure parting to weak fine subangular blocky; friable; common fine roots; many very fine and fine pores; 2 percent coarse fragments; medium acid; abrupt smooth boundary.

BE—9 to 12 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; many fine and very fine pores; brown (10YR 4/3) faces of peds; thin patchy pale brown (10YR 6/3) silt coatings on faces of peds; 2 percent coarse fragments; medium acid; clear smooth boundary.

Bt1—12 to 20 inches; brown (10YR 4/3) clay; common fine distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; many very fine and fine pores; thin patchy dark brown (10YR 3/3) clay coatings on faces of peds; 2 percent coarse fragments; neutral; gradual wavy boundary.

Bt2—20 to 35 inches; yellowish brown (10YR 5/4) clay loam; common fine faint yellowish brown (10YR 5/6) and common fine distinct grayish brown (10YR 5/2) and gray (10YR 5/1) mottles; moderate coarse and medium angular blocky structure; very firm; few fine roots; common very fine pores; thin continuous grayish brown (10YR 5/2) clay films on vertical faces of peds; common medium light gray (10YR 7/2) calcium carbonate coatings on vertical faces of peds, few calcium coatings on horizontal faces; 2 percent coarse fragments; mildly alkaline; diffuse wavy boundary.

C—35 to 60 inches; yellowish brown (10YR 5/4) clay loam; common fine faint yellowish brown (10YR 5/4) and common fine distinct grayish brown (10YR 5/2) mottles; weak medium platy structure in the upper 3 inches, massive with vertical cleavage planes below; very firm; few fine roots; common very fine pores; common light gray (10YR 7/2) calcium carbonate coatings on vertical cleavage faces; strong effervescence; 3 percent coarse fragments; moderately alkaline.

The solum ranges from 22 to 40 inches in thickness. Coarse fragments make up 1 to 10 percent of the soil.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Reaction ranges from medium acid to neutral. A thin E or A/B horizon is present in some pedons. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is clay, clay loam, or silty clay. Some individual subhorizons in the B horizon are silty clay loam. Reaction ranges from strongly acid to neutral in the upper part and from medium acid to mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is clay loam or silty clay loam. The C horizon is mildly alkaline or moderately alkaline.

Haskins Series

The Haskins series consists of deep, somewhat poorly drained soils on outwash plains, terraces, low beach ridges, lake plains, and moraines. These soils formed in medium textured and moderately fine textured glacial outwash and the underlying moderately fine textured or fine textured glacial till or lacustrine material. Permeability is moderate in the outwash and slow or very slow in the underlying material. Slope ranges from 0 to 3 percent.

Haskins soils are commonly adjacent to Rawson and Mermill soils, and they are similar to Digby and Kibbie soils. Digby and Kibbie soils do not have the contrasting fine textured or moderately fine textured glacial till or lacustrine material within a depth of 40 inches. Mermill soils are very poorly drained, and colors in the subsoil are dominantly low chroma. They are on flats and along drainageways. Their surface layer is darker. Rawson soils are moderately well drained and well drained on low ridges. They do not have mottles of low chroma in the upper 10 inches of the argillic horizon.

Typical pedon of Haskins loam, 0 to 3 percent slopes, about 5.3 miles north-northeast of the city of Defiance; in an area of Adams Township 2,280 feet west and 105 feet north of the southeast corner of sec. 29, T. 5 N., R. 5 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; very friable; many fine and few medium roots; common fine and very fine pores; 5 percent fine and medium gravel; slightly acid; abrupt smooth boundary.

Bt—8 to 12 inches; dark yellowish brown (10YR 4/4) clay loam; many fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable; common fine roots; common fine pores; dark grayish brown (10YR 4/2) coatings on faces of peds; few distinct very dark grayish brown (10YR 3/2) organic coatings on vertical faces of peds; thin patchy clay films on vertical faces of peds; 5 percent fine and medium gravel; neutral; clear smooth boundary.

Btg1—12 to 23 inches; grayish brown (2.5Y 5/2) gravelly clay loam; many fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium subangular blocky structure; friable; common fine roots; common fine and very fine pores; dark grayish brown (10YR 4/2) coatings on faces of peds; thin patchy clay films on faces of peds; lenses of gravelly sandy clay loam; 15 percent fine and medium gravel; neutral; gradual smooth boundary.

Btg2—23 to 32 inches; grayish brown (2.5Y 5/2) gravelly clay loam; many fine distinct yellowish brown (10YR 5/4) and many fine faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; few fine roots; common fine and medium pores; dark grayish brown (10YR 4/2) coatings on faces of peds; thin patchy clay films on faces of peds; 20 percent fine and medium gravel; mildly alkaline; abrupt wavy boundary.

2Bt—32 to 41 inches; dark yellowish brown (10YR 4/4) clay; moderate coarse and medium angular blocky structure; very firm; very few fine roots; few fine and very fine pores; thin patchy clay films on vertical faces of peds; grayish brown (10YR 5/2) and gray (5Y 6/1) coatings on vertical structural breaks; patchy white (10YR 8/2) calcium carbonate coatings on vertical breaks; 3 percent coarse fragments; mildly alkaline; gradual wavy boundary.

2C—41 to 60 inches; brown (10YR 4/3) clay loam; massive; very weak vertical breaks; very firm; gray (5Y 5/1) faces of vertical cleavages; patchy white (10YR 8/2) calcium carbonate coatings on vertical cleavage planes; 3 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 25 to 45 inches in thickness. Depth to carbonates is the same as the thickness of the solum. Fine textured glacial till or lacustrine material is at a depth of 20 to 40 inches. Coarse fragments, mainly gravel, make up 2 to 10 percent of the A horizon, 2 to 20 percent of the B horizon, and 0 to 8 percent of the 2Bt and 2C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Reaction ranges from medium acid to neutral. A thin E horizon is present in some pedons. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is sandy clay loam, clay loam, or loam and their gravelly analogs. The Bt horizon ranges from strongly acid to mildly alkaline. The 2Bt and 2C horizons have hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 4. They are clay, silty clay, clay loam, or silty clay loam. The 2Bt horizon is neutral or mildly alkaline, and the 2C horizon is mildly alkaline or moderately alkaline.

Hoytville Series

The Hoytville series consists of deep, very poorly drained soils on lake plains. These soils formed in moderately fine textured and fine textured glacial till that has been modified by water. Permeability is slow. Slope is 0 to 2 percent.

Hoytville soils are commonly adjacent to Nappanee and St. Clair soils and are similar to Latty, Lenawee, Pewamo, and Toledo soils. Latty, Lenawee, and Toledo soils formed in lake sediment. They have less sand than the Hoytville soil. These three soils have very few or no coarse fragments. Latty and Lenawee soils have a lighter colored surface layer than Hoytville soils. Nappanee and St. Clair soils are better drained and are less gray in the subsoil. They have an ochric epipedon. Pewamo soils have a thicker dark surface layer than Hoytville soils and less clay in the lower part of the B horizon.

Typical pedon of Hoytville clay, three-fourths of a mile southeast of the village of Ayersville; in an area of Highland Township 396 feet north and 1 foot east of the center of sec. 10, T. 3 N., R. 5 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) clay, grayish brown (10YR 5/2) dry; moderate medium granular structure; firm; many fine roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

Btg1—9 to 24 inches; olive gray (5Y 5/2) clay; common fine faint brown (10YR 5/3) and common fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; thin patchy olive gray (5Y 5/2) clay films on vertical faces of peds; common medium very dark grayish brown (10YR 3/2) organic stains on vertical faces of peds in the upper 5 inches; 2 percent coarse fragments; neutral; gradual smooth boundary.

Btg2—24 to 32 inches; gray (5Y 5/1) clay; many fine and medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; very firm; common fine roots; thin patchy gray (5Y 5/1) clay films on faces of peds; 4 percent coarse fragments; mildly alkaline; gradual smooth boundary.

Btg3—32 to 40 inches; gray (10YR 5/1) clay; many fine and medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; very firm; few fine roots; thin patchy gray (5Y 5/1) clay films on faces of peds; few blotches of calcium carbonate on vertical faces of prisms; 3 percent coarse fragments; mildly alkaline; gradual wavy boundary.

C—40 to 60 inches; brown (10YR 5/3) clay; many fine and medium distinct gray (5Y 5/1) and dark gray (5Y 4/1) mottles; weak medium subangular blocky structure in the upper 10 inches, massive below; very firm; very few fine roots grading to none with depth; thin very patchy dark gray (5Y 4/1) clay films in the upper 6 inches; 4 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 36 to 55 inches in thickness. Coarse fragments make up 2 to 8 percent of the solum.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is clay or clay loam. It is slightly acid or neutral. The Bt horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is clay or silty clay. The Bt horizon is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is commonly clay or clay loam, but it is silty clay in some pedons. The C horizon is mildly alkaline or moderately alkaline.

Kibbie Series

The Kibbie series consists of deep, somewhat poorly drained soils in areas of outwash material of lake plains. These soils formed in medium textured to coarse textured materials. Permeability is moderate. Slope ranges from 0 to 3 percent.

These soils do not have the dark surface layer that is definitive for the Kibbie series. This difference, however, does not alter the usefulness or behavior of the soils.

Kibbie soils are commonly adjacent to Colwood and Tuscola soils and are similar to Digby, Haskins, and Tuscola soils. Colwood soils are very poorly drained soils on broad flats and in slight depressions. They have a mollic epipedon. Haskins soils have mottles of low chroma in the upper 10 inches of the argillic horizon. Digby soils have more coarse fragments throughout the soil. Haskins soils have moderately fine textured or fine textured glacial till or lacustrine material in the substratum. Tuscola soils are moderately well drained soils on low ridges.

Typical pedon of Kibbie loam, 0 to 3 percent slopes, 4.2 miles northeast of the village of Hicksville; in an area of Hicksville Township 1,452 feet north and 320 feet east of the center of sec. 12, T. 4 N., R. 1 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

E—9 to 14 inches; brown (10YR 4/3) fine sandy loam; weak medium and fine granular structure; friable; many fine roots; common fine pores; few fine pebbles; common medium black (10YR 2/1) stains (iron and manganese oxides); slightly acid; abrupt smooth boundary.

BE—14 to 21 inches; brown (10YR 4/3) fine sandy loam; few fine distinct light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; common fine roots; common fine pores; thin very patchy clay films on vertical faces of peds; few fine pebbles; few fine black (10YR 2/1) stains (iron and manganese oxides); slightly acid; clear wavy boundary.

Bt1—21 to 24 inches; brown (10YR 4/3) silty clay loam; common fine distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable; common fine roots; common fine pores; medium patchy clay films on faces of peds; common fine black (10YR 2/1) concretions (iron and manganese oxides); neutral; clear smooth boundary.

Bt2—24 to 41 inches; brown (10YR 5/3) silt loam; common fine distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; few fine roots; common fine pores; few fine black (10YR 2/1) concretions (iron and manganese oxides); neutral; gradual smooth boundary.

Cg1—41 to 54 inches; light brownish gray (10YR 6/2) fine sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive, but has weak bedding planes; friable; few fine black (10YR 2/1) concretions (iron and manganese oxides); mildly alkaline; abrupt wavy boundary.

Cg2—54 to 57 inches; gray (10YR 6/1) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; massive; vertical cleavages; friable; common fine black (10YR 2/1) concretions (iron and manganese oxides); strong effervescence; moderately alkaline; gradual smooth boundary.

Cg3—57 to 60 inches; gray (10YR 6/1) loamy fine sand; few fine distinct yellowish brown (10YR 5/6) mottles; massive; very friable; strong effervescence; moderately alkaline.

The solum ranges from 25 to 45 inches in thickness. Coarse fragments make up 0 to 2 percent of the soil.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2. Reaction is medium acid or neutral. The E horizon is not present in all pedons. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is fine sandy loam, loam, sandy clay loam, silty clay loam, or silt loam. Reaction ranges from medium acid to neutral. It is mildly alkaline in the lower part of some pedons. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 3. It is stratified. The layers are fine sandy loam, silt loam, loamy fine sand, or loam. The C horizon is mildly alkaline or moderately alkaline.

Landes Series

The Landes series consists of deep, well drained and moderately well drained soils on flood plains. These soils formed in medium textured to coarse textured, recent alluvium washed mainly from soils formed in calcareous glacial outwash, lacustrine sediment, and glacial till. Permeability is rapid. Slope is 0 to 2 percent.

Landes soils are commonly adjacent to Shoals and Sloan soils in lower parts of the flood plain. Shoals and Sloan soils are wetter than Landes soils. Gray is dominant, or mottles of low chroma are immediately below the surface layer.

Typical pedon of Landes fine sandy loam, occasionally flooded, about 6.5 miles northwest of the village of Hicksville; in an area of Milford Township 800 feet north and 600 feet east of the southwest corner of sec. 18, T. 5 N., R. 1 E.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Bw1—11 to 15 inches; brown (10YR 5/3) fine sandy loam, pale brown (10YR 6/3) dry; few fine faint yellowish brown (10YR 5/4) mottles; moderate fine granular structure; friable; common fine roots; pale brown (10YR 6/3) sand coatings on some faces of peds; common very dark grayish brown (10YR 3/2) fillings in old worm channels; slightly acid; clear smooth boundary.

Bw2—15 to 25 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium and fine subangular blocky structure; friable; dark brown (10YR 4/3) coatings on faces of peds; common fine roots; neutral; gradual smooth boundary.

Bw3—25 to 37 inches; brown (10YR 4/3) fine sandy loam; common medium faint dark yellowish brown (10YR 4/4) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; dark yellowish brown (10YR 4/4) faces of peds; common fine roots; few loam lenses; neutral; clear smooth boundary.

BC—37 to 45 inches; dark brown (7.5YR 4/4) and brown (10YR 4/3) fine sandy loam; weak coarse subangular blocky structure; friable; few fine roots; mildly alkaline; clear wavy boundary.

C—45 to 72 inches; brown (10YR 4/3) and dark brown (7.5YR 4/4) stratified loamy fine sand and fine sandy loam; single grained; loose; few fine roots; mildly alkaline in the upper part, slight effervescence and moderately alkaline in the lower part.

The solum ranges from 25 to 50 inches in thickness. The Ap horizon has hue of 10YR and value and chroma of 2 or 3. Reaction ranges from slightly acid to mildly alkaline. The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is loam or fine sandy loam and thin layers of loamy fine sand. The B horizon ranges from slightly acid to mildly alkaline. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. It is fine sandy loam, loamy fine sand, or fine sand and an occasional lense of loam.

Latty Series

The Latty series consists of deep, very poorly drained soils on lake plains. These soils formed in calcareous, fine textured and moderately fine textured lacustrine sediment. Permeability is very slow. Slope is 0 to 2 percent.

Latty soils are commonly adjacent to Fulton and Nappanee soils and are similar to Hoytville, Lenawee, Paulding, and Toledo soils. Fulton and Nappanee soils are better drained and do not have colors of dominantly low chroma in the subsoil. Hoytville and Nappanee soils formed in glacial till and have more sand and coarse fragments in the solum. Hoytville and Toledo soils have a darker surface layer. Lenawee soils have less clay in the subsoil and substratum than the Latty soils, and Paulding soils have more clay.

Typical pedon of Latty silty clay, about 2 miles east of the hamlet of Mark Center; in an area of Mark Township 1,260 feet south and 80 feet west of the northeast corner of sec. 23, T. 4 N., R. 2 E.

Ap—0 to 7 inches; dark grayish brown (2.5Y 4/2) silty clay, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; firm; many fine roots; neutral; abrupt smooth boundary.

Bg1—7 to 12 inches; gray (10YR 5/1) silty clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate fine angular blocky; firm; common fine roots; mildly alkaline; clear wavy boundary.

Bg2—12 to 19 inches; gray (10YR 5/1) silty clay; common fine prominent yellowish brown (10YR 5/6) and common fine distinct dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure parting to moderate fine and medium angular blocky; firm; common fine roots; mildly alkaline; gradual wavy boundary.

Bg3—19 to 26 inches; gray (5Y 5/1) silty clay; common fine prominent yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium angular blocky; firm; common fine roots; gray (10YR 5/1) coatings on faces of peds; mildly alkaline; gradual wavy boundary.

Bg4—26 to 33 inches; gray (5Y 5/1) silty clay; common fine prominent yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak fine angular blocky; very firm; few fine roots; mildly alkaline; clear wavy boundary.

Bg5—33 to 40 inches; gray (5Y 5/1) silty clay; many fine prominent yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse prismatic structure parting to weak fine angular blocky; very firm; few fine roots; few light gray (10YR 7/2) calcium carbonate concretions; mildly alkaline; abrupt wavy boundary.

Cg—40 to 60 inches; gray (5Y 5/1) silty clay; common fine and medium prominent yellowish brown (10YR 5/4) and brown (10YR 4/3) mottles; massive; some vertical cleavage planes; very firm; very few roots; gray (5Y 5/1) coatings on cleavage faces; 10 percent masses of light gray (10YR 7/2) calcium carbonate blotches; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 34 to 60 inches. Glacial till is at a depth of more than 48 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 1 or 2. It is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly silty clay or clay. Thin lenses of silty clay loam are in some pedons. The B horizon is neutral or mildly alkaline. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay, clay, or clay loam. The C horizon is mildly alkaline or moderately alkaline.

Lenawee Series

The Lenawee series consists of deep, very poorly drained soils on lake plains. These soils formed in calcareous, stratified, moderately fine textured and medium textured lacustrine sediment. Permeability is moderately slow. Slope is 0 to 2 percent.

These soils have a lighter colored surface layer than is definitive for the Lenawee series. This difference, however, does not alter the usefulness or behavior of the soils.

Lenawee soils are commonly adjacent to Del Rey and Fulton soils and are similar to Hoytville, Latty, and Toledo soils. Del Rey and Fulton soils are somewhat poorly drained. They do not have dominantly low chroma in the subsoil as the Lenawee soils do. These soils are on slight rises and low ridges adjacent to drainageways. The Fulton, Hoytville, Latty, and Toledo soils have more clay in the subsoil and substratum than the Lenawee soils. Hoytville soils formed in glacial till and have more sand and coarse fragments in the solum. Hoytville and Toledo soils have a darker surface layer than Lenawee soils.

Typical pedon of Lenawee silty clay loam, about 2.3 miles southeast of the village of Hicksville; in an area of Hicksville Township 195 feet west and 865 feet south of the northeast corner of sec. 27, T. 4 N., R. 1 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; moderate medium angular blocky structure parting to moderate coarse granular; firm; many fine roots; common fine and very fine pores; neutral; abrupt smooth boundary.

Bg1—9 to 15 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct light olive brown (2.5Y 5/4) and brown (7.5YR 4/4) mottles; moderate medium and coarse prismatic structure parting to moderate fine subangular blocky; firm; common fine roots; common fine and very fine pores; some very dark grayish brown (10YR 3/2) coatings on faces of peds; few very fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); clear smooth boundary.

Bg2—15 to 28 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; common fine and very fine pores; few fine dark brown (10YR 2/2) concretions (iron and manganese oxides); neutral; clear smooth boundary.

Bg3—28 to 39 inches; gray (5Y 6/1) silty clay; common medium and coarse prominent brown (10YR 4/3) and dark yellowish brown (10YR 4/4) mottles and common medium distinct light olive brown (2.5Y 5/4) mottles; moderate coarse prismatic structure parting to moderate coarse angular blocky; very firm; few fine roots; common very fine pores; grayish brown (2.5Y 5/2) coatings on faces of peds; common fine very dark brown (10YR 2/2) concretions (iron and manganese oxides), mostly in bottom 3 inches; mildly alkaline; clear wavy boundary.

Bg4—39 to 48 inches; gray (5Y 6/1) silty clay loam; many medium prominent dark yellowish brown (10YR 4/4 and 4/6) and brown (10YR 5/3) mottles; weak coarse prismatic structure parting to moderate coarse angular blocky; firm; few fine roots along vertical structural breaks; common fine and very fine pores; gray (5Y 5/1) coatings on faces of peds; common fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); common medium white (10YR 8/2) calcium carbonate coatings on faces of peds; strong effervescence; mildly alkaline; clear smooth boundary.

Cg—48 to 55 inches; gray (10YR 6/1) silt loam; many medium and coarse distinct light olive brown (2.5Y 5/4) and strong brown (7.5YR 5/6) mottles; massive, but has weak bedding planes; friable; few fine roots; few very fine pores; some tongues of silty clay loam; strong effervescence; moderately alkaline; clear smooth boundary.

C—55 to 66 inches; light olive brown (2.5Y 5/4) stratified silt loam and silty clay loam; many medium distinct gray (10YR 6/1), yellowish brown (10YR 5/6), and dark brown (7.5YR 4/4) mottles; massive, but has distinct bedding planes; friable; very few very fine pores; 1/3- to 2/3-inch lenses of gravelly loamy fine sand and silt; few fine pebbles or rounded shale pieces; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 30 to 55 inches in thickness.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly silty clay loam, silty clay, or clay loam and some thin strata of silt loam. Reaction in the B horizon ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 to 4. It is stratified or nonstratified silt loam, silty clay loam, or clay loam. Thin strata of silt and gravelly loamy fine sand are in some pedons. The C horizon is mildly alkaline or moderately alkaline.

Mermill Series

The Mermill series consists of deep, very poorly drained soils on stream terraces and outwash plains and near beach ridges of lake plains. These soils formed in medium textured and moderately fine textured glacial outwash and in the underlying moderately fine textured and fine textured glacial till or lacustrine material. Permeability is moderate in the glacial outwash and slow or very slow in the underlying material. Slope is 0 to 2 percent.

Mermill soils are commonly adjacent to Haskins and Rawson soils and are similar to Gilford, Millgrove, and Wauseon soils. Haskins and Rawson soils have an ochric epipedon. They do not have dominantly low chroma in the subsoil as Mermill soils do. Gilford and Wauseon soils have more sand and less clay in the middle and upper parts of the subsoil than Mermill soils. Millgrove soils have a thicker dark surface layer. They do not have the moderately fine textured or fine textured glacial till or lacustrine material in the lower part of the soil.

Typical pedon of Mermill loam, about 2 miles southeast of the village of Sherwood; in an area of Delaware Township 1,860 feet east and 400 feet north of the southwest corner of sec. 28, T. 4 N., R. 3 E.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Btg1—7 to 12 inches; grayish brown (2.5Y 5/2) loam; common fine distinct dark yellowish brown (10YR 4/4) and brown (10YR 4/3) mottles; moderate medium and fine subangular blocky structure; friable; many fine roots; dark gray (5Y 4/1) coatings on faces of peds; thin patchy clay films on vertical faces of peds; few fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg2—12 to 21 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; gray (5Y 5/1) coatings on faces of peds; thin patchy clay films on faces of peds; common fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); medium acid; gradual wavy boundary.

Btg3—21 to 30 inches; grayish brown (2.5Y 5/2) clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; common fine roots; thin patchy clay films on faces of peds; common fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); medium acid; abrupt wavy boundary.

2Bg—30 to 42 inches; gray (5Y 5/1) clay; common fine distinct dark yellowish brown (10YR 4/4) and brown (10YR 4/3) mottles; weak medium and fine subangular blocky structure; firm; few fine roots; common fine and medium black (10YR 2/1) concretions (iron and manganese oxides); neutral; abrupt wavy boundary.

2Cg—42 to 60 inches; gray (5Y 5/1) clay; common medium distinct dark yellowish brown (10YR 4/4) and brown (10YR 4/3) mottles; massive; some vertical cleavage planes; very firm; strong effervescence; moderately alkaline.

The solum ranges from 24 to 48 inches in thickness. The depth to fine textured or moderately fine textured glacial till or lacustrine material ranges from 20 to 40 inches. Coarse fragments make up 0 to 10 percent of the Bt horizon.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is slightly acid or neutral. It is commonly loam, but clay loam is in some pedons. The Bt horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is loam, sandy clay loam, or clay loam. Strata of sandy loam or fine sandy loam are in some pedons. Reaction in the Bt horizon ranges from medium acid to neutral. The 2B horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is clay loam, silty clay loam, silty clay, or clay. Reaction ranges from neutral to moderately alkaline. The 2C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 3. It is clay loam, silty clay, or clay. Reaction is mildly alkaline or moderately alkaline.

Millgrove Series

The Millgrove series consists of deep, very poorly drained soils on stream terraces, on outwash plains, and in low lying areas between beach ridges of lake plains. These soils formed in moderately coarse textured to moderately fine textured outwash and in the underlying moderately coarse textured and coarse textured material. Permeability is moderate. Slope is 0 to 2 percent.

Millgrove soils are commonly adjacent to Bronson and Digby soils and are similar to Colwood, Gilford, and Mermill soils. Digby and Bronson soils do not have a mollic epipedon or dominantly low chroma in the subsoil. They are on low ridges, knolls, and flats. Colwood soils have fewer coarse fragments than the Millgrove soils. They do not have an argillic horizon. Gilford soils have more sand than Millgrove soils and less clay in the subsoil. Mermill soils have moderately fine textured or fine textured glacial till or lacustrine material in the substratum.

Typical pedon of Millgrove loam, about 2 miles southwest of the village of Edgerton; in an area of Milford Township 2,460 feet west and 65 feet south of the northeast corner of sec. 5, T. 5 N., R. 1 E.

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 fine roots; very dark gray (10YR 3/1) faces of peds; 10 percent coarse fragments, mainly fine and medium pebbles; slightly acid; gradual smooth boundary.

A—10 to 15 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; friable; common fine roots; few fine pores; 10 percent coarse fragments, mostly fine pebbles and some medium pebbles; medium acid; abrupt smooth boundary.

Btg1—15 to 21 inches; grayish brown (2.5Y 5/2) sandy clay loam; common fine distinct light olive brown (2.5Y 5/6) mottles; weak medium and fine subangular blocky structure; friable; common fine roots; common fine pores; thin patchy clay films on faces of peds and bridging sand grains; dark grayish brown (2.5Y 4/2) coatings on faces of peds; common black (10YR 2/1) organic stains; 14 percent coarse fragments, mostly fine pebbles; slightly acid; clear wavy boundary.

Btg2—21 to 30 inches; grayish brown (2.5Y 5/2) gravelly sandy clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak coarse and medium subangular blocky structure; firm; common fine roots; common fine and medium pores; thin patchy grayish brown (2.5Y 5/2) clay films on faces of peds and bridging between sand grains; some dark gray (10YR 4/1) organic stains on faces of peds; 25 percent coarse fragments, mostly fine pebbles and some medium pebbles; neutral; clear wavy boundary.

Btg3—30 to 40 inches; grayish brown (2.5Y 5/2) gravelly sandy clay loam; common fine distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) mottles; weak coarse and medium subangular blocky structure; firm; few fine roots; common fine and very fine pores; thin patchy gray (5Y 5/1) clay films on faces of peds; dark gray (5Y 4/1) and gray (5Y 5/1) coatings on faces of peds; 30 percent coarse fragments, mostly fine pebbles and some medium pebbles; mildly alkaline; gradual wavy boundary.

Cg1—40 to 50 inches; grayish brown (2.5Y 5/2) gravelly sandy loam; common fine and medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; very few fine roots; thin patchy gray (5Y 5/1) and dark gray (5Y 4/1) clay films on vertical faces of peds; few dark gray (10YR 4/1) organic stains on faces of peds; 35 percent coarse fragments, mostly fine pebbles and some medium pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

2Cg2—50 to 60 inches; grayish brown (10YR 5/2) gravelly sandy loam; single grained; loose; 15 percent coarse fragments, mainly fine pebbles and some medium pebbles; slight effervescence; moderately alkaline.

The thickness of the solum and depth to carbonates range from 30 to 48 inches. Coarse fragments make up 2 to 15 percent of the A and B horizons and 10 to 50 percent of the 2B and 2C horizons.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Reaction is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is sandy clay loam, loam, or clay loam in the upper part and loam, sandy loam, sandy clay loam, or clay loam and their gravelly or very gravelly analogs in the lower part. The B horizon ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is sandy loam, loamy sand, sand, or the gravelly or gravelly analogs of these textures. It is stratified in many pedons. Considerable silt and clay material is in thin lenses or is mixed with the gravelly and sandy deposits in many pedons.

Morley Series

The Morley series consists of deep, well drained soils on dissected parts of moraines. These soils formed in moderately fine textured glacial till. Permeability is slow or moderately slow. Slope ranges from 12 to 18 percent.

Morley soils are commonly adjacent to Blount, Glynwood, and Pewamo soils and are similar to Glynwood and St. Clair soils. The Blount, Glynwood, and Pewamo soils are wetter than Morley soils and are less sloping. They have mottles of low chroma in the subsoil. Pewamo soils have a mollic epipedon. St. Clair soils have slightly more clay in the lower part of the B horizon than that of the Morley soils. They have a less acid solum.

Typical pedon of Morley clay loam, 12 to 18 percent slopes, eroded, about 2.5 miles south-southwest of the village of Edgerton; in an area of Milford Township 200 feet east and 1,080 feet north of the southwest corner of sec. 4, T. 5 N., R. 1 E.

Ap—0 to 9 inches; brown (10YR 4/3) clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure parting to moderate fine granular; friable; many fine roots; about 10 percent soil material from the B horizon mixed throughout; medium acid; abrupt smooth boundary.

BE—9 to 13 inches; brown (10YR 4/3) clay loam; common fine and medium distinct dark brown (7.5YR 4/4) mottles; moderate medium and fine subangular blocky structure; firm; common fine roots; medium continuous pale brown (10YR 6/3) silt coatings on faces of peds; thin very patchy dark brown (7.5YR 4/4) clay films on faces of peds; few fine black (10YR 2/1) concretions (iron and manganese oxides); 3 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—13 to 18 inches; brown (10YR 4/3) clay; common fine distinct brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; medium continuous dark brown (7.5YR 4/4) clay films on faces of peds; few fine and medium black (10YR 2/1) concretions (iron and manganese oxides); 3 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—18 to 22 inches; brown (10YR 4/3) clay; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few fine roots; medium continuous dark brown (10YR 4/3) clay films on faces of peds; few fine and medium black (10YR 2/1) concretions (iron and manganese oxides); 3 percent coarse fragments; medium acid; abrupt smooth boundary.

BC—22 to 34 inches; brown (10YR 4/3) clay loam; few medium faint dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to weak medium angular blocky; firm; few fine roots; thin patchy dark brown (10YR 4/3) clay films on vertical faces of peds; 3 percent coarse fragments; some spotty slight effervescence; mildly alkaline; gradual smooth boundary.

C—34 to 60 inches; brown (10YR 5/3) clay loam; few medium faint dark yellowish brown (10YR 4/4) mottles; massive; some vertical cleaveage planes; firm; gray (10YR 5/1) coatings on cleavage faces; 3 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. Coarse fragments make up 2 to 6 percent of the B and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Reaction is slightly acid or medium acid. A thin E horizon is present in some pedons. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, silty clay loam, silty clay, or clay. The B horizon is strongly acid or medium acid in the upper part and medium acid to mildly alkaline in the lower part. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is clay loam or silty clay loam. The C horizon is mildly alkaline or moderately alkaline.

Nappanee Series

The Nappanee series consists of deep, somewhat poorly drained soils on lake plains. These soils formed in moderately fine textured and fine textured glacial till that has been modified by water. Permeability is slow. Slope ranges from 0 to 3 percent.

Nappanee soils are commonly adjacent to Hoytville and St. Clair soils. They are similar to Blount, Del Rey, and Fulton soils. Hoytville soils have a darker surface layer and are very poorly drained. They are on broad flats and along drainageways. St. Clair soils are moderately well drained and well drained. They do not have gray mottles in the upper part of the soil as the Nappanee soils do. The St. Clair soils are on slope breaks along drainageways and along valley walls. Blount soils have less clay in the lower part of the soil than Nappanee soils. They are on moraines. Del Rey and Fulton soils formed in lake sediment. These soils have less sand and coarse fragments throughout the soil than the Nappanee soils.

Typical pedon of Nappanee loam, 0 to 3 percent slopes, about 6 miles east of the city of Defiance; in an area of Richland Township 990 feet west and 135 feet north of the southeast corner of sec. 23, T. 4 N., R. 5 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

Bt1—8 to 12 inches; brown (10YR 4/3) clay; many fine distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; firm; grayish brown (10YR 5/2) coatings and thin patchy clay films on faces of peds; common fine roots; common fine black (10YR 2/1) concretions (iron and manganese oxides); 1 percent coarse fragments; medium acid; gradual wavy boundary.

Bt2—12 to 18 inches; brown (10YR 4/3) clay; many fine distinct grayish brown (2.5Y 5/2) and dark yellowish brown (10YR 4/4) mottles; moderate coarse subangular blocky structure; very firm; common fine roots; grayish brown (2.5Y 5/2) and thin patchy clay films on faces of peds; common fine black (10YR 2/1) concretions (iron and manganese oxides); 3 percent coarse fragments; slightly acid; gradual wavy boundary.

Btg1—18 to 22 inches; dark grayish brown (10YR 4/2) clay; many fine faint grayish brown (2.5Y 5/2) and many fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate coarse and medium angular blocky structure; very firm; common fine roots; grayish brown (2.5Y 5/2) coatings and thin patchy clay films on faces of peds; 3 percent coarse fragments; common fine black (10YR 2/1) concretions (iron and manganese oxides); neutral; diffuse wavy boundary.

Btg2—22 to 30 inches; dark grayish brown (10YR 4/2) clay; many medium faint grayish brown (2.5Y 5/2) and many medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium angular blocky structure; very firm; few fine roots; olive gray (5Y 5/2) coatings and thin patchy clay films on vertical faces of peds; common light gray (10YR 7/1) calcium carbonate coatings on faces of peds; 2 percent coarse fragments; mildly alkaline; gradual wavy boundary.

Btg3—30 to 38 inches; grayish brown (2.5Y 5/2) clay; many medium distinct yellowish brown (10YR 5/4 and 5/6) and dark yellowish brown (10YR 4/4) mottles; weak medium angular blocky structure; very firm; few fine roots; olive gray (5Y 5/2) coatings and thin patchy clay films on vertical faces of peds; common fine black (10YR 2/1) concretions (iron and manganese oxides); common light gray (10YR 7/1) calcium carbonate coatings on faces of peds; 2 percent coarse fragments; some spots of slight effervescence; mildly alkaline; clear wavy boundary.

Cg—38 to 44 inches; grayish brown (2.5Y 5/2) clay; many medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak medium platy structure parting to weak fine angular blocky; very firm; gray (5Y 5/1) coatings and many light gray (10YR 7/1) calcium carbonate coatings on faces of peds; 5 percent coarse fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

C—44 to 60 inches; brown (10YR 4/3) clay loam; few fine distinct gray (5Y 5/1) mottles; weak medium subangular blocky structure grading to massive with depth; very firm; 4 percent coarse fragments; gray (5Y 5/1) coatings and a few light gray (10YR 7/1) calcium carbonate coatings on faces of vertical cleavages; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 22 to 40 inches. Coarse fragments make up 1 to 8 percent of the B and C horizons. The higher percentage of fragments is commonly in the lower subhorizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It ranges from medium acid to neutral. A thin E horizon is present in some pedons. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It is clay or silty clay. The B horizon ranges from strongly acid to slightly acid in the upper part and from slightly acid to mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. It is clay or clay loam and is mildly alkaline or moderately alkaline.

Oshtemo Series

The Oshtemo series consists of deep, well drained soils on stream terraces, beach ridges, and outwash plains. These soils formed in moderately coarse textured and coarse textured glacial outwash. Permeability is moderately rapid in the subsoil and very rapid in the substratum. Slope ranges from 2 to 6 percent.

Oshtemo soils are commonly adjacent to Digby and Millgrove soils and are similar to Belmore and Boyer soils. Belmore soils contain more clay in the subsoil. Boyer soils have a thinner solum than the Oshtemo soils and a coarser textured substratum. Digby and Millgrove soils are wetter, and they are dominantly gray or have mottles in the subsoil. They are on broad flats and along drainageways. Millgrove soils have a mollic epipedon.

Typical pedon of Oshtemo sandy loam, 2 to 6 percent slopes, about 3 miles east-northeast of the city of Defiance; in an area of Richland Township 620 feet west and 360 feet north of the southeast corner of sec. 17, T. 4 N., R. 5 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) sandy loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; very friable; many fine roots; 5 percent coarse fragments; medium acid; abrupt smooth boundary.

Bt1—9 to 21 inches; brown (7.5YR 4/4) sandy loam; weak medium and fine subangular blocky structure; friable; common fine roots; thin very patchy dark brown (7.5YR 4/4) clay films on faces of peds and bridging between sand grains; 8 percent coarse fragments, mostly fine pebbles; slightly acid; gradual smooth boundary.

Bt2—21 to 36 inches; brown (7.5YR 4/4) gravelly sandy loam; weak medium and fine subangular blocky structure; friable; common fine roots; thin patchy dark brown (7.5YR 4/4) clay films on vertical faces of peds and bridging between sand grains; 25 percent coarse fragments; slightly acid; gradual smooth boundary.

Bt3—36 to 46 inches; brown (7.5YR 4/4) gravelly sandy clay loam; weak coarse and medium subangular blocky structure; friable; few fine roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds and bridging between sand grains; 12 percent coarse fragments; slightly acid; clear smooth boundary.

Bt4—46 to 55 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak medium subangular blocky structure; friable; very few fine roots; dark brown (7.5YR 4/2 and 3/2) faces of peds; few dark reddish brown (5YR 2/2) coatings; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds and bridging between sand grains; 1- to 2-inch black (10YR 2/1) layer at bottom of horizon; 20 percent fine and medium pebbles; neutral; abrupt wavy boundary.

C—55 to 60 inches; pale brown (10YR 6/3) gravelly loamy sand; single grained; loose; 25 percent coarse fragments, mostly fine pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and depth to carbonates range from 40 to 60 inches. Coarse fragments make up 1 to 30 percent of the Bt horizon and more than 45 percent of the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is medium acid to neutral. The Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is sandy loam or sandy clay loam or their gravelly analogs. Lenses or layers of loamy sand are in the lower part of some pedons. The Bt horizon 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, value of 5 or 6, and chroma of 2 to 4. It is mildly alkaline or moderately alkaline. The C horizon is loamy sand, loamy fine sand, or loamy sand and their gravelly or very gravelly analogs. It is stratified in many pedons.

Ottokee Series

The Ottokee series consists of deep, moderately well drained, rapidly permeable soils on beach ridges and outwash plains. They are also on low sand dunes of lake plains or are adjacent to plains. These soils formed in coarse textured material deposited by water. Slope ranges from 1 to 6 percent.

Ottokee soils are commonly adjacent to Oshtemo and Tedrow soils and are similar to Seward soils. Oshtemo soils are better drained and in slightly higher positions on the landscape. They have more clay in some layers of the subsoil and more gravel throughout. The somewhat poorly drained Tedrow soils are on flats. They have gray mottling closer to the surface than the Ottokee soils. They do not have lamellae within a depth of 60 inches. Seward soils have glacial till or lacustrine material in the lower part of the soil.

Typical pedon of Ottokee loamy fine sand, 1 to 6 percent slopes, about 2 miles southeast of the village of Sherwood; in an area of Delaware Township 1,400 feet east and 520 feet north of the southwest corner of sec. 28, T. 4 N., R. 3 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

E1—9 to 22 inches; yellowish brown (10YR 5/4) fine sand; weak thick platy structure parting to single grained; very friable; common fine roots; slightly acid; gradual smooth boundary.

E2—22 to 30 inches; yellowish brown (10YR 5/4) fine sand; few fine distinct dark brown (7.5YR 4/4) mottles in the upper part and common yellowish red (5YR 4/6) mottles in the lower part; single grained; very friable; common fine roots; slightly acid; abrupt wavy boundary.

E&Bt—30 to 56 inches; pale brown (10YR 6/3) fine sand in the upper part and gray (10YR 6/1) fine sand in the lower part of the E; few fine faint light brownish gray (10YR 6/2) mottles; discontinuous yellowish red (5YR 5/6) loamy fine sand lamellae (Bt) are 1/8 to 1/2 inch thick; the E part is single grained; loose; the Bt part has weak medium subangular blocky structure in some areas and is massive in others; very friable; neutral; gradual wavy boundary.

C—56 to 60 inches; grayish brown (10YR 5/2) fine sand; common fine distinct reddish brown (5YR 4/4) mottles; single grained; loose; slight effervescence; mildly alkaline.

The thickness of the solum and depth to carbonates range from 40 to 80 inches. Some profiles have layers that have a few pebbles.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is slightly acid or neutral. The E horizon and the E part of the E&B horizon have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 4. Reaction ranges from medium acid to neutral. The lamellae in the Bt horizon are 1/4 inch to 2 inches thick. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loamy fine sand or fine sand. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 3. It ranges from loamy fine sand to fine sand. The C horizon ranges from neutral to moderately alkaline.

Paulding Series

The Paulding series consists of deep, very poorly drained soils on lake plains. These soils formed in calcareous, fine textured lacustrine sediment. Permeability is very slow. Slope is 0 to 2 percent.

Paulding soils are commonly adjacent to Roselms soils and are similar to Latty soils. The Roselms and Latty soils have less clay in the subsoil and substratum than the Paulding soils. Roselms soils are somewhat poorly drained and do not have dominantly low chroma in the subsoil. They are on slight rises.

Typical pedon of Paulding clay, about 5 miles north of the city of Defiance; in an area of Tiffin Township 100 feet west and 40 feet north of the southeast corner of sec. 26, T. 5 N., R. 4 E.

Ap—0 to 7 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; weak medium angular blocky structure; very firm; many fine roots; slightly acid; clear smooth boundary.

Bg1—7 to 15 inches; dark grayish brown (2.5Y 4/2) clay; common medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak coarse prismatic structure parting to weak fine angular blocky; very firm; common fine roots; slightly acid; gradual smooth boundary.

Bg2—15 to 21 inches; dark grayish brown (2.5Y 4/2) clay; common medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4 and 5/6) mottles; weak very coarse prismatic structure parting to weak fine angular blocky; very firm; few fine roots; slightly acid; diffuse wavy boundary.

Bg3—21 to 33 inches; dark grayish brown (2.5Y 4/2) clay; weak very coarse prismatic structure parting to weak medium and fine angular blocky; very firm; very few fine roots; neutral; gradual wavy boundary.

Cg1—33 to 42 inches; dark grayish brown (2.5Y 4/2) clay; common medium distinct olive brown (2.5Y 4/4) mottles; weak coarse prismatic structure parting to weak fine angular blocky; firm; some white (10YR 8/2) calcium carbonate coatings on vertical faces of peds; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—42 to 60 inches; dark grayish brown (2.5Y 4/2) clay; common fine distinct olive brown (2.5Y 4/4) and dark yellowish brown (10YR 4/4) mottles; massive with platy separations caused by laminations of sediment; firm; some white (10YR 8/2) calcium carbonate blotches on faces of plates; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 55 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 1 or 2. It is slightly acid or neutral. The B horizon has hue of 10YR, 2.5Y, or neutral; value of 4 or 5; and chroma of 0 to 2. It is 60 to 80 percent clay. The B horizon is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. The C horizon is 60 to 75 percent clay. It is mildly alkaline or moderately alkaline.

Pewamo Series

The Pewamo series consists of deep, very poorly drained soils on ground moraines and in narrow drainageways. These soils formed in calcareous, moderately fine textured glacial till. Permeability is moderately slow. Slope is 0 to 2 percent.

Pewamo soils are commonly adjacent to Blount and Glynwood soils and are similar to Bono, Hoytville, and Mermill soils. Blount and Glynwood soils are better drained and do not have dominantly low chroma in the subsoil. They are on rises, knolls, ridges, and side slopes along drainageways. Bono soils formed in lacustrine material and have less coarse fragments throughout. Bono and Hoytville soils have more clay in the lower part of the B horizon and in the C horizon than the Pewamo soils. Hoytville soils also have a thinner dark surface layer. Mermill soils formed in glacial outwash over glacial till or lacustrine material. They have more sand and less clay in the subsoil than Pewamo soils.

Typical pedon of Pewamo silty clay loam, about 5 miles north-northwest of the village of Hicksville; in an area of Milford Township 1,200 feet east and 860 feet north of the southwest corner of sec. 30, T. 5 N., R. 1 E.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to moderate medium granular; firm; many fine roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

Btg1—11 to 14 inches; gray (10YR 5/1) clay loam; common fine distinct yellowish brown (10YR 5/4) and brown (7.5YR 4/4) mottles; moderate coarse and medium subangular blocky structure; firm; common fine roots; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds and in worm channels; 3 percent coarse fragments; few fine and medium black (5YR 2/1) concretions (iron and manganese oxides); neutral; clear smooth boundary.

Btg2—14 to 26 inches; gray (10YR 5/1) clay loam; many medium distinct brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; 3 percent coarse fragments; common fine black (5YR 2/1) concretions (iron and manganese oxides); neutral; gradual smooth boundary.

Btg3—26 to 39 inches; gray (10YR 6/1) clay; many medium distinct brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; 3 percent coarse fragments; few fine black (5YR 2/1) concretions (iron and manganese oxides); few 1-inch very dark grayish brown (10YR 3/2) krotovinas; neutral; gradual smooth boundary.

Btg4—39 to 55 inches; gray (10YR 6/1) clay; common fine and medium distinct brown (10YR 4/3) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few fine roots; thin patchy gray (10YR 5/1) clay films on vertical faces of peds; 4 percent coarse fragments; few fine black (5YR 2/1) concretions (iron and manganese oxides); some spotty slight effervescence in the lower 6 inches of horizon; mildly alkaline; gradual smooth boundary.

Cg—55 to 60 inches; grayish brown (10YR 5/2) clay loam; common medium distinct brown (10YR 4/3) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure grading to massive with depth; very firm; few fine roots; 4 percent coarse fragments; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 28 to 60 inches. Coarse fragments make up 1 to 10 percent of the solum and substratum.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam, clay, silty clay, or silty clay loam. The B horizon ranges from slightly acid to mildly alkaline. Acidity decreases with depth. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam or silty clay loam. The C horizon is mildly alkaline or moderately alkaline.

Rawson Series

The Rawson series consists of deep, moderately well drained and well drained soils on stream terraces, beach ridges, and outwash plains. A few areas are on end moraines. These soils formed in medium textured and moderately fine textured glacial outwash and in the underlying fine textured or moderately fine textured glacial till or lacustrine material. Permeability is moderate in the outwash and slow or very slow in the underlying material. Slope ranges from 2 to 6 percent.

Rawson soils are commonly adjacent to Haskins and Mermill soils and are similar to Belmore, Bronson, and Tuscola soils. Belmore, Bronson, and Tuscola soils do not have the contrasting fine textured or moderately fine textured material within a depth of 40 inches. Bronson and Tuscola soils have mottles of low chroma in the upper 10 inches of the argillic horizon. Haskins and Mermill soils are wetter than Rawson soils. They are on slight rises, on broad flats, and along drainageways. They have more colors of low chroma in the subsoil. Mermill soils also have a darker surface layer.

Typical pedon of Rawson sandy loam, 2 to 6 percent slopes, about 2.5 miles southwest of the village of Hicksville; in an area of Hicksville Township 1,480 feet east and 2,140 feet south of the northwest corner of sec. 30, T. 4 N., R. 1 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; very friable; many fine roots; 4 percent fine gravel; medium acid; abrupt smooth boundary.

Bt1—9 to 15 inches; dark brown (10YR 4/3) sandy clay loam; few medium faint dark yellowish brown (10YR 4/4) mottles; weak medium and fine subangular blocky structure; friable; thin patchy clay films on faces of peds and bridging between sand grains; common fine roots; 8 percent coarse fragments, mainly fine and very fine pebbles; medium acid; gradual smooth boundary.

Bt2—15 to 24 inches; dark brown (10YR 4/3) sandy clay loam; moderate medium and fine subangular blocky structure; friable; thin patchy dark brown (7.5YR 3/2) clay films on faces of peds and bridging between sand grains; common fine roots; 8 percent coarse fragments, mostly fine pebbles; medium acid; clear wavy boundary.

Bt3—24 to 32 inches; dark brown (10YR 4/3) sandy clay loam; moderate coarse and medium subangular blocky structure; friable; thin patchy dark brown (7.5YR 4/2) clay films on faces of peds and bridging between sand grains; few fine roots; 8 percent coarse fragments, mainly fine pebbles; slightly acid; abrupt wavy boundary.

Bt4—32 to 36 inches; dark brown (10YR 4/2) sandy clay loam; weak medium subangular blocky structure; friable; thin patchy dark brown (10YR 4/3) clay films on faces of peds and bridging between sand grains; some very dark grayish brown (10YR 3/2) coatings on faces of peds; 12 percent coarse fragments, mainly fine pebbles; few angular fragments; neutral; abrupt wavy boundary.

2Btg—36 to 40 inches; grayish brown (10YR 5/2) clay; common coarse distinct dark yellowish brown (10YR 4/6) mottles; moderate medium angular blocky structure; very firm; thin patchy brown (10YR 4/3) clay films on faces of peds; 4 percent coarse fragments; spots of slight effervescence; mildly alkaline; clear wavy boundary.

2Cg—40 to 48 inches; grayish brown (10YR 5/2) clay loam; many medium distinct dark yellowish brown (10YR 4/4 and 4/6) mottles; some evidence of platy structure parting to weak medium angular blocky; very firm; patchy light gray (10YR 7/1) calcium carbonate blotches on faces of peds; 4 percent coarse fragments, mainly fine pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

2C—48 to 60 inches; dark brown (10YR 4/3) clay loam; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; massive; some vertical cleavage planes; very firm; patchy light gray (10YR 7/1) calcium carbonate coatings on faces of cleavages; 4 percent coarse fragments, mainly fine pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 48 inches and typically extend into the underlying fine textured or moderately fine textured material. Coarse fragments, dominantly gravel, make up 2 to 30 percent of the Bt horizon and 2 to 8 percent of the 2Bt and 2C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. 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 or 4. It is loam, sandy clay loam, or clay loam and their gravelly analogs. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is neutral or mildly alkaline. The 2Bt horizon is clay loam, silty clay loam, clay, or silty clay. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is clay loam, clay, silty clay loam, or silty clay.

Rimer Series

The Rimer series consists of deep, somewhat poorly drained soils on stream terraces and in areas of outwash materials on lake plains. Some areas are on moraines. These soils formed in coarse textured glacial outwash and in the underlying moderately fine textured and fine textured glacial till or lacustrine material. Permeability is rapid in the upper part of the solum and slow or very slow in the lower part of the solum and in the substratum. Slope ranges from 0 to 3 percent.

Rimer soils are commonly adjacent to Seward and Wauseon soils and are similar to Tedrow soils. Seward soils are moderately well drained and do not have mottles of low chroma in the upper 10 inches of the argillic horizon. Wauseon soils are very poorly drained and have dominantly low chroma in the subsoil. Seward soils are on low rises, and Wauseon soils are on broad flats and in depressions. Tedrow soils do not have glacial till or lacustrine material in the lower part of the soil.

Typical pedon of Rimer loamy fine sand, 0 to 3 percent slopes, about 3 1/2 miles northeast of the city of Defiance; in an area of Richland Township 1,160 feet north and 700 feet east of the southwest corner of sec. 8, T. 4 N., R. 5 E.

AP—0 to 11 inches; dark grayish brown (10YR 4/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

E1—11 to 17 inches; yellowish brown (10YR 5/4) loamy fine sand; many medium distinct grayish brown (10YR 5/2) mottles; single grained; loose; common fine roots; slightly acid; gradual wavy boundary.

E2—17 to 22 inches; grayish brown (10YR 5/2) loamy fine sand; few medium distinct brown (7.5YR 4/4) and many medium distinct yellowish brown (10YR 5/4) mottles; single grained; loose; common fine roots; slightly acid; gradual wavy boundary.

E3—22 to 29 inches; yellowish brown (10YR 5/4) loamy fine sand; common medium distinct dark brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; single grained; loose; few fine roots; neutral; clear wavy boundary.

Bt1—29 to 36 inches; yellowish brown (10YR 5/4) fine sandy loam; common medium distinct brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; weak medium and fine subangular blocky structure; friable; few fine roots; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds and numerous bridgings between sand grains; neutral; abrupt wavy boundary.

2Bt2—36 to 46 inches; gray (10YR 5/1) clay loam; many medium and coarse distinct dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very firm; thin patchy clay films on vertical faces of peds; 2 percent coarse fragments; spots of slight effervescence in the upper part; strong effervescence in the lower 6 inches; mildly alkaline; gradual wavy boundary.

2C—46 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) mottles; massive; very firm; 2 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 24 to 48 inches in thickness. The coarse textured deposit ranges from 20 to 32 inches in thickness. Coarse fragments make up 0 to 3 percent of the E horizon and 0 to 8 percent of the 2B and 2C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It is commonly loamy fine sand, but it is fine sand in some pedons. It ranges from medium acid to neutral. The E horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is loamy fine sand, fine sand, or loamy sand. The E horizon ranges from strongly acid to neutral. The Bt horizon has hue of 10YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is fine sandy loam, sandy loam, or sandy clay loam. The Bt horizon ranges from medium acid to neutral. The 2Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is clay, silty clay, clay loam, or silty clay loam. The 2Bt horizon is neutral or mildly alkaline. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is clay, silty clay, clay loam, or silty clay loam. The 2C horizon is mildly alkaline or moderately alkaline.

Roselms Series

The Roselms series consists of deep, somewhat poorly drained soils on lake plains. These soils formed in calcareous, fine textured lacustrine sediment. Permeability is very slow. Slope ranges from 0 to 3 percent.

Roselms soils are commonly adjacent to Broughton and Paulding soils and are similar to Del Rey and Fulton soils. Broughton soils are moderately well drained and do not have as many mottles of low chroma in the upper part of the subsoil. They are on slope breaks along drainageways and along the sides of valleys. The Del

Rey and Fulton soils have less clay in the subsoil and the upper part of the substratum than Roselms soils. Paulding soils are very poorly drained and are on broad flats. They are dominantly gray in the subsoil.

Typical pedon of Roselms silty clay, 0 to 3 percent slopes, about 3 3/4 miles east of the hamlet of Ney; in an area of Tiffin Township 300 feet south and 240 feet east of the northwest corner of sec. 19, T. 5 N., R. 4 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, light brownish gray (10YR 6/2) dry; moderate medium granular structure grading to subangular blocky in the lower part; firm; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 17 inches; yellowish brown (10YR 5/4) clay; many fine distinct grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; firm; common fine roots; grayish brown (10YR 5/2) coatings and thin very patchy dark grayish brown (10YR 4/2) clay films on faces of peds; some thin very patchy silt coatings on vertical faces of peds; strongly acid; clear smooth boundary.

Bt2—17 to 25 inches; brown (10YR 4/3) clay; common fine and medium faint dark yellowish brown (10YR 4/4) and dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; firm; common fine roots; grayish brown (10YR 5/2) coatings and thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; few fine black (10YR 2/1) stains (iron and manganese oxides) on faces of peds; mildly alkaline; clear smooth boundary.

Btg—25 to 32 inches; gray (10YR 5/1) clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium angular blocky structure; very firm; few fine roots; thin very patchy dark grayish brown (10YR 4/2) clay films on vertical faces of peds; few fine black (5YR 2/1) stains (iron and manganese oxides); few white (10YR 8/1) calcium carbonate coatings; spotty slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—32 to 40 inches; gray (10YR 5/1) clay; common fine and medium distinct brown (10YR 5/3) and yellowish brown (10YR 5/4) mottles; massive; some vertical cleavage planes; very firm; some dark gray (10YR 4/1) coatings on cleavage planes; few fine black (5YR 2/1) stains (iron and manganese oxides); common white (10YR 8/1) calcium carbonate coatings on faces of cleavages; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—40 to 47 inches; yellowish brown (10YR 5/4) clay; many fine distinct gray (10YR 5/1) mottles; massive; some vertical cleavage planes; very firm; gray (10YR 5/1) coatings on faces of cleavages; common fine black (5YR 2/1) stains (iron and manganese oxides); many fine and medium white (10YR 8/1) calcium carbonate coatings on faces of cleavages; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—47 to 60 inches; light olive brown (2.5Y 5/4) clay; common fine and medium distinct grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) mottles; massive; some vertical cleavages; very firm; gray (5Y 5/1) and greenish gray (5GY 5/1) coatings on faces of cleavages; some gypsum crystals; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 35 inches. The lower few inches of the solum in many pedons have calcareous blotches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay or loam. The Ap horizon is medium acid to neutral. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. Clay ranges from 60 to 80 percent. The B horizon ranges from strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the middle and lower parts. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is dominantly clay and thin lenses of silty clay loam and silt loam in some pedons. The C horizon is mildly alkaline or moderately alkaline.

Ross Series

The Ross series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed dominantly in medium textured and moderately fine textured, recent alluvium washed from soils formed in calcareous glacial till or lacustrine sediment. Slope is 0 to 2 percent.

Ross soils are commonly adjacent to Genesee, Shoals, and Sloan soils and are similar to Genesee soils. Genesee and Ross soils are in similar positions in the landscape. Genesee and Shoals soils do not have a mollic epipedon. Shoals and Sloan soils are wetter than Ross soils and in lower positions on flood plains. They have mottles immediately below the surface layer. Sloan soils have a mollic epipedon less than 24 inches thick.

Typical pedon of Ross silt loam, occasionally flooded, about 1/2 mile south of the hamlet of "The Bend;" in an area of Delaware Township 2,020 feet south and 250 feet east of the northwest corner of sec. 27, T. 4 N., R. 3 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; mildly alkaline; abrupt smooth boundary.

Bw1—9 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; friable;

many fine roots; mildly alkaline; gradual wavy boundary.

Bw2—15 to 24 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine and very fine subangular blocky structure; friable; very dark gray (10YR 3/1) faces of peds; common fine roots; mildly alkaline; gradual wavy boundary.

Bw3—24 to 29 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine and very fine subangular blocky structure; friable; very dark grayish brown (10YR 3/2) faces of peds; common fine roots; mildly alkaline; clear wavy boundary.

Bw4—29 to 38 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; few fine roots; mildly alkaline; gradual wavy boundary.

C1—38 to 48 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; slight effervescence; mildly alkaline; diffuse wavy boundary.

C2—48 to 60 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; strong effervescence; moderately alkaline.

The solum ranges from 24 to 45 inches in thickness. The depth to carbonates generally is the same as the thickness of the solum. In some pedons, however, carbonates are somewhat deeper.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It ranges from slightly acid to mildly alkaline. The B horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 4. It is commonly silty clay loam or silt loam. Subhorizons are loam or sandy loam in some pedons. The B horizon ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is stratified or nonstratified. It is silty clay loam, loam, or silt loam. Strata of sandy loam are in some pedons. The C horizon is neutral to moderately alkaline.

St. Clair Series

The St. Clair series consists of deep, moderately well drained and well drained soils along slope breaks of dissected lake plains. These soils formed in moderately fine textured and fine textured glacial till that has been modified by water. Permeability is slow or very slow. Slope ranges from 2 to 35 percent.

St. Clair soils are commonly adjacent to Haskins, Nappanee, and Rimer soils and are similar to Broughton, Glynwood, and Morley soils. Broughton soils formed in lacustrine sediment. They have less sand than St. Clair soils. Few or no coarse fragments are in the solum. Broughton soils also have more clay in the subsoil and substratum than St. Clair soils. Glynwood and Morley soils formed in glacial till on plains that have not been modified by wave action. Glynwood soils also have mottles of low chroma in the upper 10 inches of the argillic horizon. Morley soils have slightly less clay in the lower part of the subsoil than the St. Clair soils. Haskins, Nappanee, and Rimer soils are somewhat poorly drained and are grayer in the subsoil. Haskins and Rimer soils have more sand and less clay in the upper part of the soil than St. Clair soils.

Typical pedon of St. Clair silty clay loam, 18 to 35 percent slopes, about 5 3/4 miles east of the city of Defiance; in an area of Richland Township 2,300 feet west and 440 feet north of the southeast corner of sec. 23, T. 4 N., R. 5 E.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) silty clay loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; many fine roots; common medium roots; slightly acid; abrupt smooth boundary.

E—2 to 7 inches; brown (10YR 5/3) silty clay loam; weak medium and fine subangular blocky structure; firm; common fine roots; some medium roots; thin patchy pale brown (10YR 6/3) silt coatings on faces of peds; common fine and medium pores; 3 percent coarse fragments; medium acid; clear wavy boundary.

Bt1—7 to 12 inches; brown (10YR 4/3) clay; moderate medium and fine angular blocky structure; firm; common fine and medium roots; thin patchy clay films on faces of peds; common fine pores; 3 percent coarse fragments; medium acid; clear wavy boundary.

Bt2—12 to 18 inches; brown (10YR 4/3) clay; moderate coarse and medium angular blocky structure; firm; common fine and medium roots; thin patchy clay films on faces of peds; common fine and very fine pores; 5 percent coarse fragments; medium acid; gradual wavy boundary.

Bt3—18 to 25 inches; brown (10YR 5/3) clay; moderate coarse and medium angular blocky structure; firm; common fine roots; thin patchy brown (10YR 4/3) clay films on faces of peds; common fine and very fine pores; 5 percent coarse fragments; slightly acid; clear wavy boundary.

Bt4—25 to 40 inches; brown (10YR 5/3) clay; few fine distinct gray (5Y 6/1) mottles; moderate coarse and medium angular blocky structure; very firm; few fine and medium roots; common fine pores; 5 percent coarse fragments; spots of strong effervescence; mildly alkaline; gradual wavy boundary.

C—40 to 60 inches; brown (10YR 5/3) clay loam; few medium distinct gray (5Y 5/1) mottles; weak coarse angular blocky structure grading to massive with depth; very firm; dark brown (10YR 4/3) coatings on faces of peds; few fine pores; very few fine roots; 5 percent coarse fragments; strong effervescence; moderately alkaline.

The solum generally ranges from 20 to 42 inches in thickness. Where the soil has been eroded, however, it is thinner. The depth to carbonates is the same as the thickness of the solum or, in places, slightly less.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. Some areas have an Ap horizon that has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A and Ap horizons are loam, silty clay loam, or clay. They are medium acid to neutral. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay or clay. The B horizon is medium acid or slightly acid in the upper part and slightly acid to mildly alkaline in the lower part. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is clay loam, silty clay, or clay. The C horizon is mildly alkaline or moderately alkaline.

Seward Series

The Seward series consists of deep, moderately well drained soils on stream terraces and in areas of outwash materials on lake plains. Some areas are on moraines. These soils formed in coarse textured glacial outwash that overlies moderately fine textured and fine textured glacial till or lacustrine material. Permeability is rapid in the upper part of the solum and slow or very slow in the lower part of the solum and in the substratum. Slope ranges from 1 to 6 percent.

Seward soils are commonly adjacent to Rimer and Wauseon soils and are similar to Ottokee soils. Rimer soils are somewhat poorly drained soils on flats and slight rises. They have mottles of low chroma in the upper 10 inches of the argillic horizon. Ottokee soils do not have glacial till or lacustrine sediment in the lower part. Wauseon soils are very poorly drained. They are on flats and in depressions, and they have a mollic epipedon. Wauseon soils have dominantly low chroma in the subsoil.

Typical pedon of Seward loamy fine sand, 1 to 6 percent slopes, about 5 3/4 miles north-northeast of the city of Defiance; in an area of Adams Township 1,340 feet west and 180 feet south of the center of sec. 29, T. 5 N., R. 5 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common fine roots; medium acid; abrupt smooth boundary.

E1—8 to 15 inches; yellowish brown (10YR 5/4) loamy fine sand; single grained; loose; common fine roots; few reddish brown (5YR 4/4) stains and concretions (iron oxide); medium acid; clear smooth boundary.

E2—15 to 23 inches; brown (10YR 5/3) loamy fine sand; few fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very friable; few fine roots; few concretions (iron oxide); slightly acid; clear wavy boundary.

BE—23 to 29 inches; yellowish brown (10YR 5/4) loamy fine sand; common fine faint pale brown (10YR 6/3) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; thin very patchy clay films on vertical faces of peds and bridging between sand grains; few dark brown (7.5YR 3/2) stains; neutral; gradual wavy boundary.

Bt1—29 to 38 inches; brown (10YR 5/3) fine sandy loam; common fine faint pale brown (10YR 6/3) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; dark brown (10YR 4/3) coatings on faces of peds; thin patchy clay films on vertical faces of peds and bridging between sand grains; neutral; abrupt smooth boundary.

2Bt2—38 to 46 inches; gray (10YR 5/1) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; very firm; few fine roots; thin very patchy gray (10YR 5/1) clay films on vertical faces of peds; mildly alkaline; abrupt wavy boundary.

2C—46 to 60 inches; dark yellowish brown (10YR 4/4) clay; common fine distinct gray (10YR 5/1) mottles; massive; vertical cleavage planes; very firm; 5 percent coarse fragments; common light brownish gray (10YR 6/2) carbonate coatings on faces of cleavages; strong effervescence; moderately alkaline.

The solum ranges from 24 to 48 inches in thickness. The coarse textured deposit ranges from 20 to 32 inches in thickness. Coarse fragments make up 0 to 8 percent of the 2B and 2C horizons.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 1 to 3. It is commonly loamy fine sand, but it is fine sand in some pedons. The Ap horizon ranges from strongly acid to neutral. The E horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is loamy fine sand, fine sand, or loamy sand. The E horizon ranges from strongly acid to neutral. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is fine sandy loam or sandy loam. Lenses of sandy clay loam are in some pedons. The Bt horizon ranges from medium acid to neutral. The 2B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. The 2B horizon is slightly acid to mildly alkaline. It is silty clay loam, clay loam, clay, or silty clay. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is clay, clay loam, silty clay loam, or silty clay. The 2C horizon is mildly alkaline or moderately alkaline.

Shoals Series

The Shoals series consists of deep, somewhat poorly drained soils that are moderately permeable. These soils are on flood plains. They formed in moderately fine textured to moderately coarse textured, recent alluvium. This alluvium washed mainly from soils that formed in calcareous, lacustrine sediment or glacial till. Slope is 0 to 2 percent.

Shoals soils are commonly adjacent to Genesee and Sloan soils. Genesee soils are well drained and in slightly higher positions in the landscape. The very poorly drained Sloan soils are in depressions and in the lowest positions. They have a mollic epipedon.

Typical pedon of Shoals silt loam, frequently flooded, about 1 mile east-southeast of the hamlet "The Bend;" in an area of Delaware Township 740 feet west and 680 feet south of the northeast corner of sec. 27, T. 4 N., R. 3 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak very coarse angular blocky structure parting to moderate medium granular; friable; many fine roots; few very fine pores; mildly alkaline; abrupt smooth boundary.

C—10 to 18 inches; brown (10YR 4/3) silt loam; many fine faint grayish brown (10YR 5/2) and few fine faint dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; grayish brown (10YR 5/2) coatings on faces of peds; common fine roots; common fine pores; mildly alkaline; clear smooth boundary.

Cg1—18 to 26 inches; grayish brown (10YR 5/2) silt loam; many fine distinct dark yellowish brown (10YR 4/4 and 4/6) mottles; weak coarse subangular blocky structure; friable; common fine roots; common fine and very fine pores; mildly alkaline; gradual wavy boundary.

Cg2—26 to 36 inches; grayish brown (10YR 5/2) loam; many fine distinct dark yellowish brown (10YR 4/6) mottles; weak coarse and medium subangular blocky structure; very friable; dark grayish brown (10YR 4/2) coatings on some faces of peds; few fine roots; common fine pores; few snail shells; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg3—36 to 44 inches; light brownish gray (10YR 6/2) loam; many fine and medium distinct yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/6) mottles; massive; very friable; few fine roots; common fine pores; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg4—44 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam; many fine and medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; massive; very friable; lenses of loam and loamy fine sand; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 20 inches to more than 60 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It is slightly acid to mildly alkaline. The part of the C horizon above a depth of 40 inches has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is dominantly silt loam, loam, or silty clay loam. It is slightly acid to mildly alkaline. The part of the C horizon below a depth of 40 inches has hue of 10YR, value of 5 or 6, and chroma of 1 to 3. It is stratified or nonstratified fine sandy loam, loam, silt loam, or silty clay loam and has lenses of loamy fine sand, loamy sand, or sandy loam. It is neutral to moderately alkaline.

Sloan Series

The Sloan series consists of deep, very poorly drained soils on flood plains. The soils formed in medium textured and moderately fine textured recent alluvium that washed mainly from soils that formed in highly calcareous glacial till or lacustrine sediment. Permeability is moderate or moderately slow. Slope is 0 to 2 percent.

Sloan soils are commonly adjacent to Genesee, Landes, and Shoals soils and are similar to Wabasha soils. Genesee, Landes, and Shoals soils are better drained soils in slightly higher positions than the Sloan soils. These soils do not have chroma of 2 or less between the Ap horizon and a depth of 30 inches. Genesee and Shoals soils do not have a mollic epipedon. Landes soils have more sand in the control section. Wabasha soils have more clay in the subsoil and substratum than the Sloan soils, and they have illitic mineralogy.

Typical pedon of Sloan silty clay loam, frequently flooded, about 4 3/4 miles east of the hamlet of Ney; in an area of Tiffin Township 2,660 feet south and 50 feet east of the northwest corner of sec. 20, T. 5 N., R. 4 E.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure parting to moderate fine granular; friable; common very fine roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

Bg1—12 to 17 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium and fine subangular blocky structure; firm; common very fine roots; 1 percent coarse fragments; neutral; clear smooth boundary.

Bg2—17 to 25 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium and fine subangular blocky structure; firm; few very fine roots; 1 percent coarse fragments; neutral; gradual wavy boundary.

Bg3—25 to 35 inches; gray (10YR 5/1) clay loam; common fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure grading to weak with depth; firm; few fine and very fine roots; 3 percent coarse fragments; thin lenses of sandy loam; neutral; gradual wavy boundary.

Bg4—35 to 45 inches; gray (10YR 5/1) clay loam; common medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine roots; 3 percent coarse fragments; spots of slight effervescence; mildly alkaline; clear wavy boundary.

C—45 to 60 inches; brown (10YR 4/3) clay loam; common medium distinct grayish brown (10YR 5/2) and gray (10YR 5/1) mottles; massive; firm; few very fine roots; 2 percent coarse fragments; thin lenses of sandy loam; slight effervescence; moderately alkaline.

The solum ranges from 30 to 55 inches in thickness. The depth to carbonates ranges from 22 inches to more than 60 inches. The mollic epipedon ranges from 10 to 14 inches in thickness.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is neutral or mildly alkaline. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly silty clay loam, silt loam, loam, or clay loam. Reaction in the B horizon is neutral or mildly alkaline in the upper part and neutral to moderately alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is commonly stratified silty clay loam, clay loam, loam, or silt loam and their gravelly analogs. Thin strata of fine sandy loam, sandy loam, or loamy sand and thier gravelly analogs are in most pedons. Coarse fragments make up 0 to 20 percent of individual strata. The C horizon is mildly alkaline or moderately alkaline.

Tedrow Series

The Tedrow series consists of deep, somewhat poorly drained soils on the outwash plains, stream terraces, and beach ridges. These soils formed in coarse textured deposits. Permeability is rapid. Slope ranges from 0 to 3 percent.

Tedrow soils are commonly adjacent to Gilford and Ottokee soils and are similar to Rimer soils. Gilford soils are very poorly drained and are of dominantly low chroma in the subsoil. They have a mollic epipedon. Gilford soils are on flats and in depressions. Ottokee soils are moderately well drained, and mottles are at a greater depth. Rimer soils have glacial till or lacustrine material in the lower part of the soil.

Typical pedon of Tedrow loamy fine sand, 0 to 3 percent slopes, about 2 1/4 miles south-southeast of the village of Ayersville; in an area of Highland Township 580 feet west and 1,600 feet north of the southeast corner of sec. 15, T. 3 N., R. 5 E.

Ap—0 to 7 inches; brown (10YR 4/3) loamy fine sand, very pale brown (10YR 7/3) dry; weak medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

Bw1—7 to 14 inches; yellowish brown (10YR 5/4) fine sand; common medium faint yellowish brown (10YR 5/6) mottles; single grained; very friable; common fine roots; some pale brown (10YR 6/3) coatings on faces of peds; slightly acid; clear wavy boundary.

Bw2—14 to 22 inches; dark yellowish brown (10YR 4/4) loamy fine sand; common coarse faint yellowish brown (10YR 5/4) mottles; single grained; very friable; common fine roots; numerous strong brown (7.5YR 5/6) bands (iron oxide); common pale brown (10YR 6/3) coatings on faces of peds; slightly acid; clear wavy boundary.

Bw3—22 to 34 inches; pale brown (10YR 6/3) fine sand; common fine faint light brownish gray (10YR 6/2) mottles; single grained; loose; few fine roots; numerous strong brown (7.5YR 5/6) bands (iron oxide); slightly acid; clear wavy boundary.

BC—34 to 50 inches; pale brown (10YR 6/3) fine sand; common medium faint brown (10YR 5/3) mottles; single grained; loose; numerous strong brown (7.5YR 5/6) bands and mottles (iron oxide); slightly acid; clear wavy boundary.

C—50 to 60 inches; light brownish gray (10YR 6/2) fine sand; single grained; loose; common brown (7.5YR 5/4) bands and mottles (iron oxide); weak effervescence; mildly alkaline.

The solum ranges from 30 to 50 inches in thickness. The depth to carbonates and the thickness of the solum generally are the same. In some pedons, however, carbonates are deeper. Some horizons are 0 to 3 percent gravel.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. It is slightly acid or neutral. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 or 4. It is loamy fine sand or fine sand. The B horizon is slightly acid or neutral. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is fine sand or sand and mildly alkaline or moderately alkaline.

Toledo Series

The Toledo series consists of deep, very poorly drained soils on lake plains. These soils formed in calcareous, fine textured and moderately fine textured lacustrine sediment. Permeability is slow. Slope is 0 to 2 percent.

Toledo soils are commonly adjacent to Fulton soils and are similar to Bono, Hoytville, Latty, and Lenawee soils. Bono soils have a thicker dark surface layer. Fulton soils are somewhat poorly drained and do not have the dominantly low chroma in the subsoil. They are on slight rises. Hoytville soils formed in glacial till. They have more sand than Toledo soils, and some coarse fragments are throughout the soil. Latty and Lenawee soils have a lighter colored surface layer. Lenawee soils have less clay in the subsoil and substratum than Toledo soils.

Typical pedon of Toledo silty clay loam, about 2.5 miles southeast of the hamlet of Arthur; in an area of Highland Township 1,420 feet east and 355 feet north of the southwest corner of sec. 31, T. 3 N., R. 5 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure grading to weak coarse subangular blocky in the lower 3 inches; friable; common fine roots; few fine black (10YR 2/1) stains (iron and manganese oxides); neutral; abrupt smooth boundary.

Bg1—7 to 17 inches; dark gray (10YR 4/1) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium and fine angular blocky structure; firm; few fine roots; common fine black (10YR 2/1) concretions and nodules (iron and manganese oxides); neutral; clear wavy boundary.

Bg2—17 to 42 inches; gray (5Y 5/1) silty clay; many medium prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6 and 5/8) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; few fine roots; common black (10YR 2/1) concretions, stains, and nodules (iron and manganese oxides); some dark grayish brown (10YR 4/2) and brown (10YR 5/3) krotovinas about 1 inch to 2 inches in diameter; few slickensides at a 15 degree angle; neutral; clear wavy boundary.

C1—42 to 49 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct gray (10YR 5/1) mottles; weak coarse prismatic structure; firm; few fine roots; gray (5Y 5/1) coatings on faces of peds; common dark grayish brown (10YR 4/2) and brown (10YR 5/3) krotovinas 1 inch to 2 inches in diameter; many light gray (10YR 7/2) 2- to 5-millimeter secondary carbonate nodules; common black (10YR 2/1) concretions and nodules (iron and manganese oxides); slight effervescence; moderately alkaline; gradual wavy boundary.

C2—49 to 60 inches; brown (10YR 4/3) silty clay; weak very coarse prismatic structure grading to massive with depth; very firm; gray (5Y 5/1) coatings on faces of peds; common 2- to 5-millimeter carbonate nodules; patchy light gray (10YR 7/2) carbonate coatings on vertical faces of peds; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 35 to 55 inches.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly silty clay and thin layers of silty clay loam in some pedons. The B horizon is commonly slightly acid or neutral but in some pedons is mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is silty clay or silty clay loam. The C horizon is mildly alkaline or moderately alkaline.

Tuscola Series

The Tuscola series consists of deep, moderately well drained soils on stream terraces, outwash plains, deltas, and lake plains. These soils formed in stratified, moderately fine textured to coarse textured materials. Permeability is moderate. Slope ranges from 2 to 6 percent.

Tuscola soils are commonly adjacent to Colwood and Kibbie soils and are similar to Bronson, Kibbie, and Rawson soils. Bronson soils have more sand in the subsoil than Tuscola soils and more gravel throughout. Colwood soils are very poorly drained soils. They have a mollic epipedon. Colwood soils are on broad flats and in slight depressions. The somewhat poorly drained Kibbie soils are on low knolls and long, low ridges. Rawson soils have fine textured or moderately fine textured glacial till or lacustrine material in the substratum.

Typical pedon of Tuscola very fine sandy loam, 2 to 6 percent slopes, about 4 1/4 miles northeast of the village of Hicksville; in an area of Hicksville Township 1,500 feet west and 1,400 feet south of the northeast corner of sec. 12, T. 4 N., R. 1 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very pale brown (10YR 7/3) dry; weak fine granular structure; very friable; many fine roots; about 8 percent material from E horizon mixed throughout; very few fine pebbles; medium acid; abrupt smooth boundary.

BE—9 to 14 inches; brown (10YR 4/3) loam; moderate medium and fine subangular blocky structure; friable; common fine roots; thin very patchy dark brown (7.5YR 4/4) clay films on vertical faces of peds; few fine and medium pebbles; medium acid; clear smooth boundary.

Bt1—14 to 20 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; some very fine bedding planes; firm; common fine roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; thin patchy light gray (10YR 7/1) sand coatings on faces of peds and in a few small pockets; medium acid; abrupt smooth boundary.

Bt2—20 to 35 inches; dark yellowish brown (10YR 4/4) and brown (10YR 5/3) stratified loam and very fine sandy loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; weak bedding planes; friable; common fine roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; some light brownish gray (10YR 6/2) sand coatings on faces of peds; 2 percent shale fragments; nodules of clay material related to weathered shale; medium acid; clear wavy boundary.

Bt3—35 to 44 inches; brown (10YR 4/3) stratified silty clay loam and loamy fine sand; few fine distinct light brownish gray (10YR 6/2) mottles; weak thick platy structure parting to weak medium subangular blocky; very friable; 1/4- to 1/2-inch lenses of very fine sand; slightly acid; clear wavy boundary.

Cg—44 to 60 inches; light brownish gray (10YR 6/2) and dark grayish brown (2.5Y 4/2) stratified very fine sand, loamy fine sand, and silt loam; massive; very friable; strong effervescence; moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. Coarse fragments make up 0 to 2 percent of the soil.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It ranges from medium acid to neutral. A thin E horizon is in some pedons. The upper part of the B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is very fine sandy loam, loam, or silt loam. The B horizon in the upper part ranges from medium acid to neutral. The lower part of the B horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay loam, loam, silt loam, fine sandy loam, very fine sandy loam, loamy fine sand, or very fine sand. The B horizon in the lower part ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It is stratified very fine sand, loamy fine sand, fine sandy loam, silt loam, or silty clay loam. Individual layers range from 1/2 inch to several inches in thickness. The C horizon is mildly alkaline or moderately alkaline.

Wabasha Series

The Wabasha series consists of deep, very poorly drained soils on flood plains. The soils formed dominantly in fine textured, recent alluvium. Permeability is slow. Slope is 0 to 2 percent.

Wabasha soils are commonly adjacent to Defiance soils and are similar to Defiance and Sloan soils. Defiance soils are somewhat poorly drained and are in slightly higher positions than Wabasha soils. They have a lighter colored surface layer than the Wabasha soils. They do not have dominant chroma of 2 or less between the Ap horizon and a depth of 30 inches. Sloan soils have a mollic epipedon. They have less clay in the subsoil than Wabasha soils.

Typical pedon of Wabasha silty clay loam, frequently flooded, about 5 miles south-southeast of the village of Ayersville; in an area of Highland Township 560 feet west and 1,240 feet north of the southeast corner of sec. 34, T. 3 N., R. 5 E.

Ap—0 to 9 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, olive gray (5Y 5/2) dry; weak coarse and medium subangular blocky structure; friable; common fine and medium roots; common fine pores; slightly acid; abrupt smooth boundary.

Bg1—9 to 16 inches; dark gray (N 4/0) silty clay; common fine distinct grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; dark gray (10YR 4/1) coatings on faces of peds; common fine roots; common fine pores; few very fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); mildly alkaline; clear smooth boundary.

Bg2—16 to 23 inches; gray (5Y 5/1) silty clay; common medium prominent dark brown (7.5YR 4/4) and common medium distinct light brownish gray (2.5Y 6/2) mottles; moderate very coarse prismatic structure parting to moderate medium and coarse angular blocky; firm; common fine roots; common fine and very fine pores; dark gray (N 4/0) coatings on faces of peds; few very fine black (N 2/0) concretions and stains (iron and manganese oxides); mildly alkaline; gradual smooth boundary.

Bg3—23 to 30 inches; gray (N 5/0) silty clay; common medium distinct olive (5Y 5/3) and pale brown (10YR 6/3) mottles; moderate very coarse prismatic structure parting to moderate medium and coarse angular blocky; firm; few fine roots; common fine and very fine pores; few very fine black (N 2/0) concretions (iron and manganese oxides); brown (7.5YR 4/4) iron coatings on faces of vertical root channels; mildly alkaline; gradual smooth boundary.

Bg4—30 to 44 inches; gray (N 5/0) silty clay; many medium distinct light brownish gray (2.5Y 6/2) mottles; weak coarse prismatic structure parting to weak medium and coarse angular blocky; firm; few fine roots; common fine and very fine pores; few fine black (N 2/0) concretions and stains (iron and manganese oxides); brown (7.5YR 4/4) iron coatings on faces of vertical root channels; mildly alkaline; gradual smooth boundary.

BCg—44 to 52 inches; gray (5Y 5/1) silty clay; common medium distinct light brownish gray (2.5Y 6/2) mottles; weak coarse subangular blocky structure parting to weak medium subangular blocky; firm; very few fine roots; common fine pores; common black (N 2/0) concretions (iron and manganese oxides); brown (7.5YR 4/4) iron coatings on faces of vertical root channels; mildly alkaline; gradual smooth boundary.

Cg—52 to 60 inches; light olive gray (5Y 6/2) silty clay; many fine distinct yellowish brown (10YR 5/6) and light yellowish brown (2.5Y 6/3) mottles; weak coarse subangular blocky structure in the upper part grading to massive with depth; firm; very few fine roots; common very fine pores; olive gray (5Y 5/2) faces of peds; common fine black (10YR 2/1) concretions and stains (iron and manganese oxides); mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. The dark surface layer ranges from 6 to 10 inches in thickness.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is slightly acid to mildly alkaline. The B horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is dominantly silty clay or clay. Thin strata of silty clay loam or coarser textures are in some pedons. The B horizon is slightly acid to mildly alkaline. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 3. It is dominantly silty clay or clay. Thin strata of fine sandy loam, silt loam, or silty clay loam are in some pedons. The C horizon ranges from neutral to moderately alkaline. It is slightly calcareous or strongly calcareous in some pedons.

Wallkill Variant

The Wallkill Variant consists of deep, very poorly drained soils in depressions, mainly on end moraines. These soils formed in fine textured slack water deposits and erosional sediment and in the underlying organic deposit. Permeability is slow or very slow in the mineral layers and moderately rapid or rapid in the organic layers. Slope is 0 to 2 percent.

Wallkill Variant soils are commonly adjacent to Blount, Glynwood, and Pewamo soils. Blount, Glynwood, and Pewamo soils do not have the organic layer in the lower part of the soil that the Wallkill Variant has. Blount and Glynwood soils are on flats, slight rises, knolls, and side slopes along drainageways. Pewamo soils are on flats and in depressions. They have a mollic epipedon.

Typical pedon of Wallkill Variant silty clay, 5 1/4 miles southwest of the village of Edgerton; in an area of Milford Township 2,400 feet east and 166 feet north of the southwest corner of sec. 17, T. 5 N., R. 1 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate medium and fine subangular blocky structure; firm; many fine roots; very dark gray (10YR 3/1) faces of peds; slightly acid; abrupt smooth boundary.

Bg1—9 to 15 inches; dark gray (10YR 4/1) clay; few fine distinct dark brown (7.5YR 4/4) mottles; moderate coarse prismatic structure parting to weak medium angular blocky; firm; common fine roots; distinct pressure faces; black (10YR 2/1) organic stains on faces of peds; medium acid; gradual smooth boundary.

Bg2—15 to 22 inches; dark gray (10YR 4/1) clay; few fine distinct dark brown (7.5YR 4/4) mottles; moderate coarse prismatic structure parting to weak coarse angular blocky; firm; few fine roots; distinct pressure faces; common medium and coarse black (10YR 2/1) organic stains on faces of peds; medium acid; gradual smooth boundary.

Bg3—22 to 30 inches; dark gray (10YR 4/1) clay; common medium faint very dark gray (10YR 3/1) mottles; moderate coarse prismatic structure parting to weak thin platy in the lower part; firm; few fine roots; pale brown (10YR 6/3) coatings on horizontal faces of plates; brown (10YR 5/3) organic coatings on faces of peds; 75 percent mineral, 25 percent organic; medium acid; clear smooth boundary.

Bg4—30 to 32 inches; mixed dark gray (10YR 4/1) clay and very dark gray (10YR 3/1) organic material; firm and friable; medium acid; clear wavy boundary.

2Oa—32 to 55 inches; very dark gray (10YR 3/1) rubbed, sapric material; 5 percent fibers, less than 1 percent rubbed; weak and medium platy structure; friable; medium acid; clear smooth boundary.

2C—55 to 70 inches; dark brown (10YR 4/3) coprogenous earth (sedimentary peat); grades to dark olive gray (5Y 3/2) with depth; 3 percent fibers when broken, 1/2 percent when rubbed; weak medium platy structure in the upper part and massive in the lower part; friable; medium acid.

The mineral soil is 16 to 40 inches deep to organic material.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It is medium acid to neutral. The B horizon has hue of 10YR to 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly silty clay loam, silty clay, or clay. The B horizon ranges from medium acid to neutral. The Oa horizon, which consists of sapric material and includes herbaceous and woody plant material, ranges from 10 to 30 inches in thickness. It has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. In some pedons the Oa horizon has an abundance of reed stems that have hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The 2C horizon consists of coprogenous earth, or sedimentary peat, to a depth of 10 to 20 feet or more. It has hue of 7.5YR to 5Y, value of 2 to 4, and chroma of 2 or 3. The 2C horizon is strongly acid to slightly acid.

Wauseon Series

The Wauseon series consists of deep, very poorly drained soils on lake plains. These soils are in areas between beach ridges and on toe slopes of the beach ridges. They formed in moderately coarse textured and coarse textured glacial outwash over medium textured to fine textured glacial till or lacustrine material. Permeability is rapid in the solum and very slow in the substratum. Slope is 0 to 2 percent.

Wauseon soils are commonly adjacent to Mermill and Rimer soils and are similar to Gilford and Mermill soils. Gilford soils do not have glacial till or lacustrine material in the lower part of the soil. Mermill soils have a thinner dark surface layer and more clay in the subsoil than Wauseon soils. Rimer soils are somewhat poorly drained. They do not have a mollic epipedon. Mermill and Wauseon soils are in similar positions. Rimer soils are on flats and slight rises.

Typical pedon of Wauseon fine sandy loam, about 1.6 miles northeast of the village of Ayersville; in an area of Highland Township 1,840 feet east and 600 feet south of the northwest corner of sec. 2, T. 3 N., R. 5 E.

Ap—0 to 12 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; weak coarse subangular blocky structure parting to weak coarse granular; very friable; many fine roots; common light gray (10YR 7/1) sand grains throughout; slightly acid; abrupt smooth boundary.

A—12 to 18 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; common fine distinct dark brown (10YR 3/3) mottles; weak medium subangular blocky structure; friable; common fine roots; neutral; gradual wavy boundary.

Bg1—18 to 28 inches; dark gray (10YR 4/1) loamy fine sand; common fine distinct dark grayish brown (2.5Y 4/2) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very friable; common fine roots; patchy very dark gray (10YR 3/1) organic stains on faces of peds; thin lenses of fine sandy loam and fine sand; neutral; clear wavy boundary.

Bg2—28 to 31 inches; dark gray (10YR 4/1) fine sandy loam; common fine distinct dark grayish brown (2.5Y 4/2) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very friable; few fine roots; patchy very dark gray (10YR 3/1) organic stains on faces of peds; mildly alkaline; abrupt wavy boundary.

2Cg1—31 to 36 inches; gray (5Y 6/1) silt loam; many medium prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to weak medium and fine angular blocky; friable; gray (5Y 5/1) coatings on faces of peds; few coarse fragments, mainly fine pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

2Cg2—36 to 60 inches; dark grayish brown (10YR 4/2) clay loam; few medium distinct yellowish brown (10YR 5/4) mottles; massive; vertical cleavage planes; firm; medium patchy gray (N 6/0) coatings on faces of cleavages; few coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum, depth to carbonates, and depth to the 2C horizon range from 24 to 40 inches.

The Ap and A horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Ap horizon is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is commonly fine sandy loam or loamy fine sand. Thin lenses of fine sand are in some pedons. The B horizon is neutral or mildly alkaline. The 2C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 3. It is commonly clay, silty clay, or silty clay loam. It has subhorizons of silt loam in some pedons. The content of coarse fragments in this horizon ranges from 0 to 5 percent. The 2C horizon is mildly alkaline or moderately alkaline.

Formation of the Soils

The characteristics of a soil are determined by the interaction of five factors of soil formation: climate, plants and animals, parent material, relief, and time (*6*). The relative effect of each factor varies from place to place.

Climate and vegetation act on the parent material and gradually change it to a natural body of soil. The nature of the parent material affects the kind of soil that is formed. Relief modifies the effects of climate and vegetation, mainly through its influence on runoff and temperature, and time is needed for a soil to form from parent material. Generally, a long period of time is required for distinct soil horizons to develop.

The interaction among these factors is more complex for some soils than for others. On the following pages, the five main factors of soil formation are described as they relate to the soils in the survey area.

Climate

Climate is largely responsible for determining the kind of vegetation in an area. The climate in Defiance County has been relatively uniform for a long period of time. Hardwood trees are the climax vegetation. During the formation of the soils climate has been favorable to physical change, to chemical weathering of parent material, and to biological activity.

Rainfall has been abundant enough for percolating water to leach carbonates. This has affected soil reaction. The percolating water has leached bases and carbonates from most of the soils so that many soils are acid to a moderate depth. Examples are Blount, Fulton, Glynwood, Nappanee, and Roselms soils. In most soils, differences in soil reaction in the upper 2 feet can be partly attributed to differences in the carbonate content of the parent material. Carbonates are present in most of the soils in the survey area at a depth of 2 to 3 feet in light colored soils and 3 to 5 feet in darker soils.

The frequency of rainfall has resulted in wetting and drying cycles that have increased the downward movement of clay minerals. For example, Blount, Del Rey, Fulton, and Digby soils have horizons of clay accumulation in the subsoil. The wetting and drying cycles accompanied by freezing and thawing have aided in the development of soil structure in many of the soils that have a loamy or clayey subsoil. Warm temperatures in summer have increased biological and chemical activity in the soils. Both rainfall and temperature have promoted plant growth and subsequent accumulation of a moderate or high organic matter content in Fulton, Hoytville, and similar soils.

The climate is relatively uniform throughout the county and is not significantly different in temperature and rainfall. Differences in relief, however, have resulted in differences in the microclimate in some areas. For example, cold air flowing from beach ridges to lower elevations lessens hazards of frost and freeze damage to orchards.

All the soils in Defiance County are classified as mesic because of their soil temperature. The average annual soil temperature at a depth of 20 inches is about 2 degrees F. higher than the average annual air temperature. The average annual soil temperature in the county at a depth of 20 inches ranges from 47 to 59 degrees F.

Plants and Animals

The hardwood trees in Defiance County have greatly affected soil formation. Soils on beach ridges and on the moraine in the northwestern part of the county formed under forest vegetation comprising several species of oak and other hardwood trees. Soils in the Great Black Swamp and other low lying areas formed under swamp forest comprising mainly elm and ash (*7*). The leaves of these native trees had a relatively low content of bases. In undisturbed areas, most of the soils in the survey area have a thin surface layer of organic matter accumulation. The upper horizons are relatively low in accumulated bases. Organic matter content ranges from 1 to 3 percent in many of the light colored soils and from 3 to 7 percent in most dark colored soils. The parent material of Carlisle soils has thick organic deposits that accumulated in depressions where the water table was high for a long period of time. The organic material in these deposits consists mainly of the remains of trees, grasses, and sedges.

Fungi, bacteria, and animals, including earthworms, rodents, and insects, have added some organic matter to the soils and have mixed the soil material to some extent. Crawfish also mix the soil as they form channels. They are most prevalent in the very poorly drained soils, such as Bono, Hoytville, Latty, Lenawee, Paulding, Pewamo, and Toledo soils. These living organisms and root channels have made the soil more permeable.

Windthrow, particularly in areas of very poorly drained soils, has caused mixing of soil material. In wooded areas of very poorly drained soils, a pronounced microrelief of low knolls and depressions has resulted from trees being uprooted by the wind.

In most areas the soils have been cleared of trees and are used as cropland. More trees are disappearing as remaining woodlots are cleared. Man is a present factor influencing the future development of soils in many areas. He has changed the soils by accelerating the rate of erosion in some areas and by cutting and filling during construction. In places, he moves and removes soil to suit his purposes. In addition, extensive drainage projects have lowered the water table in many areas; additions of lime and fertilizer have changed soil chemistry; and tillage has affected the structure of the surface layer. Agricultural and other uses of the soil have changed the dominant vegetation, which has affected soil formation.

Parent Material

The main kinds of parent material in Defiance County are glacial till, lacustrine sediment, deposits on glacial lake beaches, deltaic sediment deposited in postglacial lakes, outwash deposits, organic deposits, and recent alluvium. The location and extent of these kinds of parent material are shown in figure 2. Parent material has greatly affected the texture of the soils.

Hoytville, Nappanee, and St. Clair soils formed in glacial till on lake plains. Pewamo, Blount, Glynwood, and Morley soils formed in glacial till on moraines. Belmore soils formed in beach deposits. Colwood, Kibbie, and Tuscola soils formed in outwash deposits and deltaic sediment. Bono, Del Rey, Lenawee, Broughton, Latty, Paulding, Roselms, and Toledo soils and the Del Rey Variant formed in lacustrine deposits. Defiance, Genesee, Landes, Ross, Shoals, Sloan, and Wabasha soils formed in recent alluvium. The alluvium in which Defiance and Wabasha soils formed has a higher clay content than that in which the other soils formed. Carlisle soils formed in organic deposits.

The parent material of most soils in the county was relatively high in calcium and magnesium carbonates. Weathering of the parent material has reduced the amount of carbonates in the surface layer and upper part of the subsoil.

Relief

Relief modifies the effects of climate within short horizontal distances. Soils on hillsides generally are drier than those in adjacent depressions because water runs off the hillsides and collects in the depressions. The presence or absence of a seasonal high water table is largely determined by relief. Most nearly level soils, including Del Rey, Gilford, and Latty soils, have a seasonal high water table.

Water runs off and erodes the sloping or steep soils. These steeper soils commonly have a thinner solum than the nearly level soils. The slower rate of percolation and leaching in the more sloping soils result in less weathering of the parent material.

Differences in drainage among soils that formed in similar parent material are largely caused by differences in relief. The Morley, Glynwood, Blount, and Pewamo soils are in a drainage sequence that illustrates the effect of relief on drainage. Morley soils are well drained; they generally are in higher positions or are steeper. Glynwood soils are moderately well drained; they generally are in lower positions and are more gently sloping or sloping than the Morley soils. Blount soils are somewhat poorly drained; they generally are more nearly level than the Morley and Glynwood soils. The level and nearly level Pewamo soils are very poorly drained. They are in the lowest part of the landscape in swales and along drainageways. Pewamo soils are the only ones in the drainage sequence that have a dark surface layer. This dark surface layer results from the accumulation of organic matter.

In Defiance County, the steepest slopes are along the major drainageways and their tributaries and in the more rolling areas of the Ft. Wayne end moraine. Less sloping areas are on the beach ridges and along the small drainageways. Much of the rest of the county is nearly level or level. Most very poorly drained soils are level and nearly level. In depressional areas that have no natural drainage, water was ponded for many years in the postglacial period. The accumulation of organic matter from wet vegetation has resulted in the organic Carlisle muck. The Wallkill Variant has a buried organic tier and a mineral overburden.

Time

Time is required for the development of distinct horizons in a soil. The length of time that parent material has been in place and vegetation and climate are important factors in soil formation. These factors influence the degree of weathering of minerals and the formation of soil structure. The influence of time on soil formation is modified by relief and the nature of the parent material.

Time has caused few differences among the soils in Defiance County because most of the parent materials have been in place for about the same amount of time. Soils that formed in recent alluvium are an exception. Examples of alluvial soils are the Defiance, Genesee, Landes, Ross, Shoals, Sloan, and Wabasha soils. These soils are on flood plains and are periodically flooded. The sediment deposited with each flood prevents the development of distinct horizons.

In terms of geologic age, the soils of Defiance County have been forming for a relatively short period of time.

This accounts both for the shallowness of leaching and the slightly acid to neutral reaction in many of the soils.

Processes of Soil Formation

The factors of soil formation discussed in the preceding section govern the four soil-forming processes—additions, losses, transfers, and alterations (*8*). Some of these processes cause differences within a soil, while others retard or preclude differences. The differentiation between horizons in soils is a result of one or more of these processes.

Additions. One of the more noticeable kinds of additions to the soil is the accumulation of organic matter in the surface layer. In all soils, plant litter or organic material breaks down to form plant nutrients, which are recycled back into the plants. All soils in Defiance County have some organic matter accumulation. A dark surface layer indicates a higher content of organic matter. Bono, Colwood, Gilford, Hoytville, Lenawee, Millgrove, Pewamo, Toledo, and Wauseon soils have a dark surface layer. Where the surface layer was originally thin, plowing and cultivating have largely destroyed it or incorporated it into other layers. Soils that have a limited addition of organic matter are the Blount, Del Rey, Fulton, Glynwood, Nappanee, Ottokee, Roselms, and St. Clair soils.

Other additions to the soil include bases derived from lime and fertilizer, ground water, and deposition by runoff or flooding. Lime and fertilizer can be applied on cropland and pasture to counteract the loss of plant nutrients that is common to most soils. If these applications are heavy, nutrient gains can exceed nutrient losses. Soils that are seasonally saturated, for example the Colwood, Gilford, Mermill, and Wauseon soils, continually accumulate bases derived from ground water. Generally, the addition of bases in these soils is greater than the loss. Soils on flood plains, for example Genesee and Shoals soils, periodically receive additions of soil material deposited by floodwaters.

Losses. Losses in soils include the leaching of bases, the removal of plant nutrients by crops, the loss of soil by erosion, and volatilization. One of the main losses in soils in Defiance County is the leaching of carbonates. The loss of carbonates precedes other chemical changes in the solum. It happens more slowly if the content of carbonates is high. Other minerals also are subject to chemical weathering and loss by leaching but at a slow rate.

Carbonates have been leached to a depth of 2 to 3 feet in most light colored soils that have a fine textured subsoil. These soils are on uplands. Prior to weathering, the glacial till or lacustrine deposits in which these soils formed was 15 to 25 percent calcium carbonate. Carbonates in the coarser textured soils, including Oshtemo and Ottokee soils, generally have been leached to a greater depth—from 3 to 10 feet.

Transfers. The main kind of transference is that of colloidal material from the surface layer to a layer below. The primary minerals are transformed into silicate clay, largely by the processes of hydrolysis and base substitution. The clay is carried downward by water and is deposited as clay films on the faces of soil peds, in cracks, and in root and earthworm channels. Most of the clay remains in the soil. Del Rey, Haskins, Nappanee, and Fulton soils have clay films.

The translocation and development, in place, of silicate clay has greatly influenced horizon development in many of the soils in Defiance County. Various sesquioxides also have been transferred from the surface layer to lower layers by this weathering process.

Iron oxides have been leached from Belmore, Bronson, and Oshtemo soils by rainwater. This water, containing iron in solution, moves laterally down the surface of the underlying clay. It surfaces in a narrow belt on toe slopes of the beach ridges. This iron enriched, red soil has been identified by iron oxide spot symbols on the soil maps.

Alterations. Ferrous iron has been reduced, dissolved, and translocated in the very poorly drained and somewhat poorly drained soils. This reduction of iron, called gleying, is evident in Bono, Colwood, Gilford, Latty, Lenawee, Millgrove, Mermill, Paulding, Pewamo, and Wauseon soils. It is caused by a recurring high water table. The gray soil indicates that conditions are favorable to the reduction process. Reduced iron is soluble. In Defiance County, however, iron commonly has been moved only a short distance within the soil.

Some of this iron, reoxidized and segregated, has formed into bright, yellow and red mottles. The mottles are in all but the better drained soils. This alteration of iron is caused by a fluctuating water table. Accumulations of iron and manganese oxides are common in the somewhat poorly drained and very poorly drained soils. They are dark brown or black blotches on the faces of peds or small concretions.

References

(1) Allan, P. F., L. E. Garland, and R. Dugan. 1963. Rating northeastern soils for their suitability for wildlife habitat. 28th North Am. Wildl. Nat. Resour. Conf. Wildl. Manage. Inst., pp. 247-261, illus.

(2) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vols., illus.

(3) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(4) Defiance County Historical Society. 1976. History of Defiance County, Ohio. Taylor Publ. Co.: 4-6

(5) Forsyth, Jane L. 1959. The beach ridges of northern Ohio. Ohio Dep. of Natural Resour., Div of Geol. Surv. Inf. Circular No. 25, 10 pp., illus., map.

(6) Jenny, Hans. 1941. Factors of soil formation. McGraw-Hill Book Company, Inc., 281 pp., illus.

(7) Kaatz, Martin R. 1955. The Black Swamp: a study in historical geography. *In* Annals of the Assoc. of Am. Geog., vol. XLV, No. 1: 1-35, illus.

(8) Simonson, Roy W. 1959. Outline of a generalized theory of soil genesis. Soil Sci. Soc. Am. Proc. 23: 152-156, illus.

(9) Stout, Wilbur; Karl Bergsteeg; and G. S. Lamb. 1943. Geology of water in Ohio. Fourth Ser., Bull. 44, F. J. Heer Print. Co., 694 pp., illus.

(10) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(11) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(12) United States Department of Agriculture. 1971. Ohio soil and water conservation needs inventory. Ohio Soil and Water Conserv. Needs Comm., 131 pp., illus.

(13) United States Department of Agriculture. 1975. Soil Taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep Agric. Handb. 436, 754 pp., illus.

(14) United States Department of Agriculture. 1981. Ohio agricultural statistics—1980. Econ. and Stat. Serv., Agdex 100/850, 57 pp., illus.

(15) United States Department of Commerce. 1980. State of Ohio, federal census of population. Bur. Census, 41 pp.

(16) United States Department of the Interior. 1958. Geological and geophysical study of the preglacial Teays Valley in west-central Ohio. Geol. Surv. Water Supply Pap. 1460E: 207-232, illus.

(17) Walker, Alfred C. 1959. Maumee River Basin (middle portion), underground water resources. *In* Ohio water plan inventory. Ohio Dep. of Natural Resour., Div. of Water No. A-10, 4 pp., illus., map.

(18) Walker, Alfred C. 1959. St. Joseph River Basin, underground water resources. *In* Ohio water plan inventory. Ohio Dep. of Natural Resour., Div. of Water No. A-9, 4 pp., illus., map.

(19) Walker, Alfred C. 1959. Tiffin River Basin, underground water resources. *In* Ohio water plan inventory. Ohio Dep. of Natural Resour., Div. of Water No. A-8, 4 pp., illus., map.

(20) Walker, Alfred C. 1959. Upper Maumee and lower Auglaize River Basins, underground water resources. *In* Ohio water plan inventory. Ohio Dep. of Natural Resour., Div. of Water No. A-7, 4 pp., illus., map.

Glossary

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.

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

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.

Bottom land. The normal flood plain of a stream, subject to flooding.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

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.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

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.

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.

Delta. A body of alluvium, whose surface form is nearly flat and fan-shaped, deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, usually a sea or a lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

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.

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 melt water.

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 melt water. 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.

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.

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.

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.

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.)

No-till planting. A method of planting crops that involves no seedbed preparation other than opening the soil for the purpose of placing the seed at the intended depth. This usually involves opening a small slit or punching a hole into the soil. There is no cultivation during crop production. Chemical weed control is normally used.

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, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

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.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

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 underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

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.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

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 insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

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 (7.5 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.

Stratified. Arranged in strata or layers.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 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. 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.

Trash mulch. A method of pasture renovation that consists of disking the existing sod followed by seeding. A cultipacker is commonly used after seeding to firm the seedbed.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

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.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and reduce erosion.

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.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-78 at Defiance, Ohio. Summaries are based on incomplete records]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	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[1]	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----	31.3	14.0	22.7	58	-13	0	2.04	.94	2.98	6	6.9
February---	34.8	16.2	25.5	62	-9	0	1.77	.82	2.58	5	5.6
March------	44.5	24.9	34.7	75	4	11	2.64	1.51	3.63	7	4.6
April------	59.1	36.3	47.8	84	19	64	3.47	2.13	4.67	8	.9
May--------	71.0	46.6	58.8	91	29	298	3.48	2.18	4.64	8	.0
June-------	81.0	56.7	68.8	95	41	564	3.42	2.03	4.64	7	.0
July-------	84.6	60.4	72.6	98	48	701	3.40	2.21	4.48	7	.0
August-----	82.9	58.2	70.6	95	44	639	2.90	1.48	4.13	5	.0
September--	76.4	51.1	63.7	94	33	411	2.71	1.42	3.84	6	.0
October----	64.6	39.5	52.0	85	22	149	2.26	.83	3.47	5	.1
November---	48.9	30.1	39.5	74	9	9	2.61	1.40	3.66	7	2.3
December---	36.4	19.7	28.1	63	-7	0	2.38	.86	3.64	7	6.2
Yearly:											
Average--	59.6	37.8	48.7	---	---	---	---	---	---	---	---
Extreme--	---	---	---	98	-13	---	---	---	---	---	---
Total----	---	---	---	---	---	2,846	33.08	28.35	37.63	78	26.6

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-78 at Defiance, Ohio]

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--	April 21	May 6	May 18
2 years in 10 later than--	April 16	May 1	May 13
5 years in 10 later than--	April 7	April 21	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 17	October 10	September 24
2 years in 10 earlier than--	October 22	October 15	September 29
5 years in 10 earlier than--	October 31	October 24	October 9

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-78 at Defiance, Ohio]

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	185	164	140
8 years in 10	192	172	146
5 years in 10	206	186	157
2 years in 10	220	200	169
1 year in 10	227	207	175

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
BmB	Belmore loam, 2 to 6 percent slopes	689	0.3
BnA	Blount loam, 0 to 3 percent slopes	11,148	4.2
Bp	Bono silty clay loam	899	0.3
BrB	Bronson sandy loam, 1 to 6 percent slopes	1,084	0.4
BsB	Boyer loamy sand, 1 to 6 percent slopes	131	*
BvE	Broughton silt loam, 12 to 35 percent slopes	1,253	0.5
BwC3	Broughton clay, 6 to 12 percent slopes, severely eroded	806	0.3
Ca	Carlisle muck	684	0.3
Cm	Colwood loam	2,379	0.9
Db	Defiance silty clay loam, frequently flooded	209	0.1
DfA	Del Rey silt loam, 0 to 3 percent slopes	3,243	1.2
DgA	Del Rey Variant silt loam, 0 to 3 percent slopes	1,070	0.4
DmA	Digby loam, 0 to 3 percent slopes	1,811	0.7
FsA	Fulton loam, 0 to 3 percent slopes	4,416	1.7
FtA	Fulton silty clay loam, 0 to 3 percent slopes	8,636	3.3
Ge	Genesee loam, occasionally flooded	3,299	1.3
Gf	Gilford fine sandy loam	739	0.3
GwB	Glynwood loam, 2 to 6 percent slopes	8,010	3.0
GwB2	Glynwood loam, 2 to 6 percent slopes, eroded	1,708	0.6
GwC2	Glynwood loam, 6 to 12 percent slopes, eroded	1,726	0.7
HnA	Haskins loam, 0 to 3 percent slopes	8,081	3.1
Ho	Hoytville clay loam	1,551	0.6
Hv	Hoytville clay	41,835	15.9
KfA	Kibbie loam, 0 to 3 percent slopes	3,499	1.3
Lb	Landes fine sandy loam, occasionally flooded	196	0.1
Lc	Latty silty clay	36,663	13.9
Lf	Lenawee silty clay loam	8,330	3.2
Md	Mermill loam	6,979	2.6
Mh	Millgrove loam	2,457	0.9
MrD2	Morley clay loam, 12 to 18 percent slopes, eroded	331	0.1
NnA	Nappanee loam, 0 to 3 percent slopes	5,328	2.0
NpA	Nappanee silty clay loam, 0 to 3 percent slopes	3,888	1.5
OsB	Oshtemo sandy loam, 2 to 6 percent slopes	2,062	0.8
OtB	Ottokee loamy fine sand, 1 to 6 percent slopes	863	0.3
Pa	Paulding clay	32,470	12.3
Pm	Pewamo silty clay loam	4,258	1.6
Pt	Pits, gravel	64	*
RmB	Rawson sandy loam, 2 to 6 percent slopes	1,093	0.4
RnA	Rimer loamy fine sand, 0 to 3 percent slopes	1,956	0.7
RrA	Roselms loam, 0 to 3 percent slopes	4,126	1.6
RsA	Roselms silty clay, 0 to 3 percent slopes	22,760	8.6
Ru	Ross silt loam, occasionally flooded	329	0.1
SaB	St. Clair loam, 2 to 6 percent slopes	250	0.1
SbC2	St. Clair silty clay loam, 6 to 12 percent slopes, eroded	675	0.3
SbE	St. Clair silty clay loam, 18 to 35 percent slopes	590	0.2
ScD3	St. Clair clay, 12 to 18 percent slopes, severely eroded	302	0.1
ScE3	St. Clair clay, 18 to 35 percent slopes, severely eroded	462	0.2
SdB	Seward loamy fine sand, 1 to 6 percent slopes	1,249	0.5
Sh	Shoals silt loam, frequently flooded	3,680	1.4
So	Sloan silty clay loam, frequently flooded	2,731	1.0
TdA	Tedrow loamy fine sand, 0 to 3 percent slopes	404	0.2
Tn	Toledo silty clay loam	4,356	1.7
TsB	Tuscola very fine sandy loam, 2 to 6 percent slopes	563	0.2
Ud	Udorthents, rolling	911	0.3
Ur	Urban land	300	0.1
Wa	Wabasha silty clay loam, frequently flooded	1,652	0.6
Wd	Wallkill Variant silty clay	254	0.1
Wf	Wauseon fine sandy loam	249	0.1
	Water	1,993	0.8
	Total	263,680	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
BmB	Belmore loam, 2 to 6 percent slopes
BnA	Blount loam, 0 to 3 percent slopes (where drained)
Bp	Bono silty clay loam (where drained)
BrB	Bronson sandy loam, 1 to 6 percent slopes
Cm	Colwood loam (where drained)
DfA	Del Rey silt loam, 0 to 3 percent slopes (where drained)
DgA	Del Rey Variant silt loam, 0 to 3 percent slopes (where drained)
DmA	Digby loam, 0 to 3 percent slopes (where drained)
FsA	Fulton loam, 0 to 3 percent slopes (where drained)
FtA	Fulton silty clay loam, 0 to 3 percent slopes (where drained)
Ge	Genesee loam, occasionally flooded
Gf	Gilford fine sandy loam (where drained)
GwB	Glynwood loam, 2 to 6 percent slopes
GwB2	Glynwood loam, 2 to 6 percent slopes, eroded
HnA	Haskins loam, 0 to 3 percent slopes (where drained)
Ho	Hoytville clay loam (where drained)
Hv	Hoytville clay (where drained)
KfA	Kibbie loam, 0 to 3 percent slopes
Lb	Landes fine sandy loam, occasionally flooded
Lc	Latty silty clay (where drained)
Lf	Lenawee silty clay loam (where drained)
Md	Mermill loam (where drained)
Mh	Millgrove loam (where drained)
NnA	Nappanee loam, 0 to 3 percent slopes (where drained)
NpA	Nappanee silty clay loam, 0 to 3 percent slopes (where drained)
OsB	Oshtemo sandy loam, 2 to 6 percent slopes
Pm	Pewamo silty clay loam (where drained)
RmB	Rawson sandy loam, 2 to 6 percent slopes
Ru	Ross silt loam, occasionally flooded
SaB	St. Clair loam, 2 to 6 percent slopes
Tn	Toledo silty clay loam (where drained)
TsB	Tuscola very fine sandy loam, 2 to 6 percent slopes
Wf	Wauseon fine sandy loam (where drained)

TABLE 6.--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	Corn	Soybeans	Winter wheat	Oats	Grass-legume hay
	Bu	Bu	Bu	Bu	Ton
BmB Belmore	90	30	40	75	4.0
BnA Blount	110	40	50	70	4.5
Bp Bono	120	40	42	75	4.5
BrB Bronson	95	36	38	78	3.8
BsB Boyer	85	35	40	70	3.8
BvE. Broughton					
BwC3 Broughton	---	---	---	---	3.0
Ca Carlisle	120	40	---	---	3.0
Cm Colwood	150	55	60	100	5.5
Db Defiance	105	35	---	---	3.0
DfA Del Rey	110	40	48	70	4.5
DgA Del Rey Variant	112	40	50	72	4.6
DmA Digby	115	42	48	80	4.5
FsA, FtA Fulton	100	35	44	70	4.0
Ge Genesee	120	42	---	---	5.0
Gf Gilford	125	45	50	90	5.0
GwB Glynwood	105	35	42	75	4.0
GwB2 Glynwood	95	30	35	70	3.8
GwC2 Glynwood	85	25	30	65	3.5
HnA Haskins	110	42	48	78	4.5
Ho Hoytville	125	44	50	80	5.0
Hv Hoytville	125	44	50	80	5.0

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Oats	Grass-legume hay
	Bu	Bu	Bu	Bu	Ton
KfA Kibbie	120	40	50	85	4.6
Lb Landes	95	34	---	65	3.5
Lc Latty	115	42	45	75	4.8
Lf Lenawee	125	45	50	80	5.2
Md Mermill	130	48	55	90	5.3
Mh Millgrove	140	50	55	90	5.4
MrD2 Morley	---	---	30	50	3.0
NnA, NpA Nappanee	105	35	45	75	3.8
OsB Oshtemo	80	30	35	70	3.0
OtB Ottokee	90	34	40	70	3.4
Pa Paulding	105	35	38	60	4.0
Pm Pewamo	125	45	50	80	5.0
Pt*. Pits					
RmB Rawson	105	38	44	80	4.2
RnA Rimer	94	35	40	75	4.0
RrA, RsA Roselms	80	35	33	55	3.5
Ru Ross	135	48	---	70	4.5
SaB St. Clair	95	30	40	70	4.0
SbC2 St. Clair	85	25	35	60	3.5
SbE St. Clair	---	---	---	---	---
ScD3 St. Clair	---	---	---	---	2.0
ScE3. St. Clair					
SdB Seward	90	30	34	75	3.5

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Oats	Grass-legume hay
	Bu	Bu	Bu	Bu	Ton
Sh------------------------ Shoals	115	40	---	60	3.5
So------------------------ Sloan	110	40	---	55	3.8
TdA----------------------- Tedrow	80	30	35	60	3.0
Tn------------------------ Toledo	120	42	47	80	4.8
TsB----------------------- Tuscola	110	40	50	80	4.0
Ud. Udorthents					
Ur*. Urban land					
Wa------------------------ Wabasha	110	35	---	---	3.8
Wd------------------------ Wallkill Variant	95	35	30	50	3.5
Wf------------------------ Wauseon	125	45	45	80	4.0

* 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	119,332	11,604	106,644	1,084	---
III	136,661	3,684	129,517	3,460	---
IV	1,006	1,006	---	---	---
V	---	---	---	---	---
VI	806	806	---	---	---
VII	2,607	2,607	---	---	---
VIII	---	---	---	---	---

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	
BmB Belmore	2o	Slight	Slight	Slight	Slight	Northern red oak White oak Black cherry Black walnut Sugar maple White ash Yellow-poplar	80 --- --- --- --- --- ---	Eastern white pine, white oak, yellow-poplar, white ash, black walnut, red pine, northern red oak.
BnA Blount	3c	Slight	Slight	Severe	Severe	White oak Northern red oak Green ash Bur oak Pin oak	65 65 --- --- ---	Eastern white pine, eastern redcedar, red pine, yellow-poplar.
Bp Bono	3w	Slight	Severe	Severe	Severe	Pin oak Swamp white oak Green ash Red maple Eastern cottonwood Black cherry	80 --- --- --- --- ---	Red maple, eastern cottonwood, American sycamore, green ash, swamp white oak.
BrB Bronson	3o	Slight	Slight	Slight	Slight	Northern red oak Red pine Eastern white pine	70 72 85	Eastern white pine, red pine, green ash.
BsB Boyer	3s	Slight	Slight	Moderate	Slight	White oak Red pine Eastern white pine Northern red oak	70 75 65 75	Green ash, eastern white pine, red pine.
BvE Broughton	4c	Moderate	Moderate	Severe	Severe	Pin oak White oak White ash Black cherry Slippery elm Red maple	70 55 --- --- --- ---	Austrian pine, green ash, red maple, yellow-poplar, pin oak.
BwC3 Broughton	4c	Slight	Moderate	Severe	Severe	Pin oak White oak White ash Black cherry Slippery elm Red maple	70 55 --- --- --- ---	Austrian pine, green ash, red maple, yellow-poplar, pin oak.
Ca Carlisle	4w	Slight	Severe	Severe	Severe	Eastern cottonwood Red maple White ash Green ash Black cherry Swamp white oak	80 --- --- --- --- ---	Eastern cottonwood, green ash, black willow.
Cm Colwood	2w	Slight	Severe	Severe	Severe	Pin oak Swamp white oak Red maple White ash	90 90 --- ---	Red maple, green ash, American sycamore, eastern cottonwood, pin oak, swamp white oak.
Db Defiance	3c	Slight	Moderate	Moderate	Severe	White oak White ash Black cherry Slippery elm Red maple	65 --- --- --- ---	Green ash, yellow-poplar, red maple, Austrian pine, pin oak.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
DfA: Del Rey	3c	Slight	Slight	Severe	Severe	White oak	70	Austrian pine, green ash, pin oak, red maple.
						Northern red oak	70	
						Green ash	---	
						Bur oak	---	
DgA: Del Rey Variant	3c	Slight	Slight	Severe	Severe	Northern red oak	70	Red maple, green ash, American sycamore, eastern cottonwood, pin oak, swamp white oak.
						White oak	70	
						Green ash	---	
						Black cherry	---	
						Eastern cottonwood	---	
						Red maple	---	
						Swamp white oak	---	
						Pin oak	---	
DmA: Digby	2o	Slight	Slight	Slight	Slight	Northern red oak	80	White ash, red maple, eastern white pine, yellow-poplar.
						White oak	75	
						White ash	---	
						Pin oak	---	
FsA, FtA: Fulton	3c	Slight	Slight	Severe	Severe	Pin oak	80	Red maple, Austrian pine, green ash, yellow-poplar, pin oak.
						American beech	---	
						White oak	---	
						White ash	---	
						Black cherry	---	
						Slippery elm	---	
						Red maple	---	
Ge: Genesee	1o	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar, white ash, white oak, red pine.
Gf: Gilford	4w	Slight	Severe	Severe	Severe	Pin oak	70	White ash, red maple, green ash, American sycamore, eastern cottonwood, pin oak, swamp white oak.
						Eastern white pine	55	
						Bigtooth aspen	70	
						Red maple	60	
GwB, GwB2, GwC2: Glynwood	2c	Slight	Slight	Moderate	Moderate	Northern red oak	80	Eastern white pine, yellow-poplar, white ash.
						Black oak	80	
						White oak	80	
HnA: Haskins	2o	Slight	Slight	Slight	Slight	White oak	75	Red maple, white ash, eastern white pine, yellow-poplar, red pine, northern red oak, white oak.
						Northern red oak	80	
						Pin oak	90	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
						Yellow-poplar	---	
Ho, Hv: Hoytville	3w	Slight	Severe	Severe	Moderate	Northern red oak	72	Red maple, green ash, American sycamore, eastern cottonwood, pin oak, swamp white oak.
						Pin oak	76	
						White ash	77	
						Green ash	---	
						Black cherry	---	
						Eastern cottonwood	---	
						Red maple	---	
KfA: Kibbie	2o	Slight	Slight	Slight	Slight	Pin oak	90	Eastern white pine, yellow-poplar, white ash, northern red oak, red pine, white oak.
						Northern red oak	---	
						White ash	---	
						Eastern cottonwood	---	
Lb: Landes	1o	Slight	Slight	Slight	Slight	Eastern cottonwood	106	Sugar maple, eastern cottonwood, yellow-poplar, American sycamore, green ash, black walnut, eastern white pine.
						Yellow-poplar	95	
						American sycamore	---	
						Green ash	---	

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	
Lc------------------ Latty	3w	Slight	Severe	Severe	Severe	Swamp white oak----- Pin oak------------- Red maple----------- Green ash----------- Black cherry-------- Eastern cottonwood--	70 70 --- --- --- ---	Green ash, eastern cottonwood, red maple, pin oak, American sycamore, swamp white oak, sweetgum.
Lf------------------ Lenawee	2w	Slight	Severe	Severe	Moderate	Pin oak------------- Red maple----------- Green ash----------- Black cherry-------- Swamp white oak----- Eastern cottonwood--	85 --- --- --- --- ---	American sycamore, eastern cottonwood, red maple, green ash, sweetgum, pin oak, swamp white oak.
Md------------------ Mermill	2w	Slight	Severe	Severe	Severe	Pin oak------------- Swamp white oak----- Green ash----------- Black cherry-------- Eastern cottonwood-- Red maple-----------	90 90 --- --- --- ---	Red maple, swamp white oak, green ash, pin oak, American sycamore, eastern cottonwood, sweetgum.
Mh------------------ Millgrove	2w	Slight	Severe	Severe	Severe	Pin oak------------- Northern red oak---- Swamp white oak----- Red maple----------- Eastern cottonwood-------- Black cherry-------- Green ash-----------	86 80 85 --- --- ---	Swamp white oak, eastern cottonwood, green ash, pin oak, red maple, American sycamore.
MrD2---------------- Morley	2r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak---- Yellow-poplar------- Black walnut-------- Bur oak------------- Shagbark hickory----	80 80 90 --- --- ---	White oak, black walnut, green ash, eastern white pine, red pine, white spruce.
NnA, NpA------------ Nappanee	3c	Slight	Slight	Severe	Severe	White oak----------- Pin oak------------- American sycamore---	75 85 ---	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
OsB----------------- Oshtemo	3o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- American basswood--- Sugar maple---------	66 --- 66 61	Eastern white pine, red pine, white ash, Carolina poplar, northern red oak, yellow-poplar.
OtB----------------- Ottokee	3s	Slight	Slight	Moderate	Slight	Northern red oak---- White oak----------- Red maple----------- Black oak----------- Bur oak------------- Quaking aspen------- Green ash----------- Slippery elm--------	70 65 --- --- --- --- --- ---	Green ash, red pine, eastern white pine.
Pa------------------ Paulding	3w	Slight	Severe	Severe	Severe	Swamp white oak----- Pin oak------------- Green ash----------- Red maple----------- Black cherry-------- Eastern cottonwood--	65 76 --- --- --- ---	Sweetgum, green ash, American sycamore, eastern cottonwood, pin oak, swamp white oak, red maple.

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	Trees to plant
Pm------------------ Pewamo	2w	Slight	Severe	Moderate	Moderate	Pin oak-------------	90	White ash, eastern white pine, red maple, green ash, pin oak, black willow, American sycamore.
						Swamp white oak-----	---	
						Red maple-----------	71	
						White ash-----------	71	
						Eastern cottonwood--	98	
						Green ash-----------	---	
RmB----------------- Rawson	2o	Slight	Slight	Slight	Slight	White oak-----------	75	Eastern white pine, yellow-poplar, white ash, red pine, white oak.
						Northern red oak----	80	
						Black cherry--------	---	
						Sugar maple---------	---	
						White ash-----------	---	
						Yellow-poplar-------	---	
RnA----------------- Rimer	2s	Slight	Slight	Moderate	Slight	Northern red oak----	80	Eastern white pine, red pine, green ash.
						White oak-----------	75	
						Red maple-----------	---	
						Bur oak-------------	---	
						Quaking aspen-------	---	
						Green ash-----------	---	
						Slippery elm--------	---	
RrA, RsA----------- Roselms	4c	Slight	Moderate	Severe	Severe	White oak-----------	60	Austrian pine, red maple, green ash, pin oak, yellow-poplar.
						Red maple-----------	---	
						White ash-----------	---	
						Black cherry--------	---	
						Slippery elm--------	---	
Ru------------------ Ross	1o	Slight	Slight	Slight	Slight	Northern red oak----	86	Eastern white pine, black walnut, white ash, yellow-poplar.
						Yellow-poplar-------	96	
						Sugar maple---------	85	
						White oak-----------	---	
						Black walnut--------	---	
						Black cherry--------	---	
						White ash-----------	---	
SaB, SbC2---------- St. Clair	3c	Slight	Slight	Severe	Severe	Northern red oak----	66	Eastern white pine, yellow-poplar, pin oak, Austrian pine, green ash, red maple.
						White oak-----------	62	
						White ash-----------	---	
						Sugar maple---------	---	
SbE, ScD3, ScE3---- St. Clair	3c	Moderate	Moderate	Severe	Severe	Northern red oak----	66	Eastern white pine, yellow-poplar, pin oak, Austrian pine, green ash, red pine.
						White oak-----------	62	
						White ash-----------	---	
						Sugar maple---------	---	
SdB----------------- Seward	2s	Slight	Slight	Moderate	Slight	Northern red oak----	80	Eastern white pine, yellow-poplar, red pine, green ash.
						Yellow-poplar-------	95	
						Red maple-----------	---	
						Black oak-----------	---	
						Bur oak-------------	---	
						Quaking aspen-------	---	
						Green ash-----------	---	
						Slippery elm--------	---	
Sh------------------ Shoals	2o	Slight	Slight	Slight	Slight	Pin oak-------------	90	Red maple, pin oak, yellow-poplar, eastern white pine, white ash, red pine, white oak.
						Yellow-poplar-------	90	
						Eastern cottonwood--	---	
						White ash-----------	---	
So------------------ Sloan	2w	Slight	Severe	Severe	Severe	Pin oak-------------	86	Red maple, white ash, eastern cottonwood, Austrian pine, pin oak, swamp white oak.
						Swamp white oak-----	---	
						Red maple-----------	---	
						Green ash-----------	---	
						Eastern cottonwood--	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
TdA------------------ Tedrow	3s	Slight	Slight	Moderate	Slight	Bur oak------------- Northern red oak---- Red maple----------- Quaking aspen------- Green ash----------- Slippery elm-------- Black oak-----------	75 --- --- --- --- --- ---	Yellow-poplar, red pine, white ash, jack pine, black oak, northern red oak.
Tn------------------ Toledo	3w	Slight	Severe	Severe	Severe	Pin oak------------- Swamp white oak----- Red maple----------- Green ash----------- Eastern cottonwood--	80 80 --- --- ---	Eastern cottonwood, pin oak, eastern cottonwood, American sycamore, red maple, sweetgum.
TsB------------------ Tuscola	1o	Slight	Slight	Slight	Slight	Northern red oak---- Black walnut-------- White ash----------- American basswood--- White oak----------- Sugar maple--------- Yellow-poplar-------	86 --- --- --- --- --- ---	Black walnut, yellow-poplar, eastern white pine, Austrian pine, red pine, northern red oak, white ash.
Wa------------------ Wabasha	3w	Slight	Severe	Moderate	Moderate	Pin oak------------- Green ash----------- Red maple----------- Black cherry-------- Swamp white oak----- Eastern cottonwood--	80 --- --- --- --- ---	Red maple, green ash, American sycamore, eastern cottonwood, pin oak, swamp white oak, sweetgum.
Wd------------------ Wallkill Variant	4w	Slight	Severe	Severe	Severe	Pin oak------------- Red maple----------- Black willow-------- Eastern cottonwood-- American sycamore--- Green ash-----------	80 --- --- --- --- ---	Red maple, eastern cottonwood, American sycamore, sweetgum, silver maple, swamp white oak, pin oak.
Wf------------------ Wauseon	3w	Slight	Severe	Severe	Severe	Swamp white oak----- Silver maple-------- Green ash----------- Black cherry-------- Eastern cottonwood-- Swamp white oak----- Red maple----------- Pin oak-------------	80 70 --- --- --- --- --- ---	Red maple, American sycamore, green ash, eastern cottonwood, pin oak, swamp white oak, sweetgum.

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 heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
BmB---------------- Belmore	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
BnA---------------- Blount	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
Bp----------------- Bono	---	American cranberrybush, silky dogwood, Amur privet, Amur honeysuckle.	Northern white-cedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine, Norway spruce.	---
BrB---------------- Bronson	---	Silky dogwood, American cranberrybush, Amur privet, Amur honeysuckle.	Austrian pine, northern white-cedar, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
BsB---------------- Boyer	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
BvE, BwC3---------- Broughton	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Ca----------------- Carlisle	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Cm: Colwood	---	American cranberrybush, silky dogwood, Amur honeysuckle, Amur privet.	Northern white-cedar, Washington hawthorn, white fir, blue spruce, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
Db: Defiance	---	Silky dogwood, American cranberrybush, Amur privet, Amur honeysuckle.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
DfA: Del Rey	---	Amur privet, arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
DgA: Del Rey Variant	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
DmA: Digby	---	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.
FsA, FtA: Fulton	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
Ge: Genesee	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine.
Gf: Gilford	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, northern white-cedar, Washington hawthorn, blue spruce, Austrian pine.	Eastern white pine	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
GwB, GwB2, GwC2--- Glynwood	---	Amur honeysuckle, Washington hawthorn, Amur privet, arrowwood, eastern redcedar, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
HnA--------------- Haskins	---	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.
Ho, Hv------------ Hoytville	---	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.
KfA--------------- Kibbie	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Pin oak, eastern white pine.
Lb---------------- Landes	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Lc---------------- Latty	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, Washington hawthorn.	Eastern white pine	---
Lf---------------- Lenawee	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, northern white-cedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Md---------------- Mermill	---	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.
Mh---------------- Millgrove	---	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.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
MrD2. Morley	---	Amur honeysuckle, Washington hawthorn, Amur privet, eastern redcedar, arrowwood, American cranberrybush, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
NnA, NpA. Nappanee	---	Eastern redcedar, Washington hawthorn, Amur privet, American cranberrybush, arrowwood, Amur honeysuckle, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
OsB. Oshtemo	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
OtB. Ottokee	---	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.
Pa. Paulding	---	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.
Pm. Pewamo	---	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.
Pt*. Pits					
RmB. Rawson	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
RnA. Rimer	---	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.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
RrA, RsA: Roselms	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Ru: Ross	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, Austrian pine.	Norway spruce	Eastern white pine.
SaB, SbC2, SbE, ScD3, ScE3: St. Clair	---	Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
SdB: Seward	---	Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle, Amur privet, American cranberrybush.	Eastern redcedar, northern white-cedar, Austrian pine, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Sh: Shoals	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, blue spruce, Washington hawthorn.	Norway spruce	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.
TdA: Tedrow	---	Silky dogwood, American cranberrybush, Amur privet, Amur honeysuckle.	Austrian pine, northern white-cedar, white fir, blue spruce, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
Tn: Toledo	---	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.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
TsB: Tuscola	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush, Tatarian honeysuckle.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Ud. Udorthents					
Ur*. Urban land					
Wa: Wabasha	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, Washington hawthorn.	Eastern white pine	---
Wd: Wallkill Variant	---	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.
Wf: Wauseon	---	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.

* 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
BmB: Belmore	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
BnA: Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Bp: Bono	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
BrB: Bronson	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
BsB: Boyer	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
BvE: Broughton	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: wetness, slope.	Severe: slope.
BwC3: Broughton	Severe: percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: slope, too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
Ca: Carlisle	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Cm: Colwood	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Db: Defiance	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Severe: erodes easily.	Severe: flooding.
DfA: Del Rey	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
DgA: Del Rey Variant	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
DmA: Digby	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
FsA, FtA: Fulton	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
Ge: Genesee	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Gf: Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
GwB, GwB2: Glynwood	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: wetness, slope, percs slowly.	Moderate: wetness.	Slight.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
GwC2------------------ Glynwood	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
HnA------------------- Haskins	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
Ho-------------------- Hoytville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Hv-------------------- Hoytville	Severe: ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
KfA------------------- Kibbie	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Lb-------------------- Landes	Severe: flooding.	Slight----------	Moderate: flooding.	Slight------------	Moderate: droughty, flooding.
Lc-------------------- Latty	Severe: ponding, too clayey.	Severe: ponding, too clayey.	Severe: ponding, too clayey.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
Lf-------------------- Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Md-------------------- Mermill	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
Mh-------------------- Millgrove	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MrD2------------------ Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
NnA, NpA-------------- Nappanee	Severe: wetness.	Moderate: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
OsB------------------- Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight------------	Moderate: small stones.
OtB------------------- Ottokee	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight------------	Moderate: droughty.
Pa-------------------- Paulding	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
Pm-------------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pt*. Pits					
RmB------------------- Rawson	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight------------	Slight.
RnA------------------- Rimer	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, 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
RrA Roselms	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
RsA Roselms	Severe: wetness, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: too clayey.	Severe: too clayey.
Ru Ross	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
SaB St. Clair	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
SbC2 St. Clair	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
SbE St. Clair	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, erodes easily.	Severe: slope.
ScD3 St. Clair	Severe: slope, percs slowly, too clayey.	Severe: slope, percs slowly, too clayey.	Severe: slope, percs slowly, too clayey.	Severe: too clayey, erodes easily.	Severe: too clayey, slope.
ScE3 St. Clair	Severe: slope, percs slowly, too clayey.	Severe: slope, percs slowly, too clayey.	Severe: slope, percs slowly, too clayey.	Severe: slope, erodes easily.	Severe: too clayey, slope.
SdB Seward	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Moderate: droughty.
Sh Shoals	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
So Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
TdA Tedrow	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Tn Toledo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
TsB Tuscola	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
Ud. Udorthents					
Ur*. Urban land					
Wa Wabasha	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Wd Wallkill Variant	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
Wf Wauseon	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
BmB: Belmore	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BnA: Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Bp: Bono	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
BrB: Bronson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BsB: Boyer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BvE: Broughton	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BwC3: Broughton	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ca: Carlisle	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Cm: Colwood	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Db: Defiance	Poor	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
DfA: Del Rey	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
DgA: Del Rey Variant	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
DmA: Digby	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
FsA, FtA: Fulton	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ge: Genesee	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Gf: Gilford	Fair	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
GwB, GwB2: Glynwood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
GwC2: Glynwood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HnA: Haskins	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ho, Hv: Hoytville	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
KfA: Kibbie	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.

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
Lb----------------- Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Lc----------------- Latty	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
Lf----------------- Lenawee	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Md----------------- Mermill	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
Mh----------------- Millgrove	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
MrD2--------------- Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
NnA, NpA----------- Nappanee	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
OsB---------------- Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OtB---------------- Ottokee	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Pa----------------- Paulding	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Pm----------------- Pewamo	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Pt*. Pits										
RmB---------------- Rawson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RnA---------------- Rimer	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
RrA, RsA----------- Roselms	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
Ru----------------- Ross	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SaB---------------- St. Clair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SbC2--------------- St. Clair	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
SbE---------------- St. Clair	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ScD3--------------- St. Clair	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ScE3--------------- St. Clair	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
SdB---------------- Seward	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	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 herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Sh------------------ Shoals	Fair	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
So------------------ Sloan	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
TdA----------------- Tedrow	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair.
Tn------------------ Toledo	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
TsB----------------- Tuscola	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ud. Udorthents										
Ur*. Urban land										
Wa------------------ Wabasha	Poor	Poor	Fair	Good	Poor	Good	Good	Fair	Good	Good.
Wd------------------ Wallkill Variant	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wf------------------ Wauseon	Poor	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]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BmB: Belmore	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
BnA: Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Bp: Bono	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell, low strength.	Severe: ponding.
BrB: Bronson	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
BsB: Boyer	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: small stones.
BvE: Broughton	Severe: slope, wetness.	Severe: shrink-swell, slope.	Severe: slope, wetness, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope.
BwC3: Broughton	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Ca: Carlisle	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
Cm: Colwood	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Db: Defiance	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
DfA: Del Rey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
DgA: Del Rey Variant	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
DmA: Digby	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
FsA, FtA: Fulton	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
Ge: Genesee	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Gf: Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
GwB, GwB2: Glynwood	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: slope, shrink-swell, wetness.	Severe: frost action, low strength.	Slight.

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
GwC2-------------- Glynwood	Severe: wetness.	Moderate: slope, shrink-swell, wetness.	Severe: wetness.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
HnA--------------- Haskins	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Ho---------------- Hoytville	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
Hv---------------- Hoytville	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding, too clayey.
KfA--------------- Kibbie	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Lb---------------- Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Lc---------------- Latty	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding, low strength.	Severe: ponding, too clayey.
Lf---------------- Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Md---------------- Mermill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Mh---------------- Millgrove	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
MrD2-------------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
NnA, NpA---------- Nappanee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Moderate: wetness.
OsB--------------- Oshtemo	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: small stones.
OtB--------------- Ottokee	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
Pa---------------- Paulding	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding, too clayey.
Pm---------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Pt*. 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
RmB: Rawson	Moderate: too clayey, dense layer, wetness.	Slight	Moderate: wetness, shrink-swell.	Moderate: slope.	Moderate: frost action.	Slight.
RnA: Rimer	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
RrA: Roselms	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.	Moderate: wetness.
RsA: Roselms	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.	Severe: too clayey.
Ru: Ross	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
SaB: St. Clair	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
SbC2: St. Clair	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
SbE: St. Clair	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
ScD3, ScE3: St. Clair	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: too clayey, slope.
SdB: Seward	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Moderate: frost action.	Moderate: droughty.
Sh: Shoals	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
So: Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
TdA: Tedrow	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Tn: Toledo	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
TsB: Tuscola	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: frost action.	Slight.
Ud. Udorthents						
Ur*. Urban land						

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
Wa----------------- Wabasha	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
Wd----------------- Wallkill Variant	Severe: excess humus, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, low strength.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding, too clayey.
Wf----------------- Wauseon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, frost action.	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," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BmB: Belmore	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
BnA: Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Bp: Bono	Severe: percs slowly, ponding.	Slight	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
BrB: Bronson	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage.
BsB: Boyer	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
BvE: Broughton	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: slope, too clayey, wetness.	Severe: slope.	Poor: slope, too clayey, hard to pack.
BwC3: Broughton	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
Ca: Carlisle	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Cm: Colwood	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, thin layer.
Db: Defiance	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
DfA: Del Rey	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
DgA: Del Rey Variant	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
DmA: Digby	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: wetness, seepage.	Poor: wetness, too sandy, seepage.
FsA, FtA: Fulton	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

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
Ge------------------ Genesee	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Gf------------------ Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
GwB, GwB2----------- Glynwood	Severe: percs slowly, wetness.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
GwC2---------------- Glynwood	Severe: percs slowly, wetness.	Severe: slope.	Moderate: wetness, too clayey, slope.	Moderate: slope, wetness.	Fair: slope, too clayey, wetness.
HnA----------------- Haskins	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Ho, Hv-------------- Hoytville	Severe: ponding, percs slowly.	Slight-----------	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
KfA----------------- Kibbie	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
Lb------------------ Landes	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Lc------------------ Latty	Severe: percs slowly, ponding.	Slight-----------	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
Lf------------------ Lenawee	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Md------------------ Mermill	Severe: ponding, percs slowly.	Moderate: seepage.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Mh------------------ Millgrove	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: small stones, ponding.
MrD2---------------- Morley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
NnA, NpA------------ Nappanee	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
OsB----------------- Oshtemo	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
OtB----------------- Ottokee	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, seepage.

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
Pa: Paulding	Severe: ponding, percs slowly.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Pm: Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
Pt*. Pits					
RmB: Rawson	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
RnA: Rimer	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
RrA, RsA: Roselms	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Ru: Ross	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Good.
SaB: St. Clair	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
SbC2: St. Clair	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
SbE, ScD3, ScE3: St. Clair	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
SdB: Seward	Severe: percs slowly, wetness.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
Sh: Shoals	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
So: Sloan	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
TdA: Tedrow	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Tn: Toledo	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
TsB: Tuscola	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy.
Ud. Udorthents					
Ur*. Urban land					
Wa: Wabasha	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Wd: Wallkill Variant	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too clayey.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Wf: Wauseon	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, 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," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BmB-------------------- Belmore	Good------------------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, small stones.
BnA-------------------- Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Bp--------------------- Bono	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
BrB-------------------- Bronson	Fair: wetness.	Probable-------------	Probable-------------	Poor: small stones.
BsB-------------------- Boyer	Good------------------	Probable-------------	Probable-------------	Poor: small stones, area reclaim.
BvE-------------------- Broughton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
BwC3------------------- Broughton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ca--------------------- Carlisle	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
Cm--------------------- Colwood	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Db--------------------- Defiance	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
DfA-------------------- Del Rey	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
DgA-------------------- Del Rey Variant	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
DmA-------------------- Digby	Fair: wetness.	Probable-------------	Improbable: too sandy.	Poor: thin layer.
FsA, FtA--------------- Fulton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Ge--------------------- Genesee	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Gf--------------------- Gilford	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: wetness.
GwB, GwB2, GwC2-------- Glynwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
HnA-------------------- Haskins	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ho------------------- Hoytville	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Hv------------------- Hoytville	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
KfA------------------ Kibbie	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lb------------------- Landes	Good----------------	Probable------------	Improbable: too sandy.	Poor: thin layer.
Lc------------------- Latty	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Lf------------------- Lenawee	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Md------------------- Mermill	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Mh------------------- Millgrove	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
MrD2----------------- Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
NnA, NpA------------- Nappanee	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
OsB------------------ Oshtemo	Good----------------	Probable------------	Probable------------	Poor: small stones.
OtB------------------ Ottokee	Fair: wetness.	Probable------------	Improbable: too sandy.	Fair: too sandy.
Pa------------------- Paulding	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Pm------------------- Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Pt*. Pits				
RmB------------------ Rawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
RnA------------------ Rimer	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RrA-------------------- Roselms	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
RsA-------------------- Roselms	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ru--------------------- Ross	Good------------------	Improbable: excess fines.	Improbable: excess fines.	Good.
SaB, SbC2------------- St. Clair	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SbE-------------------- St. Clair	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
ScD3------------------- St. Clair	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
ScE3------------------- St. Clair	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
SdB-------------------- Seward	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Sh--------------------- Shoals	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
So--------------------- Sloan	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
TdA-------------------- Tedrow	Fair: wetness.	Probable--------------	Improbable: too sandy.	Fair: too sandy.
Tn--------------------- Toledo	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
TsB-------------------- Tuscola	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Ud. Udorthents				
Ur*. Urban land				
Wa--------------------- Wabasha	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wd--------------------- Wallkill Variant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess humus, wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Wf-------------------- Wauseon	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, 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]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
BmB Belmore	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable	Favorable.
BnA Blount	Slight	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
Bp Bono	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
BrB Bronson	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, slope, cutbanks cave.	Wetness, too sandy, soil blowing.	Favorable.
BsB Boyer	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
BvE Broughton	Severe: slope.	Severe: hard to pack.	Severe: no water.	Slope, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, droughty.
BwC3 Broughton	Severe: slope.	Severe: hard to pack.	Severe: no water.	Slope, percs slowly.	Slope, percs slowly, wetness.	Slope, droughty.
Ca Carlisle	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
Cm Colwood	Moderate: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
Db Defiance	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
DfA Del Rey	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
DgA Del Rey Variant	Severe: seepage.	Severe: wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
DmA Digby	Severe: seepage.	Severe: wetness, seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Wetness.
FsA, FtA Fulton	Slight	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Ge Genesee	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Gf Gilford	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, too sandy, soil blowing.	Wetness.
GwB, GwB2 Glynwood	Moderate: slope.	Moderate: wetness, piping.	Severe: no water.	Slope, percs slowly, frost action.	Erodes easily, wetness.	Erodes easily.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
GwC2 Glynwood	Severe: slope.	Moderate: wetness, piping.	Severe: no water.	Slope, percs slowly, frost action.	Slope, erodes easily, wetness.	Slope, erodes easily.
HnA Haskins	Moderate: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily, rooting depth.
Ho, Hv Hoytville	Slight	Severe: ponding.	Severe: no water.	Ponding, frost action.	Ponding	Wetness, rooting depth.
KfA Kibbie	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
Lb Landes	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Too sandy, soil blowing.	Droughty.
Lc Latty	Slight	Severe: hard to pack, ponding.	Severe: no water.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Lf Lenawee	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Wetness.
Md Mermill	Moderate: seepage.	Severe: ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Wetness, rooting depth, percs slowly.
Mh Millgrove	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding	Wetness.
MrD2 Morley	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
NnA, NpA Nappanee	Slight	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly	Erodes easily, wetness.	Wetness, erodes easily.
OsB Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
OtB Ottokee	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Slope, cutbanks cave.	Too sandy, soil blowing, wetness.	Droughty.
Pa Paulding	Slight	Severe: hard to pack, ponding.	Severe: no water.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, droughty, percs slowly.
Pm Pewamo	Slight	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Wetness.
Pt*. Pits						
RmB Rawson	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Wetness, soil blowing.	Percs slowly.
RnA Rimer	Severe: seepage.	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly, frost action.	Wetness, soil blowing, percs slowly.	Wetness, droughty, rooting depth.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
RrA, RsA----------- Roselms	Slight----------	Severe: hard to pack.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.
Ru---------------- Ross	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
SaB--------------- St. Clair	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily.
SbC2, SbE, ScD3, ScE3------------- St. Clair	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily.
SdB--------------- Seward	Severe: seepage.	Moderate: hard to pack.	Severe: no water.	Deep to water	Soil blowing, percs slowly.	Droughty, rooting depth.
Sh---------------- Shoals	Moderate: seepage.	Severe: wetness, piping.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
So---------------- Sloan	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
TdA--------------- Tedrow	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, too sandy, soil blowing.	Wetness, droughty.
Tn---------------- Toledo	Slight----------	Severe: ponding, hard to pack.	Severe: no water.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Wetness, percs slowly.
TsB--------------- Tuscola	Moderate: seepage, slope.	Severe: piping.	Severe: cutbanks cave.	Frost action, slope, cutbanks cave.	Wetness, too sandy.	Favorable.
Ud. Udorthents						
Ur*. Urban land						
Wa---------------- Wabasha	Slight----------	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
Wd---------------- Wallkill Variant	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Wetness, percs slowly.
Wf---------------- Wauseon	Severe: seepage.	Severe: hard to pack, ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Ponding, soil blowing, percs slowly.	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: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BmB---------------- Belmore	0-6	Loam--------------	ML, CL-ML, CL	A-4	0	85-100	80-100	60-90	50-80	20-32	3-10
	6-12	Sandy clay loam, clay loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	85-100	80-100	55-75	40-70	20-36	4-14
	12-25	Gravelly sandy clay loam, gravelly clay loam, sandy loam.	SC, CL	A-6, A-4, A-2	0	80-100	45-80	30-80	15-65	25-40	7-15
	25-60	Gravelly sandy loam, very gravelly sand, sandy loam.	SM, SC, SM-SC, ML	A-2, A-4, A-1	0	80-100	50-80	30-75	15-60	15-30	*NP-10
BnA---------------- Blount	0-9	Loam--------------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	9-31	Silty clay loam, clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	80-90	75-85	35-60	15-35
	31-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
Bp----------------- Bono	0-6	Silty clay loam	CH, CL	A-7	0	100	98-100	95-100	80-95	40-60	20-35
	6-38	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	98-100	95-100	90-100	40-66	26-44
	38-60	Clay, silty clay loam, silty clay.	CH, CL	A-7, A-6	0	100	98-100	95-100	90-100	35-60	20-40
BrB---------------- Bronson	0-8	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	65-75	20-40	<25	NP-5
	8-39	Sandy loam, sandy clay loam, loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	60-95	60-85	25-45	<30	NP-15
	39-60	Gravelly sandy loam, loamy sand.	SM, SP-SM	A-2	0-5	85-95	60-95	55-70	10-15	---	NP
BsB---------------- Boyer	0-9	Loamy sand--------	SM, SM-SC	A-2, A-1	0-5	95-100	65-95	45-75	15-30	<20	NP-6
	9-27	Gravelly sandy clay loam, loam, gravelly sandy loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	27-60	Very gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
BvE---------------- Broughton	0-7	Silt loam---------	CL, ML	A-6, A-4	0	100	100	90-100	70-90	25-40	8-15
	7-17	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	85-95	60-85	30-50
	17-60	Clay--------------	CH, MH	A-7	0	100	100	90-100	80-95	60-85	30-50
BwC3--------------- Broughton	0-5	Clay--------------	CL, CH, ML, MH	A-7	0	100	100	95-100	85-95	40-55	15-30
	5-17	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	85-95	60-85	30-50
	17-60	Clay--------------	CH, MH	A-7	0	100	100	90-100	80-95	60-85	30-50
Ca----------------- Carlisle	0-60	Sapric material	PT	A-8	---	---	---	---	---	---	---
Cm----------------- Colwood	0-12	Loam--------------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	15-35	2-12
	12-34	Loam, silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	100	100	80-100	50-90	20-40	6-20
	34-60	Stratified silty clay loam to fine sand.	SM, ML	A-2, A-4	0	100	95-100	70-100	30-80	<35	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	
Db----------------- Defiance	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	12-25
	8-39	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	75-95	40-65	20-35
	39-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	80-95	40-65	20-35
DfA---------------- Del Rey	0-8	Silt loam---------	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	25-45	10-25
	8-32	Silty clay loam, silty clay.	CH, CL	A-7	0	95-100	95-100	90-100	85-95	40-55	20-30
	32-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	10-25
DgA---------------- Del Rey Variant	0-7	Silt loam---------	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	70-90	25-40	5-15
	7-37	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	85-100	35-55	15-30
	37-60	Stratified sandy loam to gravelly loamy sand.	SM, SM-SC	A-2, A-4, A-1	0	80-100	70-100	45-65	15-40	<30	NP-5
DmA---------------- Digby	0-9	Loam--------------	SM, ML, CL-ML	A-4	0	85-100	80-100	70-90	40-80	20-36	NP-10
	9-20	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-6, A-4, A-2	0	85-100	80-100	65-80	30-60	25-40	4-15
	20-35	Gravelly sandy clay loam, gravelly clay loam, gravelly loam.	CL, CL-ML, SC, SM-SC	A-6, A-4, A-1, A-2	0-5	85-100	50-80	40-75	20-60	25-40	4-15
	35-60	Stratified very gravelly sandy loam to gravelly sand.	SM, SW-SM, SP-SM	A-2, A-1	0-5	80-100	50-80	30-60	10-30	<20	NP-4
FsA---------------- Fulton	0-8	Loam--------------	CL, ML, CL-ML	A-6, A-4	0	95-100	90-100	80-100	65-90	24-40	3-16
	8-32	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	85-100	40-60	18-34
	32-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	85-100	40-60	18-34
FtA---------------- Fulton	0-10	Silty clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	75-95	35-50	12-24
	10-37	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	85-100	40-60	18-34
	37-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	85-100	40-60	18-34
Ge----------------- Genesee	0-10	Loam--------------	ML, CL	A-4, A-6	0	100	100	90-100	75-90	26-40	3-15
	10-60	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	90-100	75-90	26-40	3-15
Gf----------------- Gilford	0-11	Fine sandy loam	SM, SC, SM-SC	A-4	0	95-100	90-100	65-80	35-45	<25	2-10
	11-34	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
	34-60	Loamy fine sand, fine sand.	SM, SP, SP-SM	A-3, A-1-B, A-2-4	0	90-100	85-100	18-60	3-20	---	NP
GwB, GwB2, GwC2-- Glynwood	0-9	Loam--------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-100	55-90	23-40	4-15
	9-35	Clay, clay loam, silty clay loam.	CL, CH	A-7, A-6	0-5	95-100	85-100	75-100	65-95	35-55	15-30
	35-60	Clay loam, silty clay loam.	CL	A-6, A-4	0-5	95-100	80-100	75-95	65-90	25-40	7-18

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	
HnA----- Haskins	0-8	Loam-----	CL-ML, CL	A-4, A-6	0	95-100	85-100	70-100	55-90	25-40	5-20
	8-32	Sandy clay loam, clay loam, gravelly clay loam.	SC, CL	A-6, A-4, A-2	0	85-100	70-100	55-85	30-65	20-40	7-20
	32-60	Clay, silty clay, clay loam.	CH, CL	A-7, A-6	0	100	85-100	80-100	70-95	35-65	15-40
Ho----- Hoytville	0-7	Clay loam-----	CL	A-7	0-5	100	90-100	80-100	70-100	40-50	22-30
	7-39	Clay, silty clay	CH, CL, MH	A-7	0-5	100	85-100	80-100	75-100	42-66	22-40
	39-60	Clay, silty clay loam, clay loam.	CH, CL, MH	A-7	0-5	100	85-100	80-100	75-100	40-62	22-40
Hv----- Hoytville	0-9	Clay-----	CH, CL, MH	A-7	0-5	100	90-100	85-100	80-100	45-66	22-40
	9-40	Clay, silty clay	CH, CL, MH	A-7	0-5	100	85-100	80-100	75-100	42-66	22-40
	40-60	Clay, silty clay loam, clay loam.	CH, CL, MH	A-7	0-5	100	85-100	80-100	75-100	40-62	22-40
KfA----- Kibbie	0-9	Loam-----	ML	A-4, A-6	0	100	100	75-95	50-85	25-40	2-14
	9-41	Silt loam, silty clay loam, fine sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-7	0	90-100	85-100	80-100	35-90	25-45	6-25
	41-60	Stratified silt loam to fine sand.	ML, SM, SC, CL	A-4, A-2	0	100	95-100	70-95	30-80	<30	NP-10
Lb----- Landes	0-11	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	95-100	85-95	20-50	<25	NP-10
	11-72	Stratified fine sand to silt loam.	SM, ML, SP-SM, SC	A-2, A-4	0	100	95-100	60-95	10-70	<30	NP-10
Lc----- Latty	0-7	Silty clay-----	CH, MH	A-7	0	100	100	90-100	85-100	50-75	20-40
	7-40	Clay, silty clay	CH	A-7	0	100	100	90-100	85-100	50-70	25-45
	40-60	Clay, silty clay	CH	A-7	0	100	100	90-100	85-100	50-70	25-45
Lf----- Lenawee	0-9	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	50-95	25-45	11-22
	9-48	Silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	80-95	40-55	20-30
	48-66	Silt loam, silty clay loam, clay loam.	CL, CL-ML	A-6, A-4, A-7	0	100	95-100	95-100	85-95	25-45	6-22
Md----- Mermill	0-7	Loam-----	ML, SM, CL, SC	A-4	0	95-100	90-100	75-95	40-75	20-35	3-10
	7-30	Clay loam, sandy clay loam, loam.	SC, CL	A-6, A-7, A-4	0	90-100	80-100	70-85	40-75	24-44	8-22
	30-60	Clay, silty clay, clay loam.	CH, CL	A-7, A-6	0-2	100	90-100	90-100	80-95	38-65	18-40
Mh----- Millgrove	0-15	Loam-----	ML, CL, CL-ML	A-4, A-6	0	85-100	80-100	75-100	55-85	22-40	3-16
	15-21	Clay loam, sandy clay loam, gravelly loam.	CL, SC	A-6	0	85-100	80-100	70-95	40-75	25-40	11-26
	21-40	Gravelly loam, gravelly sandy loam, gravelly sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2, A-1	0-5	80-100	35-85	25-80	15-60	25-40	4-15
	40-60	Stratified gravelly sandy loam to loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0-5	80-100	35-80	30-70	25-55	16-36	NP-10
MrD2----- Morley	0-9	Clay loam-----	CL	A-6, A-7	0-5	95-100	90-100	85-95	80-90	30-45	15-25
	9-13	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	13-22	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	22-60	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30

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	
NnA-------------- Nappanee	0-8	Loam-------------	ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	55-90	25-40	3-15
	8-38	Silty clay, clay	CH	A-7	0-5	95-100	95-100	85-100	70-95	50-70	25-45
	38-60	Silty clay, clay, clay loam.	CL, CH	A-7	0-5	95-100	95-100	85-100	70-95	40-60	20-35
NpA-------------- Nappanee	0-8	Silty clay loam	CL	A-7	0-5	95-100	95-100	85-100	70-95	40-50	20-25
	8-32	Silty clay, clay	CH	A-7	0-5	95-100	95-100	85-100	70-95	50-70	25-45
	32-60	Silty clay, clay, clay loam.	CL, CH	A-7	0-5	95-100	95-100	85-100	70-95	40-60	20-35
OsB-------------- Oshtemo	0-9	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	9-55	Sandy loam, gravelly sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	55-60	Stratified loamy sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
OtB-------------- Ottokee	0-9	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	90-100	70-100	5-35	---	NP
	9-56	Loamy fine sand, fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	100	90-100	70-100	5-35	---	NP
	56-60	Fine sand, sand	SM, SW-SM, SP-SM	A-2, A-3	0	100	95-100	70-100	5-25	---	NP
Pa--------------- Paulding	0-7	Clay-------------	MH, CH	A-7	0	100	100	95-100	90-100	50-80	20-46
	7-33	Clay-------------	CH, MH	A-7	0	100	100	95-100	90-100	60-86	20-46
	33-60	Clay-------------	CH, MH	A-7	0	100	100	95-100	90-100	60-86	20-46
Pm--------------- Pewamo	0-11	Silty clay loam	CL	A-6, A-7	0-5	90-100	80-100	80-100	70-90	35-50	15-25
	11-55	Clay loam, clay, silty clay.	CL, CH	A-7, A-6	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	55-60	Clay loam, silty clay loam.	CL	A-7	0-5	95-100	90-100	90-100	70-90	40-50	15-25
Pt**. Pits											
RmB-------------- Rawson	0-9	Sandy loam-------	SM, ML	A-2-4, A-4	0	90-100	80-100	50-85	25-55	<30	NP-5
	9-36	Clay loam, sandy clay loam, gravelly sandy clay loam.	SC, CL, GC	A-4, A-6, A-2-4, A-2-6	0	65-100	55-95	45-90	25-75	20-40	7-20
	36-60	Clay, silty clay, clay loam.	CH, CL	A-7, A-6	0	90-100	85-100	85-100	75-95	35-65	15-40
RnA-------------- Rimer	0-11	Loamy fine sand	SM, ML	A-2, A-4, A-1	0	100	95-100	45-80	15-55	---	NP
	11-29	Loamy fine sand, fine sand, loamy sand.	SM	A-2, A-4	0	100	95-100	75-90	20-40	---	NP
	29-36	Fine sandy loam, sandy loam.	SM, SM-SC, SC	A-4	0	100	95-100	60-80	35-50	15-30	NP-10
	36-60	Clay loam, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	100	90-100	85-100	75-95	35-65	15-38
RrA-------------- Roselms	0-9	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	75-95	55-80	20-40	3-16
	9-32	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	90-100	55-80	24-40
	33-60	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	90-100	50-80	24-45
RsA-------------- Roselms	0-9	Silty clay-------	ML, CL, CH MH	A-6, A-7	0	95-100	95-100	90-100	85-100	35-65	11-32
	9-32	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	90-100	55-80	24-40
	32-60	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	90-100	50-80	24-45

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	
Ru---------------- Ross	0-24	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	90-100	90-100	80-100	65-95	20-35	NP-12
	24-38	Loam, silt loam, silty clay loam.	ML, CL, CL-ML	A-6, A-4, A-7	0	90-100	85-100	70-100	55-95	22-45	3-20
	38-60	Stratified gravelly sandy loam to silt loam.	CL, ML, SM, GM	A-6, A-4, A-2, A-1	0-5	65-100	55-100	35-100	20-80	<30	NP-12
SaB--------------- St. Clair	0-10	Loam-------------	ML, CL, CL-ML	A-4, A-6	0-5	95-100	90-100	70-90	50-90	20-40	3-15
	10-24	Clay, silty clay	CH, MH	A-7	0-5	95-100	90-100	75-100	65-95	50-70	20-40
	24-60	Clay, silty clay, clay loam.	CH	A-7	0-5	95-100	90-100	70-100	60-95	50-60	25-35
SbC2, SbE--------- St. Clair	0-7	Silty clay loam	CL	A-4, A-6	0-5	95-100	90-100	80-100	60-95	30-45	10-20
	7-25	Clay, silty clay	CH, MH	A-7	0-5	95-100	90-100	75-100	65-95	50-70	20-40
	25-60	Clay, silty clay, clay loam.	CH	A-7	0-5	95-100	90-100	70-100	60-95	50-60	25-35
ScD3, ScE3-------- St. Clair	0-3	Clay-------------	CH, CL	A-7	0-5	95-100	90-100	85-100	70-95	40-55	15-30
	3-22	Clay, silty clay	CH, MH	A-7	0-5	95-100	90-100	75-100	65-95	50-70	20-40
	22-60	Clay, silty clay, clay loam.	CH	A-7	0-5	95-100	90-100	70-100	60-95	50-60	25-35
SdB--------------- Seward	0-29	Loamy fine sand	SM, ML	A-2, A-4, A-1	0	100	95-100	45-80	15-55	---	NP
	29-38	Fine sandy loam, sandy loam.	SM	A-4	0	100	90-100	60-80	35-50	<40	NP-10
	38-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	90-100	85-100	75-95	40-65	20-38
Sh---------------- Shoals	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	6-15
	10-44	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	5-15
	44-60	Stratified silt loam to sandy loam.	ML, CL, CL-ML	A-4	0-3	90-100	85-100	60-80	50-70	<30	4-10
So---------------- Sloan	0-12	Silty clay loam	CL	A-6, A-7	0	100	95-100	85-100	70-95	35-45	12-20
	12-45	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
	45-60	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
TdA--------------- Tedrow	0-7	Loamy fine sand	SM	A-2, A-4	0	100	95-100	60-80	20-40	---	NP
	7-50	Loamy fine sand, loamy sand, fine sand.	SM	A-2, A-4	0	100	95-100	60-80	20-40	---	NP
	50-60	Sand, fine sand	SM, SP, SP-SM	A-2, A-3	0	100	95-100	50-70	3-35	---	NP
Tn---------------- Toledo	0-7	Silty clay loam	MH, CL, ML, CH	A-7, A-6	0	100	100	90-100	80-100	38-54	14-24
	7-42	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	80-100	40-65	18-36
	42-60	Silty clay, clay, silty clay loam.	CH, CL, ML, MH	A-7	0	100	100	95-100	80-100	40-65	18-36
TsB--------------- Tuscola	0-9	Very fine sandy loam.	SM, ML, SC, CL	A-4, A-2	0	100	100	60-95	30-65	15-30	2-10
	9-35	Silty clay loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-90	20-40	6-20
	35-60	Stratified very fine sand to silty clay loam.	SM, ML	A-4	0	100	95-100	75-90	40-90	<25	NP-4

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	
Ud. Udorthents											
Ur**. Urban land											
Wa---------------- Wabasha	0-9	Silty clay loam	CL, CH	A-7, A-6	0	100	100	90-100	80-95	35-55	15-30
	9-52	Silty clay, clay	CH, CL	A-7	0	100	100	90-100	80-100	45-65	22-35
	52-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	80-100	40-65	18-35
Wd---------------- Wallkill Variant	0-9	Silty clay--------	CH, CL, CL-ML	A-7, A-6	0	95-100	95-100	85-100	80-95	35-60	16-35
	9-32	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	95-100	95-100	85-100	80-95	40-65	26-44
	32-55	Sapric material	PT	A-8	0	---	---	---	---	---	---
	55-70	Coprogenous earth	PT	A-8	0	---	---	---	---	---	---
Wf---------------- Wauseon	0-18	Fine sandy loam	SM, ML	A-4, A-2	0	100	95-100	60-85	30-55	---	NP
	18-31	Fine sandy loam, loamy fine sand, very fine sand.	SM	A-2, A-4	0	100	95-100	65-95	20-45	---	NP
	31-60	Clay, clay loam, silt loam.	CH, CL, MH, ML	A-7	0	90-100	85-100	80-100	75-95	42-70	18-36

* NP means nonplastic.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less 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 K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
BmB: Belmore	0-6	10-24	1.30-1.45	0.6-2.0	0.14-0.18	5.6-7.3	Low	0.32	4	5	1-3
	6-12	15-30	1.35-1.60	2.0-6.0	0.10-0.14	4.5-7.3	Low	0.32			
	12-25	18-35	1.40-1.60	2.0-6.0	0.12-0.16	5.6-7.8	Low	0.32			
	25-60	5-15	1.50-1.70	6.0-20	0.08-0.12	7.4-8.4	Low	0.24			
BnA: Blount	0-9	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	3	6	2-3
	9-31	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-8.4	Moderate	0.43			
	31-60	27-38	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate	0.43			
Bp: Bono	0-6	35-40	1.20-1.45	0.2-2.0	0.20-0.23	6.1-7.3	High	0.28	5	4	4-8
	6-38	40-55	1.35-1.55	<0.2	0.10-0.14	6.1-8.4	High	0.28			
	38-60	35-60	1.45-1.60	<0.2	0.08-0.12	7.4-8.4	High	0.28			
BrB: Bronson	0-8	2-15	1.14-1.60	2.0-6.0	0.13-0.15	5.1-7.3	Low	0.24	4	3	1-3
	8-39	10-20	1.26-1.59	2.0-6.0	0.12-0.18	5.1-7.3	Low	0.24			
	39-60	0-10	1.26-1.59	6.0-20	0.06-0.08	5.1-7.8	Low	0.17			
BsB: Boyer	0-9	0-10	1.15-1.60	6.0-20	0.10-0.12	5.6-7.3	Low	0.17	4	2	.5-3
	9-27	10-18	1.25-1.60	2.0-6.0	0.12-0.18	5.6-7.8	Low	0.24			
	27-60	0-10	1.20-1.45	>20	0.02-0.04	7.4-8.4	Low	0.10			
BvE: Broughton	0-7	24-27	1.30-1.50	0.6-2.0	0.22-0.23	5.1-7.3	Moderate	0.43	3	6	1-3
	7-17	60-80	1.35-1.65	0.06-0.2	0.09-0.11	5.6-7.8	High	0.32			
	17-60	60-85	1.45-1.65	<0.06	0.04-0.06	7.4-8.4	High	0.32			
BwC3: Broughton	0-5	40-55	1.20-1.45	0.2-0.6	0.12-0.14	5.1-7.3	High	0.32	2	4	.5-2
	5-17	60-80	1.35-1.65	0.06-0.2	0.09-0.11	5.6-7.8	High	0.32			
	17-60	60-85	1.45-1.65	<0.06	0.04-0.06	7.4-8.4	High	0.32			
Ca: Carlisle	0-60	---	0.13-0.23	0.2-6.0	0.35-0.45	4.5-7.3	-------	----	---	3	>70
Cm: Colwood	0-12	5-26	1.15-1.60	0.6-2.0	0.20-0.24	6.1-7.8	Low	0.28	5	5	3-8
	12-34	18-35	1.30-1.60	0.6-2.0	0.17-0.22	6.1-8.4	Moderate	0.43			
	34-60	0-12	1.20-1.45	0.6-2.0	0.12-0.22	7.4-8.4	Low	0.43			
Db: Defiance	0-8	27-40	1.25-1.55	0.2-0.6	0.21-0.23	6.1-7.8	Moderate	0.37	5	7	2-3
	8-39	35-50	1.35-1.55	0.06-0.2	0.11-0.16	6.1-7.8	Moderate	0.37			
	39-60	40-55	1.35-1.65	0.06-0.2	0.10-0.13	6.6-8.4	Moderate	0.37			
DfA: Del Rey	0-8	15-27	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.43	3	6	2-3
	8-32	35-45	1.40-1.65	0.06-0.2	0.12-0.20	4.5-8.4	Moderate	0.43			
	32-60	25-35	1.50-1.70	0.06-0.2	0.09-0.11	7.9-8.4	Moderate	0.43			
DgA: Del Rey Variant	0-7	12-20	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.43	4	5	2-3
	7-37	35-45	1.35-1.55	0.06-0.2	0.12-0.20	5.6-7.8	Moderate	0.32			
	37-60	3-15	1.30-1.60	6.0-20	0.02-0.08	6.6-8.4	Low	0.24			
DmA: Digby	0-9	12-20	1.20-1.40	0.6-2.0	0.16-0.22	5.6-7.3	Low	0.32	4	5	2-4
	9-20	18-35	1.45-1.70	0.6-2.0	0.12-0.16	4.5-7.8	Low	0.32			
	20-35	18-35	1.40-1.60	0.6-2.0	0.08-0.15	6.1-7.8	Low	0.32			
	35-60	3-15	1.25-1.55	6.0-20	0.02-0.09	7.4-8.4	Low	0.10			
FsA: Fulton	0-8	16-27	1.30-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	3	6	2-3
	8-32	35-59	1.40-1.70	0.06-0.2	0.09-0.13	5.1-7.8	High	0.32			
	32-60	35-50	1.45-1.70	<0.2	0.08-0.12	7.4-8.4	High	0.32			
FtA: Fulton	0-10	27-40	1.35-1.55	0.2-0.6	0.21-0.23	5.1-7.3	Moderate	0.43	3	7	2-3
	10-37	35-59	1.40-1.70	0.06-0.2	0.09-0.13	5.1-7.8	High	0.32			
	37-60	35-50	1.45-1.70	<0.2	0.08-0.12	7.4-8.4	High	0.32			
Ge: Genesee	0-10	18-27	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.8	Low	0.37	5	5	1-3
	10-60	18-27	1.30-1.50	0.6-2.0	0.17-0.22	6.1-8.4	Low	0.37			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF 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/cm3	In/hr	In/in	pH					Pct
Gf----------------- Gilford	0-11	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
	11-34	8-17	1.60-1.80	2.0-6.0	0.12-0.14	5.6-7.8	Low-----------	0.20			
	34-60	3-12	1.70-1.90	6.0-20	0.05-0.08	6.6-8.4	Low-----------	0.15			
GwB, GwB2, GwC2-- Glynwood	0-9	16-27	1.25-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.43	3	6	1-3
	9-35	35-55	1.45-1.75	0.06-0.2	0.11-0.18	4.5-8.4	Moderate------	0.32			
	35-60	27-36	1.65-1.85	0.06-0.2	0.06-0.10	7.4-8.4	Moderate------	0.32			
HnA---------------- Haskins	0-8	12-20	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Low-----------	0.37	4	5	1-4
	8-32	18-35	1.45-1.70	0.6-2.0	0.12-0.16	5.1-7.8	Low-----------	0.37			
	32-60	35-55	1.60-1.80	<0.2	0.08-0.12	6.1-8.4	Moderate------	0.37			
Ho----------------- Hoytville	0-7	27-40	1.25-1.50	0.2-2.0	0.16-0.21	6.1-7.3	High----------	0.28	5	7	3-6
	7-39	40-55	1.40-1.80	0.2-0.6	0.11-0.15	6.1-7.8	High----------	0.28			
	39-60	35-50	1.40-1.85	0.06-0.2	0.06-0.12	6.6-8.4	High----------	0.28			
Hv----------------- Hoytville	0-9	40-48	1.30-1.55	0.2-0.6	0.14-0.17	6.1-7.3	High----------	0.28	5	4	3-6
	9-40	40-55	1.40-1.80	0.2-0.6	0.11-0.15	6.1-7.8	High----------	0.28			
	40-60	35-50	1.40-1.85	0.06-0.2	0.06-0.12	6.6-8.4	High----------	0.28			
KfA---------------- Kibbie	0-9	5-25	1.40-1.65	0.6-2.0	0.16-0.24	5.6-7.3	Low-----------	0.28	5	5	2-3
	9-41	18-35	1.40-1.65	0.6-2.0	0.17-0.22	5.6-7.3	Low-----------	0.43			
	41-60	2-18	1.40-1.70	0.6-2.0	0.12-0.22	7.4-8.4	Low-----------	0.43			
Lb----------------- Landes	0-11	5-20	1.40-1.60	2.0-6.0	0.10-0.18	6.1-8.4	Low-----------	0.20	5	3	1-2
	11-72	8-18	1.60-1.80	6.0-20	0.05-0.15	6.1-8.4	Low-----------	0.20			
Lc----------------- Latty	0-7	40-55	1.30-1.50	0.06-0.2	0.11-0.14	6.1-7.8	High----------	0.28	5	4	3-5
	7-40	45-60	1.35-1.65	0.06-0.2	0.09-0.13	6.1-7.8	High----------	0.28			
	40-60	45-60	1.45-1.60	<0.06	0.08-0.12	7.4-8.4	High----------	0.28			
Lf----------------- Lenawee	0-9	27-35	1.40-1.55	0.6-2.0	0.14-0.22	5.6-7.8	Moderate------	0.28	4	7	3-5
	9-48	35-45	1.40-1.70	0.2-0.6	0.14-0.20	6.1-7.8	Moderate------	0.28			
	48-66	18-40	1.50-1.70	0.2-0.6	0.16-0.22	7.4-8.4	Low-----------	0.28			
Md----------------- Mermill	0-7	12-27	1.30-1.50	0.6-2.0	0.16-0.20	5.6-7.3	Low-----------	0.28	5	6	3-6
	7-30	18-35	1.50-1.69	0.6-2.0	0.12-0.16	5.6-7.8	Moderate------	0.28			
	30-60	35-55	1.60-1.85	<0.2	0.08-0.10	6.6-8.4	Moderate------	0.28			
Mh----------------- Millgrove	0-15	18-27	1.30-1.50	0.6-2.0	0.19-0.24	5.6-7.3	Low-----------	0.28	5	6	3-8
	15-21	18-35	1.40-1.70	0.6-2.0	0.12-0.16	6.1-7.8	Moderate------	0.28			
	21-40	15-30	1.25-1.60	0.6-2.0	0.08-0.15	6.1-7.8	Low-----------	0.20			
	40-60	5-18	1.25-1.60	2.0-6.0	0.08-0.12	7.4-8.4	Low-----------	0.28			
MrD2--------------- Morley	0-9	27-35	1.40-1.60	0.2-0.6	0.18-0.22	5.1-6.5	Moderate------	0.43	2	7	1-3
	9-13	27-40	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate------	0.43			
	13-22	35-50	1.55-1.70	0.2-0.6	0.11-0.15	5.1-7.8	Moderate------	0.43			
	22-60	27-50	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate------	0.43			
NnA---------------- Nappanee	0-8	20-27	1.30-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	3	6	1-3
	8-38	45-60	1.40-1.80	0.06-0.2	0.08-0.14	5.1-7.8	Moderate------	0.32			
	38-60	35-50	1.60-1.85	0.06-0.2	0.06-0.12	7.4-8.4	Moderate------	0.32			
NpA---------------- Nappanee	0-8	32-40	1.30-1.50	0.2-0.6	0.18-0.22	5.1-7.3	Moderate------	0.43	3	7	1-3
	8-32	45-60	1.40-1.80	0.06-0.2	0.08-0.14	5.1-7.8	Moderate------	0.32			
	32-60	35-50	1.60-1.85	0.06-0.2	0.06-0.12	7.4-8.4	Moderate------	0.32			
OsB---------------- Oshtemo	0-9	2-10	1.20-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	9-55	10-18	1.20-1.60	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	55-60	0-15	1.20-1.50	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
OtB---------------- Ottokee	0-9	2-10	1.40-1.60	6.0-20	0.07-0.11	6.1-7.3	Low-----------	0.17	5	2	.5-2
	9-56	1-12	1.50-1.70	6.0-20	0.06-0.10	5.6-7.3	Low-----------	0.17			
	56-60	1-8	1.50-1.70	6.0-20	0.03-0.06	6.1-8.4	Low-----------	0.17			
Pa----------------- Paulding	0-7	40-65	1.20-1.40	0.06-0.2	0.11-0.14	5.6-7.3	High----------	0.28	5	4	3-5
	7-33	60-80	1.35-1.65	<0.06	0.09-0.13	5.6-7.8	High----------	0.28			
	33-60	60-75	1.40-1.65	<0.06	0.04-0.06	7.4-8.4	High----------	0.28			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF 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/cm3	In/hr	In/in	pH					Pct
Pm---------------- Pewamo	0-11	27-40	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.3	Moderate-----	0.24	5	6	3-5
	11-55	35-50	1.40-1.70	0.2-0.6	0.12-0.20	5.6-7.8	Moderate-----	0.24			
	55-60	30-40	1.50-1.75	0.2-0.6	0.14-0.18	7.4-8.4	Moderate-----	0.24			
Pt*. Pits											
RmB--------------- Rawson	0-9	9-18	1.30-1.45	0.6-2.0	0.12-0.18	4.5-7.3	Low----------	0.24	4	3	.5-3
	9-36	18-35	1.50-1.70	0.6-2.0	0.12-0.16	5.1-7.8	Low----------	0.32			
	36-60	35-55	1.60-1.85	<0.2	0.08-0.12	6.6-8.4	Moderate-----	0.32			
RnA--------------- Rimer	0-11	3-15	1.40-1.60	6.0-20	0.07-0.12	5.1-7.3	Low----------	0.17	4	2	1-3
	11-29	5-15	1.40-1.70	6.0-20	0.06-0.11	5.1-7.3	Low----------	0.17			
	29-36	7-18	1.50-1.70	2.0-6.0	0.12-0.17	5.1-7.3	Low----------	0.17			
	36-60	35-55	1.50-1.85	<0.2	0.08-0.12	6.1-8.4	High---------	0.32			
RrA--------------- Roselms	0-9	15-27	1.30-1.60	0.6-2.0	0.16-0.24	5.1-7.3	Low----------	0.32	3	6	2-3
	9-32	60-80	1.35-1.65	<0.06	0.09-0.11	4.5-7.8	High---------	0.32			
	32-60	60-75	1.40-1.70	<0.06	0.04-0.06	7.4-8.4	High---------	0.32			
RsA--------------- Roselms	0-9	40-50	1.20-1.55	0.06-0.2	0.11-0.14	5.1-7.3	High---------	0.43	3	4	2-3
	9-32	60-80	1.35-1.65	<0.06	0.09-0.11	4.5-7.8	High---------	0.32			
	32-60	60-75	1.40-1.70	<0.06	0.04-0.06	7.4-8.4	High---------	0.32			
Ru---------------- Ross	0-24	15-27	1.20-1.45	0.6-2.0	0.19-0.24	6.1-7.8	Low----------	0.32	5	5	3-5
	24-38	18-32	1.20-1.50	0.6-2.0	0.16-0.22	6.1-8.4	Low----------	0.32			
	38-60	5-25	1.35-1.60	0.6-6.0	0.05-0.18	6.1-8.4	Low----------	0.32			
SaB--------------- St. Clair	0-10	20-27	1.50-1.65	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.37	3	6	1-3
	10-24	35-55	1.35-1.70	<0.2	0.10-0.12	5.6-7.3	High---------	0.37			
	24-60	40-55	1.60-1.75	<0.2	0.09-0.11	7.4-8.4	High---------	0.37			
SbC2, SbE--------- St. Clair	0-7	27-40	1.50-1.60	0.2-2.0	0.17-0.23	5.6-7.3	Moderate-----	0.37	2	7	1-3
	7-25	35-55	1.35-1.70	<0.2	0.10-0.12	5.6-7.3	High---------	0.37			
	25-60	40-55	1.60-1.75	<0.2	0.09-0.11	7.4-8.4	High---------	0.37			
ScD3, ScE3-------- St. Clair	0-3	40-50	1.35-1.50	0.06-0.2	0.14-0.16	5.6-7.3	High---------	0.37	2	4	.5-2
	3-22	35-55	1.35-1.70	<0.2	0.10-0.12	5.6-7.3	High---------	0.37			
	22-60	40-55	1.60-1.75	<0.2	0.09-0.11	7.4-8.4	High---------	0.37			
SdB--------------- Seward	0-29	3-15	1.40-1.60	6.0-20	0.08-0.10	5.1-7.3	Low----------	0.17	4	2	.5-3
	29-38	5-18	1.50-1.70	6.0-20	0.10-0.16	5.1-7.3	Low----------	0.17			
	38-60	35-55	1.60-1.82	<0.2	0.06-0.12	6.1-8.4	High---------	0.32			
Sh---------------- Shoals	0-10	18-27	1.30-1.50	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.37	5	5	2-5
	10-44	18-32	1.35-1.55	0.6-2.0	0.17-0.22	6.1-8.4	Low----------	0.37			
	44-60	12-25	1.35-1.60	0.6-2.0	0.12-0.21	6.6-8.4	Low----------	0.37			
So---------------- Sloan	0-12	27-33	1.25-1.50	0.6-2.0	0.18-0.22	6.1-7.8	Moderate-----	0.37	5	6	3-6
	12-45	22-35	1.25-1.55	0.2-2.0	0.15-0.19	6.1-8.4	Moderate-----	0.37			
	45-60	10-30	1.20-1.50	0.2-2.0	0.13-0.18	6.6-8.4	Low----------	0.37			
TdA--------------- Tedrow	0-7	2-10	1.40-1.60	6.0-20	0.08-0.12	6.1-7.3	Low----------	0.17	5	2	1-3
	7-50	2-8	1.50-1.70	6.0-20	0.07-0.11	6.1-7.3	Low----------	0.17			
	50-60	1-8	1.50-1.70	6.0-20	0.05-0.07	6.6-8.4	Low----------	0.17			
Tn---------------- Toledo	0-7	27-40	1.40-1.60	0.2-0.6	0.17-0.23	5.6-7.3	Moderate-----	0.28	5	7	3-6
	7-42	40-60	1.40-1.70	0.06-0.2	0.09-0.13	6.1-7.8	High---------	0.28			
	42-60	35-60	1.45-1.75	0.06-0.2	0.08-0.12	7.4-8.4	High---------	0.28			
TsB--------------- Tuscola	0-9	8-20	1.30-1.65	2.0-6.0	0.13-0.22	5.6-7.3	Low----------	0.24	5	3	1-2
	9-35	18-35	1.30-1.70	0.6-2.0	0.15-0.20	5.6-7.3	Moderate-----	0.32			
	35-60	5-45	1.30-1.70	0.6-2.0	0.14-0.18	6.1-8.4	Low----------	0.32			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
Ud. Udorthents											
Ur*. Urban land											
Wa---------------- Wabasha	0-9	35-40	1.35-1.55	0.2-0.6	0.16-0.20	6.1-7.8	Moderate-----	0.32	5	4	3-6
	9-52	40-55	1.35-1.65	0.06-0.2	0.12-0.16	6.1-7.8	High---------	0.32			
	52-60	35-55	1.50-1.65	0.06-0.2	0.12-0.17	6.1-8.4	High---------	0.32			
Wd---------------- Wallkill Variant	0-9	40-45	1.20-1.50	0.2-2.0	0.19-0.23	5.6-6.8	Moderate-----	0.28	5	4	4-7
	9-32	35-60	1.35-1.55	<0.2	0.10-0.14	5.6-6.5	High---------	0.28			
	32-55	---	0.25-0.45	2.0-20	0.35-0.45	5.1-6.5	-------------	----			
	55-70	---	0.25-0.45	2.0-20	0.30-0.45	5.1-6.5	-------------	----			
Wf---------------- Wauseon	0-18	7-18	1.40-1.60	2.0-6.0	0.13-0.18	6.1-7.3	Low----------	0.20	4	3	4-8
	18-31	5-18	1.40-1.75	6.0-20	0.06-0.16	6.6-7.8	Low----------	0.20			
	31-60	35-55	1.50-1.85	<0.06	0.08-0.18	7.4-8.4	High---------	0.32			

* 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 "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not available]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
BmB---------------- Belmore	B	None---------	---	---	>6.0	---	---	Low-------	Moderate	Moderate.
BnA---------------- Blount	C	None---------	---	---	1.0-3.0	Perched	Jan-May	High------	High------	High.
Bp*---------------- Bono	B/D	None---------	---	---	+1-1.0	Apparent	Dec-May	Moderate	High------	Low.
BrB---------------- Bronson	B	None---------	---	---	2.0-3.5	Apparent	Nov-May	High------	Low-------	High.
BsB---------------- Boyer	B	None---------	---	---	>6.0	---	---	Low-------	Low-------	Moderate.
BvE, BwC3---------- Broughton	D	None---------	---	---	1.5-3.0	Perched	Jan-Apr	Moderate	High------	Moderate.
Ca----------------- Carlisle	A/D	None---------	---	---	+.5-1.0	Apparent	Sep-Jun	High------	High------	Low.
Cm----------------- Colwood	B/D	None---------	---	---	+1-1.0	Apparent	Oct-May	High------	High------	Low.
Db----------------- Defiance	D	Frequent-----	Brief------	Jan-May	1.0-2.5	Apparent	Dec-May	High------	High------	Low.
DfA---------------- Del Rey	C	None---------	---	---	1.0-3.0	Apparent	Jan-May	High------	High------	Moderate.
DgA---------------- Del Rey Variant	C	None---------	---	---	1.0-2.5	Apparent	Jan-May	High------	High------	Low.
DmA---------------- Digby	B	None---------	---	---	1.0-2.5	Apparent	Jan-Apr	High------	Moderate	High.
FsA, FtA----------- Fulton	D	None---------	---	---	1.0-2.5	Perched	Dec-May	Moderate	High------	Moderate.
Ge----------------- Genesee	B	Occasional	Brief------	Oct-Jun	>6.0	---	---	Moderate	Low-------	Low.
Gf----------------- Gilford	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	High------	High------	Moderate.
GwB, GwB2, GwC2---- Glynwood	C	None---------	---	---	2.0-3.5	Perched	Jan-Apr	High------	High------	Moderate.
HnA---------------- Haskins	C	None---------	---	---	1.0-2.5	Perched	Jan-Apr	High------	High------	Moderate.
Ho, Hv------------- Hoytville	D	None---------	---	---	+1-1.0	Perched	Jan-Apr	High------	High------	Low.
KfA---------------- Kibbie	B	None---------	---	---	1.0-2.0	Apparent	Nov-May	High------	Low-------	High.
Lb----------------- Landes	B	Occasional	Brief------	Jan-Apr	4.0-6.0	Apparent	Mar-May	Moderate	Low-------	Low.
Lc----------------- Latty	D	None---------	---	---	+.5-1.0	Perched	Jan-Apr	Moderate	High------	Low.
Lf----------------- Lenawee	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	High------	High------	Low.

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			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Md----------------- Mermill	B/D	None---------	---	---	+1-1.0	Perched	Dec-May	High-----	Moderate	Moderate.
Mh----------------- Millgrove	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	High-----	High-----	Low.
MrD2--------------- Morley	C	None---------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
NnA, NpA---------- Nappanee	D	None---------	---	---	1.0-2.0	Perched	Nov-May	Moderate	High-----	Low.
OsB---------------- Oshtemo	B	None---------	---	---	>6.0	---	---	Low------	Low------	High.
OtB---------------- Ottokee	A	None---------	---	---	2.0-3.5	Apparent	Jan-Apr	Low------	Low------	Low.
Pa----------------- Paulding	D	None---------	---	---	+1-0.5	Perched	Jan-Apr	Moderate	High-----	Low.
Pm----------------- Pewamo	C/D	None---------	---	---	+1-1.0	Apparent	Dec-May	High-----	High-----	Low.
Pt**. Pits										
RmB---------------- Rawson	B	None---------	---	---	2.5-4.0	Perched	Jan-Apr	Moderate	High-----	High.
RnA---------------- Rimer	C	None---------	---	---	1.0-2.5	Perched	Jan-Apr	High-----	High-----	Moderate.
RrA, RsA---------- Roselms	D	None---------	---	---	1.0-2.5	Perched	Jan-Apr	Moderate	High-----	Moderate.
Ru----------------- Ross	B	Occasional	Very brief	Nov-Jun	4.0-6.0	Apparent	Feb-Apr	Moderate	Low------	Low.
SaB, SbC2, SbE, ScD3, ScE3-------- St. Clair	D	None---------	---	---	2.0-3.0	Perched	Mar-May	Moderate	High-----	Moderate.
SdB---------------- Seward	B	None---------	---	---	3.0-6.0	Perched	Jan-Apr	Moderate	High-----	Moderate.
Sh----------------- Shoals	C	Frequent----	Brief-----	Oct-Jun	1.0-3.0	Apparent	Jan-Apr	High-----	High-----	Low.
So----------------- Sloan	B/D	Frequent----	Brief-----	Nov-Jun	0-1.0	Apparent	Nov-Jun	High-----	High-----	Low.
TdA---------------- Tedrow	B	None---------	---	---	1.0-2.0	Apparent	Jan-Apr	Moderate	Low------	Low.
Tn----------------- Toledo	D	None---------	---	---	+1-1.0	Perched	Jan-Apr	High-----	High-----	Low.
TsB---------------- Tuscola	B	None---------	---	---	2.0-3.5	Apparent	Nov-Apr	High-----	Moderate	Low.
Ud. Udorthents										
Ur*. Urban land										
Wa----------------- Wabasha	D	Frequent----	Long------	Jan-May	0-1.0	Apparent	Dec-Jun	High-----	High-----	Low.

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			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Wd----------------- Wallkill Variant	D	None---------	---	---	+.5-0.5	Apparent	Sep-Jun	High-----	High-----	Moderate.
Wf----------------- Wauseon	B/D	None---------	---	---	+1-1.0	Perched	Jan-Apr	High-----	High-----	Low.

* A plus sign under "Depth to high water table" indicates that the water table is above the surface of the soil.

** See description of the map unit for composition and behavior characertistics 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
Belmore	Fine-loamy, mixed, mesic Typic Hapludalfs
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Bono	Fine, illitic, mesic Typic Haplaquolls
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Bronson	Coarse-loamy, mixed, mesic Aquic Hapludalfs
Broughton	Very-fine, illitic, mesic Aquic Hapludalfs
Carlisle	Euic, mesic Typic Medisaprists
Colwood	Fine-loamy, mixed, mesic Typic Haplaquolls
Defiance	Fine, illitic, nonacid, mesic Aeric Fluvaquents
Del Rey	Fine, illitic, mesic Aeric Ochraqualfs
Del Rey Variant	Clayey over loamy, illitic, mesic Aeric Ochraqualfs
Digby	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Fulton	Fine, illitic, mesic Aeric Ochraqualfs
*Genesee	Fine-loamy, mixed, nonacid, mesic Typic Udifluvents
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Glynwood	Fine, illitic, mesic Aquic Hapludalfs
Haskins	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Hoytville	Fine, illitic, mesic Mollic Ochraqualfs
*Kibbie	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Latty	Fine, illitic, nonacid, mesic Typic Haplaquepts
*Lenawee	Fine, mixed, nonacid, mesic Mollic Haplaquepts
Mermill	Fine-loamy, mixed, mesic Mollic Ochraqualfs
Millgrove	Fine-loamy, mixed, mesic Typic Argiaquolls
Morley	Fine, illitic, mesic Typic Hapludalfs
Nappanee	Fine, illitic, mesic Aeric Ochraqualfs
Oshtemo	Coarse-loamy, mixed, mesic Typic Hapludalfs
Ottokee	Mixed, mesic Aquic Udipsamments
Paulding	Very-fine, illitic, nonacid, mesic Typic Haplaquepts
Pewamo	Fine, mixed, mesic Typic Argiaquolls
Rawson	Fine-loamy, mixed, mesic Typic Hapludalfs
Rimer	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Roselms	Very-fine, illitic, mesic Aeric Ochraqualfs
Ross	Fine-loamy, mixed, mesic Cumulic Hapludolls
Seward	Loamy, mixed, mesic Arenic Hapludalfs
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
St. Clair	Fine, illitic, mesic Typic Hapludalfs
Tedrow	Mixed, mesic Aquic Udipsamments
Toledo	Fine, illitic, nonacid, mesic Mollic Haplaquepts
Tuscola	Fine-loamy, mixed, mesic Aquic Hapludalfs
Udorthents	Loamy, mixed, mesic Typic Udorthents
Wabasha	Fine, illitic, nonacid, mesic Mollic Fluvaquents
Wallkill Variant	Fine, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Wauseon	Coarse-loamy over clayey, mixed, mesic Typic Haplaquolls

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