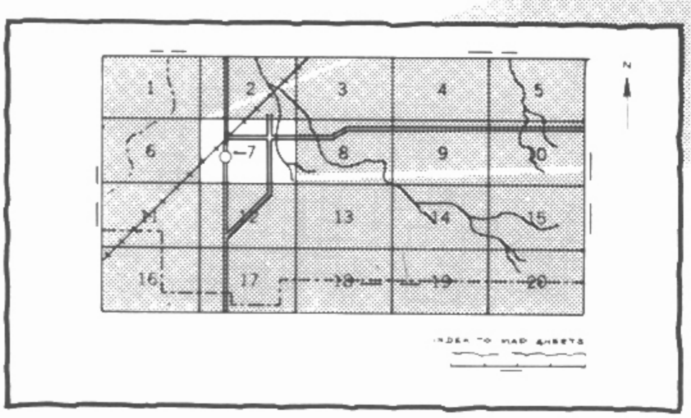
SOIL SURVEY OF

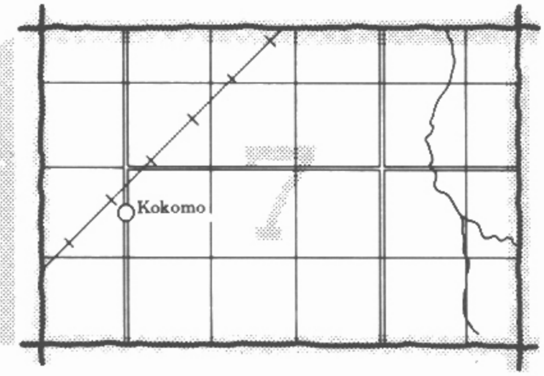
MERCER COUNTY, OHIO

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
in cooperation with
OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF LANDS AND SOIL, AND
OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER

HOW TO USE

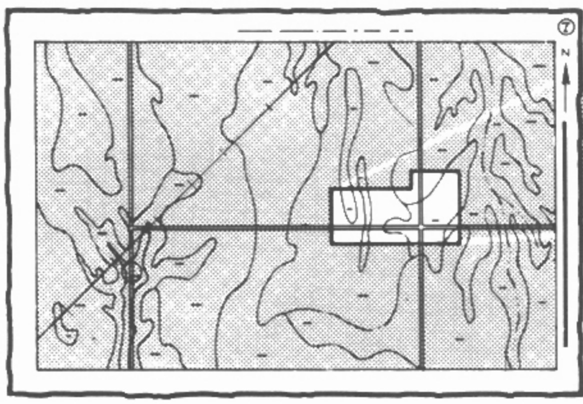
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

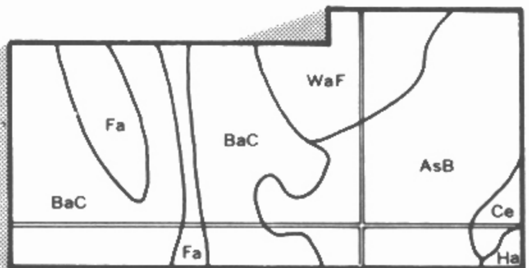




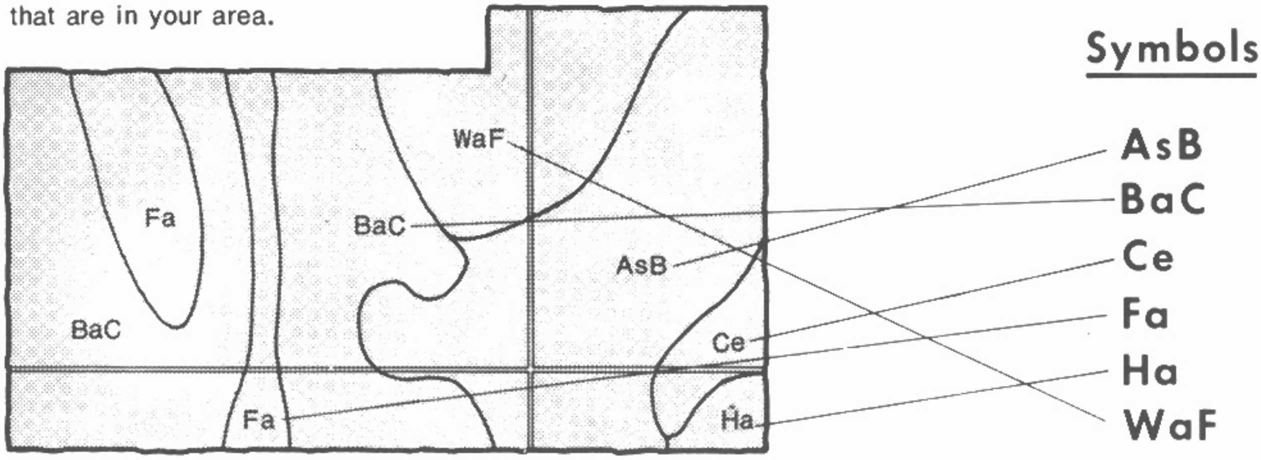
2. Note the number of the map sheet and turn to that sheet.

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



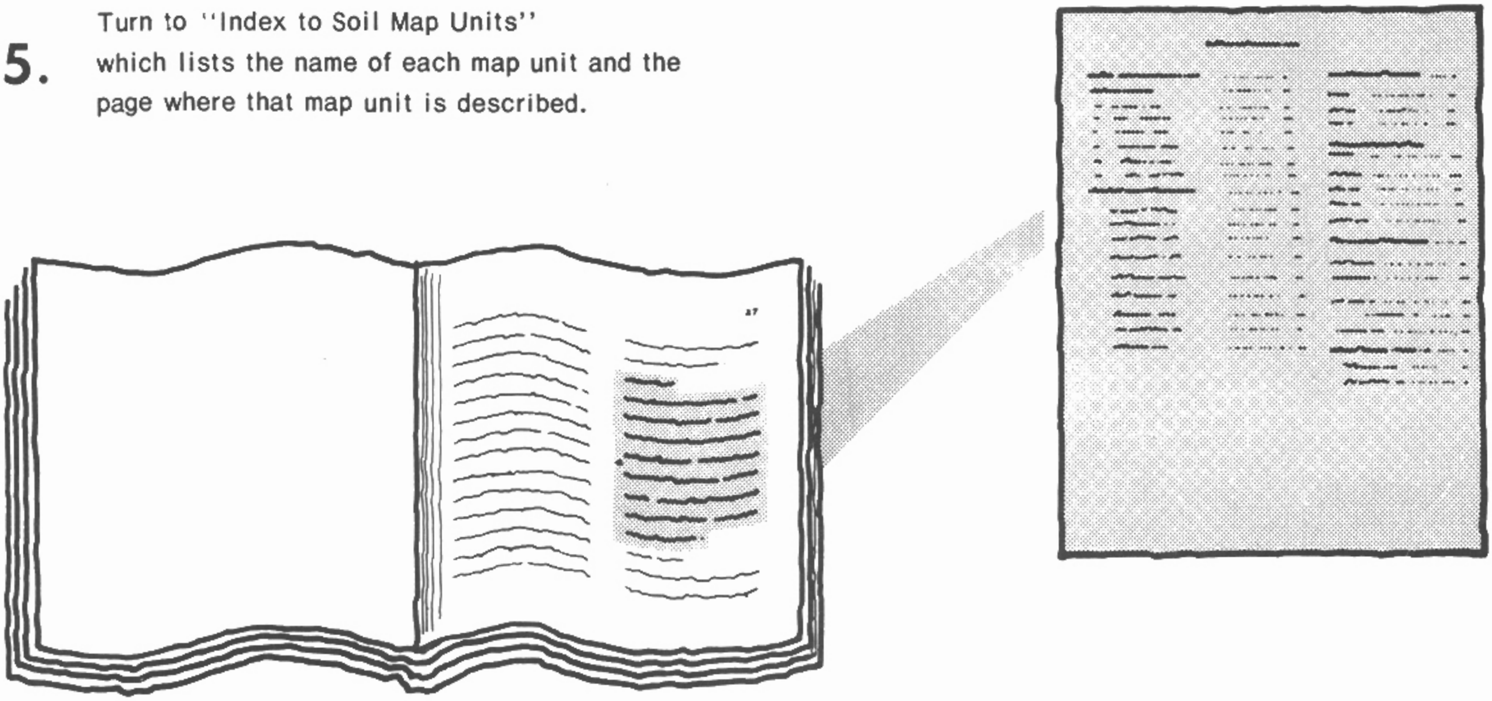


4. List the map unit symbols that are in your area.

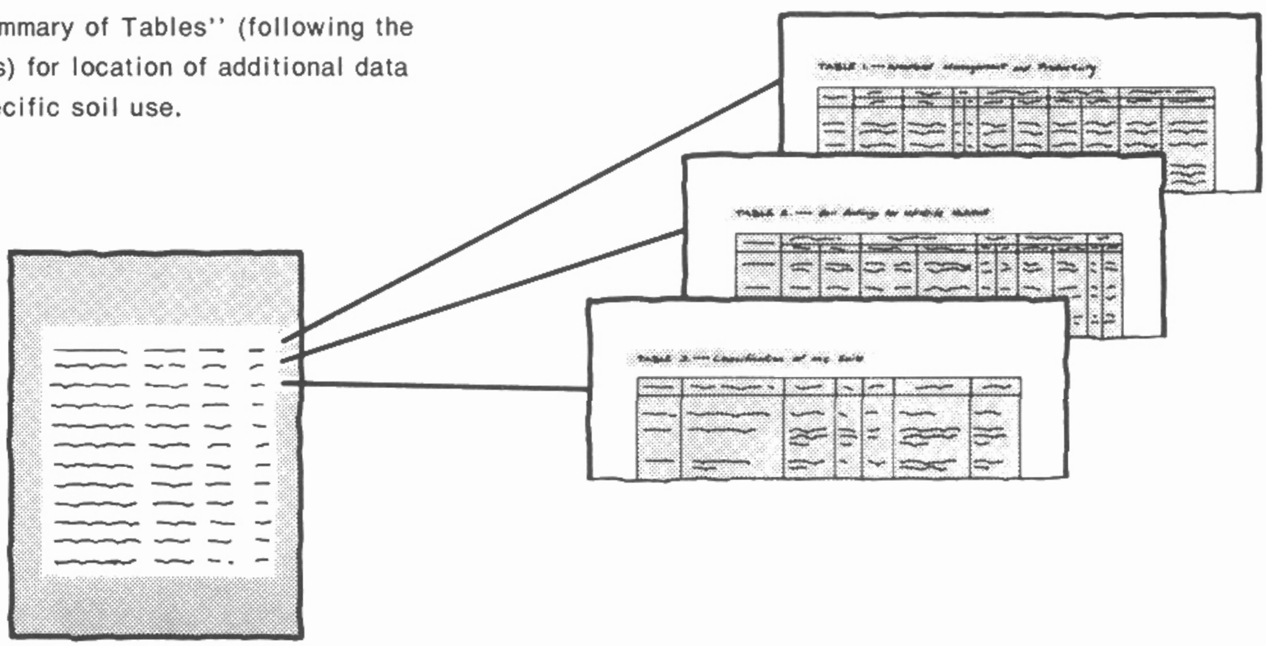


THIS SOIL SURVEY

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 is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. 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 the period 1968-74. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Lands and Soil; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Mercer County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: A former glacial lake basin known as "Cranberry Prairie" in southern Mercer County. The broad flats are occupied dominantly by Montgomery and McGary soils.

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Issued June 1979

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Summary of Tables

Foreword

The Soil Survey of Mercer County, Ohio contains basic information useful for any land planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that a selected land use will have on the environment.

This soil survey has been prepared to meet the needs of different users. Farmers, ranchers, foresters, or agronomists can use it to determine the potential of the soil and the management required for food and fiber production. Planners, community officials, engineers, developers, builders, or homebuyers can use it to plan use of land, select sites for construction, develop soil resources, and identify special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in wildlife management, recreation, waste disposal, or pollution control can use the soil survey to help understand, protect, and enhance the environment.

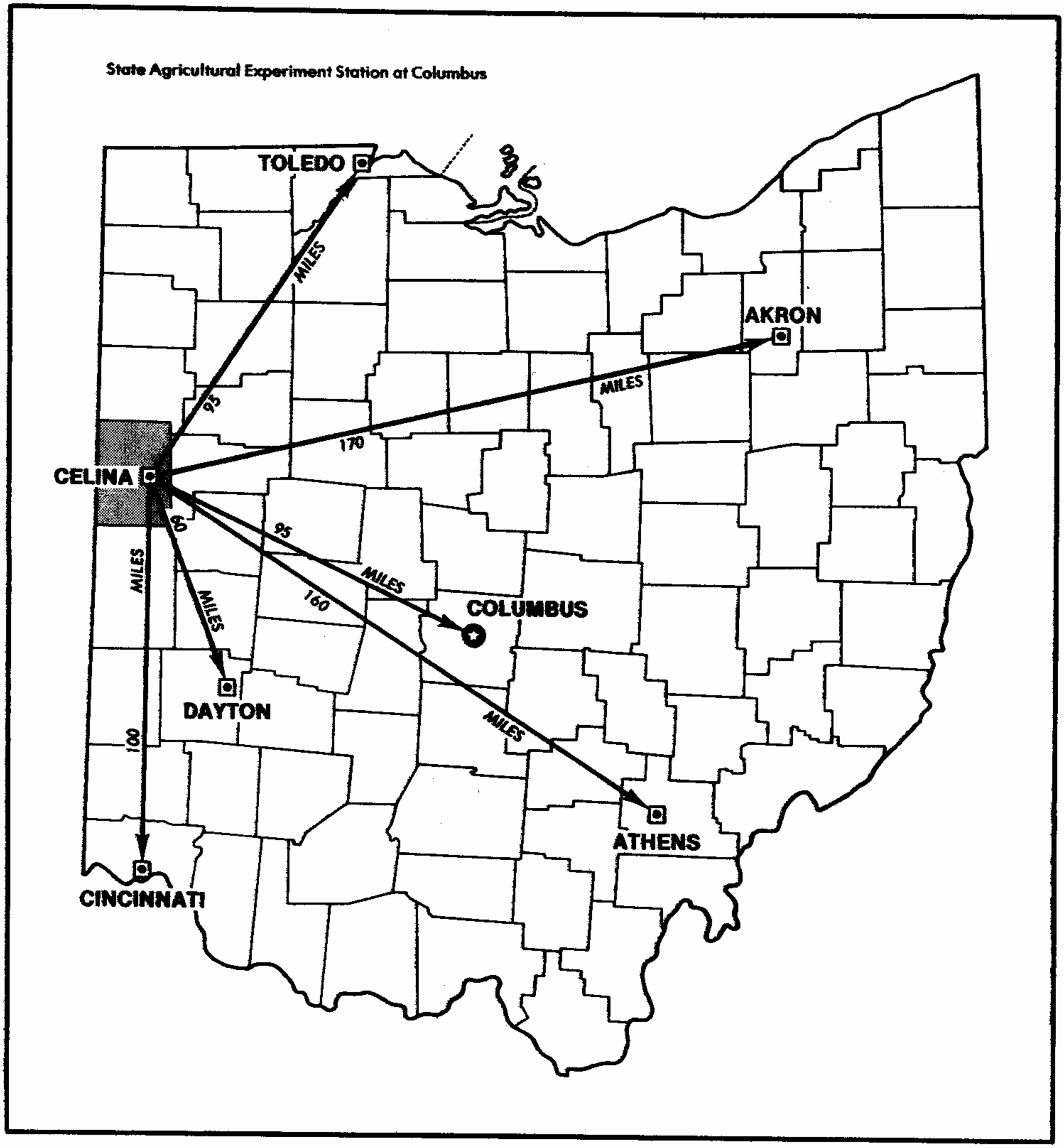
Many people assume that soils are all somewhat alike. They are unaware that great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. This publication also shows, on the general soil map, the location of broad areas of soils and, on detailed soil maps, the location of each kind of soil. It provides descriptions of each kind of soil in the survey area and gives much information about each soil for specific uses. Additional information or assistance in using this publication is available in the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be helpful in the conservation, development, and productive use of soil, water, and other resources.

Robert E. Quilliam

Robert E. Quilliam
State Conservationist
Soil Conservation Service



Location of Mercer County in Ohio.

SOIL SURVEY OF MERCER COUNTY, OHIO

By T. C. Priest, Ohio Department of Natural Resources, Division of Lands and Soil

Fieldwork by: T. C. Priest, A. R. Brock, F. L. Cunningham, and D. L. Brown, Ohio Department of Natural Resources, Division of Lands and Soil; and L. A. Tornes and V. L. Siegenthaler, Soil Conservation Service

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

General nature of the county

MERCER COUNTY is in west-central Ohio, along the Indiana border (see facing page). It occupies about 444 square miles, or 284,160 acres. Celina, the county seat and the only city, is in the east-central part of the county. In 1970, the total population of the county was 35,265.

Mercer County is one of the more important agricultural counties in Ohio. Cash grain farming dominated by corn and soybeans is the major farm enterprise in the northern part of the county. Cash grain and livestock farming are dominant in the southern part. Tomatoes are an important specialty crop.

Poor natural drainage is the major soil limitation in the flatter areas. Erosion is the major hazard in sloping areas. If adequate artificial drainage is provided, erosion is controlled, and the soil is otherwise well managed, most of the soils are highly productive.

Although Mercer County is dominantly agricultural, nonfarm development, particularly residential development, is constantly taking place. This development is not on the scale that prevails in large metropolitan areas, but many of the same limitations and hazards are commonly encountered. These limitations and hazards are particularly evident near Grand Lake St. Marys.

Climate

Mercer County is cold in winter and warm in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. Normal annual precipitation is adequate for all crops that are suited to the temperature and the length of the growing season.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Celina, Ohio for the period 1957 to 1975. 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 28 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Celina on January 16, 1972, is minus 19 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred on July 24, 1965, is 99 degrees.

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

Of the total annual precipitation, 20 inches, or 55 percent, usually falls in April through September, which includes the growing season for most crops. 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 4.43 inches at Celina on September 17, 1969. Thunderstorms occur on about 41 days each year, and 20 of these days are in summer.

Average seasonal snowfall is 36 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average, 22 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

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

Tornadoes and severe thunderstorms occur occasionally. They are usually of local extent and of short duration, and the resulting damage varies from area to area.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Physiography, relief, and drainage

Mercer County is a part of the Indiana and Ohio Till Plain section of the Central Lowland physiographic province. The highest elevation is about 1,070 feet above sea level, near the Mercer-Darke County line between Union City and Jenkins Roads in southwestern Gibson Township. The lowest elevation is 780 feet above sea level where the St. Marys River enters Van Wert County.

Much of the northern two-thirds of the county has a nearly level and gently sloping topography, and major changes in relief are evident only along streams and on the Wabash and Fort Wayne moraines.

The southern third has stronger relief and a mostly gently sloping and sloping topography dominated by the St. Johns and Mississinewa moraines. One major exception is a sizeable lacustrine area extending from the south-central to the southeastern part of the county and lying to the south of the St. Johns moraine. The western part of this lacustrine area, which is the larger part, is drained by the Wabash River and is known locally as "Cranberry Prairie."

Blount and Pewamo soils are dominant in nearly level and gently sloping areas, whereas Blount and Glynwood soils are dominant in gently sloping and sloping areas. Montgomery soils are dominant in the lacustrine areas.

Mercer County is a part of two continental watersheds. The Ohio-Erie Divide crosses the county in a general east-west direction and is partly oriented to the Wabash moraine through its central extension in the county. North of this divide, the county is mostly drained into Lake Erie by the St. Marys River and its tributaries. A small acreage in the northeastern part of the county is drained by the Little Auglaize River, which flows eventually to Lake Erie. The area several square miles south of Grand Lake is drained northward to the lake, then to the St. Marys River, and eventually to Lake Erie. South of the Ohio-Erie Divide, the major part of the county is drained by the Wabash River and its tributaries, which flow to the Ohio River. A small acreage in the southeastern part of the county is in the Great Miami River system flowing eastward out of the county in Mile Creek and to the Ohio River.

Grand Lake lies across the Ohio-Erie Divide. It is an artificially created body of water 14,500 acres in size, two-thirds of which is in Mercer County. The lake was created by damming each end of a long, narrow swale to provide water for the Ohio-Erie Canal system. It drains to Lake Erie from the east and to the Ohio River from the west by Beaver Creek, a major tributary of the Wabash River in Mercer County.

Geology

Mercer County has been covered by continental glaciers at least three times. Wisconsin age glacial drift covers the entire county (*3*). Older glacial deposits are evident only in deeply buried pre-Wisconsin age valleys of the Teays River system. The approximate location of the Teays River shows that the river entered present day Mercer County from the east in the area of Grand Lake and coursed northwestward into Indiana in the latitude of Black Creek Township (*5*).

The Wisconsin age glacial drift includes till; outwash; loess, or silty wind-blown deposits; lacustrine material, or clayey and silty water-deposited material; and alluvium. The glacial drift covers limestone bedrock, mostly of the Niagara Formation of Silurian age. A small part of the county in the northeast corner is underlain by younger limestone bedrock of the Monroe Formation. The glacial drift ranges in thickness from several hundred feet to a thin mantle in one area in the central part of the county.

Evidence indicates that the last glacier advanced generally from northeast to southwest across the county. Interstages of this glacier are revealed by the presence of four end moraines, striking gently sloping and sloping landforms created by successive advances and retreats of the ice mass spanning a period of several thousand years. These end moraines are, from south to north, the Mississinewa, the oldest; the St. Johns; the Wabash; and the Fort Wayne, the youngest. Between these end moraines, the glacial till was deposited more evenly, and the moraine is called a ground moraine. During each retreat, channels were cut through the glacial till by the melt water and the present drainage pattern was created. In some areas the melt water deposited outwash sand and gravel, most noticeably in front of the Fort Wayne moraine. In these areas Digby, Eldean, Gallman, Haskins, Millgrove, Ockley, and Rawson soils formed.

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

During the immediate postglacial periods, there were warm dry periods during which winds blew fine silt-size particles from the bare glacial drift, probably over an extensive area, and deposited the material, to depths ranging from a few to several inches, over other areas of glacial drift in the county. In many areas this material, or loess, has contributed to the silty nature of the surface layer of Blount, Elliott, Glynwood, Morley, and Pewamo soils, which formed mainly in glacial till.

Behind the Mississinewa moraine and in front of the St. Johns moraine in the southern part of the county, the retreating glacial ice created a sizeable depression. When the depression was filled with melt water from the glacier, a large lake was created. Silty and clayey sediment that washed in from areas surrounding the lake built up at the bottom of the lake. After the lake water receded, McGary and Montgomery soils formed in these lake deposits. In a few places on the lakebed where elevation is lowest and in other depressions in the county, a bog, a place where organic material accumulates, formed. Carlisle, Edwards, and Olentangy soils formed in this material.

In the present stream valleys, a more recent deposition of soil material has taken place. This alluvium was eroded from soils on uplands and terraces and deposited on flood plains. Eel, Defiance, Genesee, Shoals, Sloan, and Wabasha soils formed in this alluvium.

Farming

Mercer County is a leading agricultural county in Ohio. It is one of the most rural of Ohio counties. Approximately 81 percent of the total land area was cropland in 1967 (*7*).

In 1975, Mercer County was second in Ohio in total farm receipts; first in poultry and egg income; second in dairy products; fifth in hog production; tenth in soybean production; and seventh in corn production (*6*).

According to the 1969 Census of Agriculture, the average size of farms increased from 141 acres in 1964 to 144 acres in 1969. The number of farms increased from 1,978 to 2,029 during this period.

From 1964 to 1969, the acreage in corn decreased from 73,722 to 68,423 acres, that in wheat decreased from 30,655 to 22,098 acres, and that in hay decreased from 30,479 to 24,920 acres. During the same period, the acreage in soybeans for grain increased from 46,005 to 60,406 acres. The acreage in truck crops of potatoes, green beans, and tomatoes also decreased slightly during this period. The number of hogs and pigs increased from 82,093 in 1964 to 86,341 in 1969. The number of cattle and calves remained about the same.

History

In June of 1795, the Treaty of Greenville was signed by the Indians. All lands east and south of the Greenville Treaty Line were surrendered to the United States. The area between the Ohio River and the Great Lakes west to the Mississippi River for the first time was solely under the jurisdiction of the United States of America (*8*).

During the ensuing years, Mercer County was part of areas known as Wayne County, Michigan and Hamilton, Montgomery, and Darke Counties, Ohio. On January 2, 1824, it was detached from Darke County by the Ohio legislature and was organized as a separate county. Van Wert County was attached to Mercer County for official purposes until 1837, when it was organized separately. During 1848 and 1849, boundary adjustments were made with surrounding counties. Celina became the county seat in 1839.

Early settlement began in 1817 in the southern part of the county and in about 1819 in the northern part. Most of the early settlers in the northern six townships moved to Mercer County from other parts of Ohio or other States. Early settlement in the eight townships to the south started in Gibson Township.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

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

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land-use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Blount-Pewamo

Level, nearly level, and gently sloping, somewhat poorly drained and very poorly drained soils formed in glacial till

This map unit occurs as broad areas on till plains. Most areas are flat, and slight undulations are interspersed with drainageways and shallow depressions.

This map unit makes up about 62 percent of the county. It is about 50 percent Blount soils, 40 percent Pewamo soils, and 10 percent soils of minor extent.

Blount soils are somewhat poorly drained, nearly level and gently sloping, medium textured soils on slight rises, low knolls, and foot slopes. Permeability is slow or moderately slow, and runoff is slow and medium. Pewamo soils are very poorly drained, level and nearly level, moderately fine textured and fine textured soils in depressions. Permeability is moderately slow, and runoff is very slow. Some areas are ponded. Both soils have a seasonal high water table near the surface.

Of minor extent in this map unit are Glynwood soils on knolls and side slopes adjacent to drainageways; Montgomery and McGary soils in old shallow glacial lakes; Elliott soils on foot slopes, in about the same position as Blount soils; and Millsdale soils in areas where bedrock is at a depth of 20 to 40 inches. Also of minor extent are Haskins soils on very slight rises and low knolls on stream terraces and till plains.

The major soils are used for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. Corn, soybeans, wheat, oats, hay, pasture grasses, and tomatoes are the principal crops. The soils have good potential for farming and woodland. The potential is poor for building site development and sanitary facilities and fair or poor for most recreation uses.

The seasonal high water table is the main limitation for most uses. Maintaining the tilth of both soils and controlling erosion on the gently sloping Blount soils are also major concerns for farming. The moderately slow or slow permeability severely limits these soils for such uses as septic tank effluent fields. Low strength limits building site development.

2. Blount-Glynwood

Nearly level to sloping, somewhat poorly drained and moderately well drained soils formed in glacial till

The map unit is on ground moraines and end moraines. Most areas are undulating and are dissected along drainageways. The steeper areas are along the larger drainageways. Slopes are generally short and in some areas are complex.

This map unit makes up about 25 percent of the county. It is about 45 percent Blount soils, 35 percent Glynwood soils, and 20 percent soils of minor extent.

Blount soils are somewhat poorly drained, nearly level and gently sloping, medium textured soils on flats, low knolls, and foot slopes. Permeability is slow or moderately slow, and runoff is slow and medium. The seasonal high water table is near the surface. Glynwood soils are moderately well drained, gently sloping and sloping, medium textured soils on knolls and side slopes along drainageways. Permeability is slow, and runoff is medium and rapid. The seasonal high water table is between depths of 24 and 36 inches.

Of minor extent in this map unit are the sloping to steep Morley soils on the sides of valleys and hills, Pewamo soils in narrow depressions, and Rawson and Eldean soils on stream terraces and end moraines.

The major soils are used mainly for cash grain and livestock farming and woodland. Corn, soybeans, wheat, oats, hay, and pasture grasses are the principal crops. The soils have good and fair potential for farming. They have fair or poor potential for building site development and sanitary facilities. The potential is good for woodland and fair for recreational development.

The main limitation of these soils is the erosion hazard, especially on the sloping to steep Morley soils. Also, the Blount soils are wet. They dry out more slowly in spring than Glynwood soils and are not suited to grazing early in spring or to crops that are planted early in spring. Glynwood soils are better suited than Blount soils to building site developments. Both soils are poorly suited to such sanitary facilities as septic tank effluent fields because of the slow or moderately slow permeability.

3. Montgomery-McGary

Level, nearly level, and gently sloping, very poorly drained and somewhat poorly drained soils formed in lake-deposited clay and silt

This map unit occurs as broad areas in old shallow glacial lakes on till plains. Most areas are flat, and slight rises are interspersed with drainageways.

This map unit makes up about 6 percent of the county. It is about 65 percent Montgomery soils, 21 percent McGary soils, and 14 percent soils of minor extent.

Montgomery soils are very poorly drained, level and nearly level, fine textured soils in depressional areas. Permeability is slow or very slow, and runoff is very slow. The seasonal high water table is near the surface. McGary soils are somewhat poorly drained, nearly level and gently sloping, moderately fine textured soils on rises. Permeability is slow or very slow, and runoff is slow and medium. The seasonal high water table is between depths of 12 and 36 inches.

Of minor extent in this map unit are Pewamo soils in depressions; Blount soils on slight rises and low knolls; and Edwards soils, which formed in an organic deposit over marl, in some of the deeper depressions. Also of minor extent are Olentangy soils southeast of the village of Cranberry and at the base of the Fort Wayne moraine.

The major soils are used mainly for cash grain farming. Corn and soybeans are the principal crops. Tomatoes are an important specialty crop on the Montgomery soils. Both major soils have good potential for farming, woodland, and habitat for wetland wildlife and poor potential for building site development and sanitary facilities. The potential for most recreation uses is poor or fair.

The main limitation for most uses is the very poor and somewhat poor natural drainage. The slow or very slow permeability and the high shrink-swell potential are limitations for building site development and sanitary facilities. McGary soils are better suited than Montgomery soils to most community development uses. Maintenance of tilth in the fine textured and moderately fine textured surface layer is a major concern for farming.

4. Defiance-Wabasha

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

This map unit is on flats on flood plains and is frequently flooded. Areas are narrow along the smaller streams and wide along the larger ones.

This map unit makes up about 3 percent of the county. It is about 43 percent Defiance soils, 20 percent Wabasha soils, and 37 percent soils of minor extent.

Defiance soils are somewhat poorly drained, level and nearly level, fine textured soils that commonly are adjacent to the streams and occupy the entire flood plain along some small streams. They formed in fine textured and moderately fine textured recent alluvium. Permeability and runoff are slow or very slow. Wabasha soils are very poorly drained, level and nearly level, fine textured soils in low lying areas on flood plains. They formed in fine textured recent alluvium. Permeability is slow, and runoff is very slow. Some areas are ponded after the floodwater recedes. Both soils have a seasonal high water table near the surface.

Of minor extent in this map unit are Sloan, Shoals, and Eel soils in small areas that are intermingled with the major soils on the flood plains. Also of minor extent are Ockley and Haskins soils in narrow strips on stream terraces and Glynwood and Morley soils in narrow strips on valley walls.

The major soils are used mainly for cash grain farming. Some areas are used for pasture and woodland. The soils have good potential for farming and good or fair potential for woodland. The potential for building site development, sanitary facilities, and most recreation uses is poor.

The main limitations for most uses are the somewhat poor and very poor natural drainage and the flood hazard. The slow or very slow permeability and the high shrink-swell potential are additional limitations for building site development and sanitary facilities. Maintenance of tilth in the fine textured surface layer is a major concern for farming. Winter crops and early spring crops, such as wheat, oats, and specialty crops, are generally not grown because of the flood hazard. Surface drains greatly improve drainage.

5. Shoals-Genesee

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

This map unit is on flats on flood plains and is commonly flooded. Most areas are long and narrow.

This map unit makes up about 2 percent of the county. It is about 33 percent Shoals soils, 25 percent Genesee soils, and 42 percent soils of minor extent.

Shoals soils are somewhat poorly drained, level and nearly level, medium textured soils in low lying areas near slope breaks to the uplands. They formed in medium textured recent alluvium. The seasonal high water table is between depths of 12 and 36 inches. Permeability is moderate, and runoff is very slow. Genesee soils are well drained, level and nearly level, medium textured soils that are in the highest positions on the flood plains, commonly adjacent to the stream. They formed in medium textured and moderately coarse textured recent alluvium. Permeability is moderate, and runoff is slow.

Of minor extent in this map unit are Sloan and Wabasha soils in the lowest positions on the flood plains and Eel soils in an intermediate position between Genesee and Shoals soils. Also of minor extent are Blount, Glynwood, and Morley soils in narrow strips on valley walls and uplands.

The major soils are used mainly for annual field crops and specialty crops that are planted after the period of most spring flooding. Such crops as winter wheat may be severely damaged by floodwater in winter and early in spring. Some areas are used for pasture. The soils have good potential for farming and woodland. They have poor potential for building site development, sanitary facilities, and many recreation uses.

Diking to control flooding is difficult. Artificial drainage is needed in Shoals soils for more timely tillage and improved crop production. Adequate outlets are difficult to establish in many areas because of the flat topography and the water level in the streams. The flood hazard on both soils and the somewhat poor natural drainage of the Shoals soils are serious limitations for building site development, sanitary facilities, and many recreation uses.

6. Sloan

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

This map unit is in low lying flat areas on flood plains and is frequently flooded. Most areas are long and narrow.

This map unit makes up about 1 percent of the county. It is about 74 percent Sloan soils and 26 percent soils of minor extent.

Sloan soils are very poorly drained, level and nearly level, moderately fine textured soils that are in depressed areas near slope breaks to the uplands along the larger streams. They occupy the entire flood plain along small streams. They formed in moderately coarse textured to moderately fine textured recent alluvium. The seasonal high water table is near the surface. Permeability is moderate or moderately slow. Runoff is very slow, and some areas are ponded.

Of minor extent in this map unit are Shoals soils in low lying areas near slope breaks to the uplands and Eel soils adjacent to the streams.

The major soils are used for row crops, pasture, and woodland. They are not well suited to small grain because of the very poor natural drainage and the flooding. Areas that are difficult to drain are commonly used for pasture and woodland. The soils have good potential for farming and woodland. The potential for building site development, sanitary facilities, and recreation uses is poor.

Flooding and seasonal wetness limit these soils for most uses. In many places outlets for subsurface drains are difficult to establish because the soils are in low positions. Diking to control flooding is difficult.

7. Millgrove-Digby-Gallman

Level, nearly level, and gently sloping, very poorly drained to well drained soils formed in glacial outwash

This map unit occurs as broad to narrow areas on stream terraces. Most areas are flat, and slight undulations are interspersed with drainageways.

This map unit makes up about 1 percent of the county. It is about 45 percent Millgrove soils, 20 percent Digby soils, 15 percent Gallman soils, and 20 percent soils of minor extent.

Millgrove soils are very poorly drained, level and nearly level, moderately fine textured soils in low lying positions. The seasonal high water table is at the surface. Permeability is moderate, and runoff is very slow. Digby soils are somewhat poorly drained, nearly level and gently sloping, medium textured soils on slightly elevated flats, on short slope breaks, and near the base of the flanks of stream terraces. The seasonal high water table is near the surface. Permeability is moderate in the subsoil and rapid in the substratum. Runoff is slow or medium. Gallman soils are well drained and moderately well drained, gently sloping, medium textured and moderately coarse textured soils on low knolls and slope breaks. Permeability is moderately rapid, and runoff is slow or medium.

Of minor extent in this map unit are Haskins, Glynwood, Morley, Blount, and Rawson soils on slope breaks to the uplands and Defiance, Wabasha, Genesee, Eel, Shoals, and Sloan soils in narrow strips on flood plains. Also of minor extent are Ockley soils on flats and slight rises.

The major soils are used mainly for farming and specialty crops, for which they have good potential. They also have good potential for woodland. Millgrove and Digby soils have poor potential for building site development and recreation uses, but Gallman soils have good potential for those uses.

The seasonal wetness of the Millgrove and Digby soils is the main limitation. This limitation can be overcome for such uses as farming by surface and subsurface drains. These soils dry earlier in spring if artificially drained. The effluent from sanitary facilities on these soils can pollute underground water supplies.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Gallman series, for example, was named for a road in Mercer County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Glynwood silt loam, 2 to 6 percent slopes, is one of several phases within the Glynwood series.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits, gravel, is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

BoA—Blount silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on slight rises on ground moraines. Most areas are oval or irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 23 inches thick. It is mostly dark yellowish brown and grayish brown, mottled, firm clay, silty clay loam, and silty clay. The substratum to a depth of about 60 inches is brown and yellowish brown, mottled, calcareous, very firm clay loam. In some areas in Recovery Township, the surface layer is 10 to 15 inches thick. In some areas in Union Township, it is loam that is less susceptible to crusting.

Included with this soil in mapping are areas of the very poorly drained Pewamo soils in drainageways and depressions; small areas of the moderately well drained Glynwood soils on low knolls; and some areas, mainly in Center Township, where the subsoil is thinner and depth to the substratum is 15 to 20 inches. Also included are narrow areas of McGary soils that formed in lakebed sediments in old shallow glacial lakes. Included soils make up less than 10 percent of most areas.

The seasonal high water table is perched near the surface late in winter and in spring and other extended wet periods. Permeability is slow or moderately slow. The rooting depth is influenced by the water table. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate. The soil crusts easily after heavy rains. Runoff is slow. The shrink-swell potential is moderate. Reaction is very strongly acid to neutral in the upper part of the subsoil and ranges from medium acid to moderately alkaline in the lower part. It varies widely in the surface layer, depending on the extent of liming. Organic-matter content is moderate.

This soil is used principally for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland. The potential for building site development and sanitary facilities is poor.

This soil is suited to corn, soybeans, wheat, hay, and pasture (fig. 1). Wetness and surface crusting are the main management concerns for farming. Surface drains are used in many areas to remove excess surface water. Subsurface drainage systems are commonly used to lower the perched water table. Incorporating crop residue, planting cover crops, and applying barnyard manure reduce crusting. Soil compaction occurs if tillage, harvesting, or grazing is done when the soil is soft and sticky as a result of wetness. Tillage and harvesting are best performed at optimum moisture levels and with the kind of equipment that minimizes soil compaction. Controlled grazing is needed.

This soil is suited to woodland. Species that can tolerate some wetness should be selected for new plantings.

Seasonal wetness, low strength, and slow or moderately slow permeability severely limit the use of this soil as a site for buildings and sanitary facilities. Landscaping on building sites keeps surface water away from the foundations. Local roads can be improved by artificial drainage and a suitable base material. Soil wetness and slow or moderately slow permeability limit most recreation uses. Capability subclass IIw; woodland suitability subclass 3o.

BoB—Blount silt loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on concave foot slopes and slightly convex low knolls on ground moraines and end moraines. In some areas it occurs as a band between Glynwood soils on knolls and Pewamo soils in depressions, and in some it is at the head of small drainageways. Areas along streams and on the south face of moraines are oblong or long and narrow. Most areas range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 23 inches thick. It is mostly dark yellowish brown and grayish brown, mottled, firm clay, silty clay loam, and silty clay. The substratum to a depth of about 60 inches is brown, mottled, calcareous, very firm clay loam. Areas where the surface layer is 10 to 15 inches thick are common in southern Recovery Township. In small areas on the ground moraine north of St. Marys River and near soils formed in glacial outwash, the surface layer is loam that is less susceptible to crusting.

Included with this soil in mapping are narrow areas of Pewamo and Elliott soils in drainageways and depressions; areas of Glynwood soils on the crests of knolls and on slope breaks along drainageways; and some areas, mainly in Center Township and on the Ft. Wayne moraine in Dublin and Union Townships, where depth to the substratum is only 10 to 20 inches. Also included are small areas where slopes are 0 to 2 percent and, on the upper part of slopes, areas of an eroded soil that has a silty clay loam surface layer. Included soils make up less than 10 percent of most areas.

The seasonal high water table is perched near the surface late in winter and in spring. Permeability is slow or moderately slow. The rooting depth is influenced by the water table. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate. The soil crusts easily after heavy rains. Runoff is medium. The shrink-swell potential is moderate. Reaction ranges from very strongly acid to slightly acid in the subsoil and varies widely in the surface layer, depending on the extent of liming. Organic-matter content is moderate.

This soil is used principally for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland. The potential for building site development and sanitary facilities is poor.

This soil is suited to corn, soybeans, wheat, hay, and pasture. Erosion control, wetness, and surface crusting are the main management concerns. Subsurface drainage systems are commonly used to lower the perched water table. Contour farming, a cropping system that includes sod or meadow crops, grassed waterways, and large additions of crop residue increase the infiltration rate and reduce the risk of erosion and surface crusting. Leaving crop residue on the surface in the fall and not plowing until spring also help to protect the soil against erosion.

Soil compaction occurs if tillage, harvesting, and grazing are done when the soil is soft and sticky as a result of wetness. Tillage and harvesting are best performed at optimum moisture levels and with the kind of equipment that minimizes soil compaction. Controlled grazing is needed.

This soil is suited to woodland (fig. 2). Species that can tolerate some wetness should be selected for new plantings.

Seasonal wetness, low strength, and slow or moderately slow permeability limit the use of this soil for building site development and sanitary facilities. Runoff from higher lying soils should be diverted from sites for septic tank absorption fields. Houses without basements are better suited to this soil than those with basements. Landscaping on building sites keeps surface water away from the foundations. This soil is suitable for pond embankments (fig. 3). Capability subclass IIe; woodland suitability subclass 3o.

Ca—Carlisle muck. This deep, level and nearly level, very poorly drained, organic soil is in depressions. It is subject to frequent flooding. Slopes range from 0 to 2 percent. Most areas are irregularly shaped and 5 to 50 acres in size.

Typically, the surface layer is black, friable muck about 8 inches thick. Below this to a depth of about 63 inches are layers of black, friable muck and dark reddish brown, very friable muck.

Included with this soil in mapping, on the periphery of the mapped areas, are narrow strips of Edwards soils and a muck that is 16 to 51 inches deep over mineral material.

Water is near the surface and ponds for long periods. Runoff is very slow. Permeability is moderately rapid. The rooting depth is influenced by the water table. The root zone is deep and has a very high available water capacity. Reaction ranges from strongly acid to mildly alkaline in the part of the root zone below the surface layer and varies widely in the surface layer, depending on the extent of liming. Organic-matter content is very high.

This soil is used mainly for farming, woodland, and habitat for wildlife. It has good potential for farming and woodland. The potential for building site development, sanitary facilities, and recreation uses is very poor. The potential for habitat for wetland wildlife is good.

The very poor natural drainage and the flooding are the major limitations of this soil for crops. Drained areas are used mainly for corn and soybeans. Surface drains are commonly used to remove ponded water. Subsurface drains are also used in areas where outlets are available. Subsidence or shrinkage occurs as the result of oxidation of the organic material after draining. Controlled drainage in areas where the water table can be raised or lowered reduces the shrinkage. During dry periods soil blowing and the risk of fire are major concerns. The risk of soil blowing can be reduced by irrigation, windbreaks, and cover crops. Drained areas are suited to grasses grown for hay or pasture.

This soil is not well suited to woodland unless it is drained. Undrained areas support water-tolerant trees and some cattails, reeds, or sedges. The wetness seriously limits the use of logging equipment. Logging can generally be done during extended dry periods.

Building site development, sanitary facilities, and recreation uses are seriously limited by flooding, wetness, low strength, and seepage. Undrained areas provide good habitat for ducks, muskrat, and other wetland wildlife. Capability subclass IIIw; woodland suitability subclass 4w.

Df—Defiance silty clay. This deep, level and nearly level, somewhat poorly drained soil is on flood plains and is subject to frequent flooding. It commonly is adjacent to the streams and occupies the entire flood plain along some small streams. Slope ranges from 0 to 2 percent. Most areas are long and narrow and range from 2 to several hundred acres in size.

Typically, the surface layer is dark gray, firm silty clay loam about 10 inches thick. The subsurface layer is about 10 inches of dark gray, mottled, firm silty clay. The subsoil is mottled, firm silty clay about 27 inches thick. The upper part is gray, the next part is yellowish brown, and the lower part is dark gray. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silty clay. In some areas the surface layer is silty clay loam. Small areas of a similar very poorly drained soil is in the lowest positions on the flood plains.

The seasonal high water table is near the surface in winter and in spring and other extended wet periods. Permeability and runoff are slow or very slow. The rooting depth is influenced by the water table. The root zone is deep and has a moderate available water capacity. Tilth is poor. The shrink-swell potential is high. Reaction is slightly acid to mildly alkaline in the surface layer and subsoil. Organic-matter content is moderate.

Most of the acreage is used for cash grain farming. Some areas are in trees and shrubs and others in pasture. This soil has good potential for farming and good or fair potential for woodland. It has poor potential for building site development, sanitary facilities, and most recreation uses.

This soil is suited to row crops that can be planted after the period of most spring flooding. It is not well suited to specialty crops because it dries slowly in spring and because flooding is a hazard. Winter crops and early spring crops, such as wheat and oats, are usually not grown. Surface drains are commonly used to remove ponded water. Subsurface drains are also used in areas where suitable outlets are available. Suitable outlets are difficult to establish in many places because they are submerged during flooding. If it is cropped year after year, the soil becomes dense and compact unless a large amount of crop residue is returned. Tillage at the proper moisture content is important because the soil puddles and clods if worked when wet and sticky. Compaction can occur unless grazing is limited to periods when the soil is not soft and sticky as a result of wetness.

This soil is suited to trees that can tolerate some wetness. Spraying, mowing, and disking reduce plant competition.

The flood hazard, the seasonal wetness, the high shrink-swell potential, and the clayey surface layer seriously limit this soil for building site development, sanitary facilities, and most recreation uses. Diking to control flooding is difficult. Capability subclass IIIw; woodland suitability subclass 3c.

DmA—Digby loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on the slightly elevated flats on stream terraces. Most areas are long and narrow, oval, or irregularly shaped and range from 3 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is grayish brown, mottled, friable and firm loam and clay loam; the next part is dark yellowish brown, mottled, firm clay loam; and the lower part is grayish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is dark grayish brown and gray, loose gravelly sand and gravelly sandy loam. It is mottled in the upper part. Depth to the substratum is 48 to 80 inches in some areas. Available water capacity is higher in these areas, and the soil is not so droughty.

Included with this soil in mapping are small areas of Gallman soils on slight rises, narrow strips of Millgrove soils in depressions, and some areas where the surface layer is sandy loam, the hazard of soil blowing is greater, and cultivation is easier. Also included, on the periphery of some mapped areas, are narrow strips of Haskins soils that have moderately fine textured or fine textured glacial till or lacustrine material in the lower part.

The seasonal high water table is near the surface in winter and in spring and other extended wet periods. Permeability is moderate in the subsoil and rapid in the substratum. The rooting depth is influenced by the water table. The root zone is deep and has a moderate available water capacity. Runoff is slow. The shrink-swell potential is low. Reaction ranges from medium acid to neutral in the surface layer, from very strongly acid to slightly acid in the upper part of the subsoil, and from slightly acid to mildly alkaline in the lower part. Organic-matter content is moderate.

This soil is used mainly for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland. The potential for building site development, sanitary facilities, and recreation uses is poor.

This soil is suited to corn, soybeans, wheat, oats, pasture, and specialty crops. Seasonal wetness is the main limitation to farming. Surface drains are used to remove excess surface water. Subsurface drains are commonly used to lower the seasonal high water table. The soil is well suited to irrigation. Incorporating crop residue, planting cover crops, and applying barnyard manure increase organic-matter content and improve tilth. 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 trees and other vegetation grown as habitat for wildlife. Species that can tolerate some wetness should be selected for new plantings. Plant competition can be reduced by spraying, mowing, and disking.

Seasonal wetness and seepage severely limit the use of this soil as a site for buildings and sanitary facilities. The seepage can result in pollution of the underground water supplies. Drainage ditches and subsurface drains lower the seasonal high water table. Landscaping building sites keeps surface water away from the foundations. Local roads can be improved by artificial drainage and a suitable base material. Capability subclass IIw; woodland suitability subclass 2o.

DmB—Digby loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on short slope breaks and near the base of the flanks of stream terraces. A few areas are on till plains. Most areas are long and narrow, oval, or irregularly shaped and range from 3 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 34 inches thick. The upper part is grayish brown, mottled, friable and firm loam and clay loam; the next part is dark yellowish brown, mottled, firm clay loam; and the lower part is grayish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is dark grayish brown and gray, mottled, loose gravelly sand and gravelly sandy loam. Depth to the substratum is 48 to 80 inches in some areas. In these areas, available water capacity is higher and the soil is not so droughty.

Included with this soil in mapping are small areas of Gallman soils on the upper part of slopes and on low knolls and some areas where the surface layer is sandy loam, soil blowing is a greater hazard, and cultivation is easier. Also included, on the periphery of some mapped areas, are narrow strips of Haskins soils that have moderately fine textured or fine textured glacial till or lacustrine material in the lower part.

The seasonal high water table is near the surface in winter and in spring and other extended wet periods. Permeability is moderate in the subsoil and rapid in the substratum. The rooting depth is influenced by the water table. The root zone is deep and has a moderate available water capacity. Runoff is slow or medium. The shrink-swell potential is low. Reaction ranges from medium acid to neutral in the surface layer, from very strongly acid to slightly acid in the upper part of the subsoil, and from slightly acid to mildly alkaline in the lower part. Organic-matter content is moderate.

This soil is used mainly for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland. The potential for building site development, sanitary facilities, and recreation uses is poor.

This soil is suited to corn, soybeans, wheat, oats, pasture, and specialty crops. Controlling erosion and reducing the wetness are the main management concerns. Meadow crops in the cropping system and grassed waterways reduce the risk of erosion, increase organic-matter content, and improve tilth. Subsurface drains are commonly used to lower the seasonal high water table. Soil compaction occurs if tillage, harvesting, or grazing is done when the soil is soft and sticky as a result of wetness. Controlled grazing is needed.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Species that can tolerate some wetness should be selected for new plantings. Plant competition can be reduced by spraying, mowing, and disking.

Seasonal wetness and seepage severely limit this soil as a site for buildings, sanitary facilities, and recreation uses. The seepage can result in pollution of the underground water supplies. Drainage ditches and subsurface drains lower the seasonal high water table. Landscaping on building sites keeps surface water away from the foundations. Local roads can be improved by artificial drainage and a suitable base material. Capability subclass IIe; woodland suitability subclass 2o.

Ed—Edwards muck. This deep, level and nearly level, very poorly drained, organic soil is in depressions. It is subject to frequent flooding. Slopes range from 0 to 2 percent. Most areas are 2 to 37 acres in size and are oblong or irregularly shaped.

Typically, the surface layer is black, very friable muck about 10 inches thick. The subsurface layer, to a depth of about 28 inches, is black, very friable muck. The substratum to a depth of about 60 inches is light gray, friable marl. It is mottled in the upper part. In some areas the muck is 12 to 16 inches deep over the marl, and in others a thin layer of mineral material is between the muck and the marl.

Included with this soil in mapping are small areas of Carlisle and Olentangy soils and narrow strips, on the periphery of some mapped areas, of Pewamo and Montgomery soils. The included Pewamo and Montgomery soils are more difficult to till. Also included are a few areas where sedimentary peat is at a depth of 24 to 36 inches and areas where the surface layer is mucky silt loam and the substratum is clayey.

Water is near the surface and ponds for long periods. Runoff is very slow. Permeability is moderately rapid in the organic layers and varies in the marl. The rooting depth is influenced by the water table. The root zone is mainly moderately deep, extending to the marl, and has a moderate to very high available water capacity, depending on the depth to marl. Reaction in the root zone ranges from medium acid to mildly alkaline. Organic-matter content is very high.

This soil is used mainly for farming, woodland, and habitat for wildlife. It has poor potential for most uses but has better potential for woodland and habitat for wetland wildlife.

The very poor natural drainage, the flooding, and the marl at a depth of 16 to 35 inches are the major limitations of this soil for farming. Drained areas are easy to cultivate and are suited to such crops as corn, soybeans, potatoes, and green beans and grasses grown for hay or pasture. Surface drains are commonly used to remove ponded water. Subsurface drains are also used in areas where outlets are available. Subsidence or shrinkage, which occurs as a result of oxidation of the organic material after draining, shifts the subsurface drains. Controlled drainage in areas where the water level can be raised or lowered reduces the shrinkage. When dry, this soil is subject to soil blowing. The risk of soil blowing can be reduced by irrigation, windbreaks, and cover crops.

This soil is not well suited to woodland unless it is drained. Undrained areas support water-tolerant trees and some cattails, reeds, or sedges. The wetness seriously limits the use of logging equipment. Logging can generally be done during extended dry periods.

Building site development, sanitary facilities, and recreation uses are seriously limited by flooding, wetness, low strength, and seepage. Undrained areas provide good habitat for ducks, muskrat, and other wetland wildlife. Capability subclass IVw; woodland suitability subclass 4w.

Ee—Eel silt loam. This deep, level and nearly level, moderately well drained soil is on flood plains. It occupies the entire flood plain along small streams in some areas. Along the larger streams, it is commonly near the slope breaks to the uplands. It is commonly flooded for brief periods in fall, winter, and spring. Slopes range from 0 to 2 percent. Areas are broad, oblong, or irregularly shaped. They range from about 8 to 30 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 8 inches thick. The subsoil, to a depth of about 42 inches, is dark brown, friable and very friable silt loam. The substratum to a depth of about 68 inches is dark gray, friable sandy loam.

Included with this soil in mapping are narrow strips of Genesee soils adjacent to the streams and small areas of Shoals soils in depressions. Also included are areas where the substratum has slowly permeable silty clay or silty clay loam layers.

The seasonal high water table is at a depth of 36 to 72 inches in winter and spring. Permeability is moderate. The root zone is deep and has a high available water capacity. The surface layer crusts after heavy rains, and the crusting reduces the infiltration rate. Runoff is slow. The shrink-swell potential is low. Reaction ranges from slightly acid to mildly alkaline in the surface layer and from slightly acid to moderately alkaline in the subsoil. Organic-matter content is moderate.

This soil is mainly used for cash grain farming. Some areas on narrow flood plains are permanent pasture. The soil has good potential for farming and woodland and poor potential for building site development and sanitary facilities.

Flooding is the major hazard if this soil is farmed. The soil is suited to the commonly grown annual field crops and specialty crops. Such crops as winter wheat can be severely damaged by floodwater in winter and early in spring. The soil is suited to grasses and legumes for pasture. Cover crops and crop residue maintain organic-matter content, reduce crusting, 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.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Spraying, mowing, and disking reduce plant competition.

The flood hazard and the seasonal high water table seriously limit this soil as a site for most buildings and sanitary facilities. The soil has good potential for such recreation areas as picnic areas and hiking trails. Diking to control flooding is generally difficult. The soil is a good source of topsoil. Capability subclass IIw; woodland suitability subclass 1o.

ElB—Eldean loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on short slope breaks on stream terraces and in outwash areas on end moraines. Most areas are long and narrow or oblong and range from 2 to 17 acres in size.

Typically, the surface layer is brown, friable loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, firm clay; the next part is brown, firm gravelly clay; the lower part is brown, friable and very friable gravelly clay loam and gravelly loam. The substratum to a depth of about 70 inches is grayish brown and yellowish brown, loose fine gravelly loamy sand, loamy fine sand, and gravelly loamy sand.

Included with this soil in mapping are small areas of Ockley soils on the lower part of slopes and some small areas where the surface layer is gravelly loam. Also included are areas where slopes are of 0 to 2 percent and strips of eroded soils on the upper part of slopes.

Permeability is moderate in the subsoil and rapid or very rapid in the substratum. The root zone is mainly moderately deep and has a moderate available water capacity. Runoff is medium. The shrink-swell potential is moderate or low in the subsoil and low in the substratum. Reaction is medium acid to neutral in the surface layer, medium acid to mildly alkaline in the upper part of the subsoil, and neutral to moderately alkaline in the lower part. Organic-matter content is moderate.

This soil is used mainly for cash grain farming. It has good potential for farming, woodland, building site development, and most recreation uses.

This soil is well suited to corn, soybeans, wheat, oats, hay, pasture, and specialty crops. Because of the limited available water capacity, it is better suited to early maturing crops than to crops that mature late in summer. It is well suited to irrigation. The principal management concern is control of erosion. Minimizing tillage, returning crop residue to the soil, and including sod crops in the cropping sequence reduce the risk of erosion, improve tilth, and increase water intake.

This soil is well suited to trees and habitat for wildlife. Machine planting of tree seedlings is practical on this soil. Plant competition can be reduced by spraying, mowing, and disking.

Although low strength is a moderate limitation, this soil is suited to building site development. The low strength can be overcome by extending building foundations to the underlying sand. Local roads can be improved by replacing the subsoil with suitable base material. Sanitary facilities are limited by the possible pollution of underground water supplies. This soil is well suited to most recreation uses. It is a good source of sand and gravel. Capability subclass IIe; woodland suitability subclass 2o.

ElC2—Eldean loam, 6 to 12 percent slopes, moderately eroded. This deep, sloping, well drained soil is on short slope breaks on stream terraces and in outwash areas on end moraines. Most areas are long and narrow, oval, or irregularly shaped. They range from about 2 to 10 acres in size.

Typically, the surface layer is brown, friable loam about 7 inches thick. The subsoil is about 24 inches thick. The upper part is dark brown, firm clay; the lower part is brown, firm and friable gravelly clay, gravelly clay loam, and gravelly loam. The substratum to a depth of about 70 inches is grayish brown and yellowish brown, loose fine gravelly loamy sand, loamy fine sand, and gravelly loamy sand.

Included with this soil in mapping are narrow strips of a severely eroded soil that has a clay loam surface layer. Tilth is poor in this included soil. Also included are narrow strips where slopes are short and are 12 to 18 percent.

Permeability is moderate in the subsoil and rapid or very rapid in the substratum. The root zone is mainly moderately deep and has a low available water capacity. Runoff is rapid. The shrink-swell potential is moderate or low in the subsoil and low in the substratum. Reaction is medium acid to neutral in the surface layer, medium acid to mildly alkaline in the upper part of the subsoil, and neutral to moderately alkaline in the lower part. Organic-matter content is moderately low.

This soil is used mainly for cash grain farming. Some areas support natural shrubs and trees. The soil has fair potential for farming, building site development, sanitary facilities, and most recreation uses. It has good potential for woodland.

This soil is suited to crops, hay, and pasture. Because of the limited available water capacity, it is better suited to early maturing crops than to crops that mature late in summer. Conservation practices, such as contour tillage and diversion terraces, are not feasible in most areas because slopes are short. Including long term hay and pasture in the cropping system reduces the erosion hazard. Minimum tillage and the return of crop residue to the soil reduce the risk of erosion, improve tilth, and increase the infiltration rate.

This soil is well suited to trees and to habitat for wildlife. Plant competition can be reduced by spraying, mowing, and disking.

The slope, the low strength, and the possible pollution of underground water supplies limit this soil as a site for buildings, sanitary facilities, and most recreation uses. The low strength can be overcome by extending building foundations to the underlying sand and gravel. Local roads can be improved by replacing the subsoil with suitable base material. Trails in recreation areas should be protected against erosion and established across the slope wherever possible. This soil is a good source of sand and gravel. Capability subclass IIIe; woodland suitability subclass 2o.

EoB—Elliott silt loam, 1 to 4 percent slopes. This deep, nearly level and gently sloping, somewhat poorly drained soil is on foot slopes on ground moraines. Most areas are oblong, oval, or irregularly shaped and range from 3 to 55 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer, to a depth of about 14 inches, is very dark grayish brown, mottled, friable silt loam. The subsoil is about 16 inches thick. The upper part is dark grayish brown and yellowish brown, mottled, firm silty clay loam; the lower part is brown and yellowish brown, mottled, very firm clay and silty clay. The substratum to a depth of about 60 inches is brown, mottled, very firm clay loam.

Included with this soil in mapping are small areas of Pewamo soils in depressions and Blount soils on slight rises. Also included are small areas where the surface layer is silty clay loam and narrow strips where slopes are 4 to 6 percent.

The seasonal high water table is perched near the surface late in winter and in spring and other extended wet periods. Permeability is moderately slow. The rooting depth is influenced by the water table. The root zone is mainly moderately deep to compact glacial till. Available water capacity is high. Runoff is slow or medium. The shrink-swell potential is moderate. Reaction ranges from medium acid to neutral in the surface layer and the upper part of the subsoil and is neutral or mildly alkaline in the lower part. Organic-matter content is moderate or high.

This soil is used mainly for farming. It has good potential for farming and woodland. The potential for building site development and sanitary facilities is poor.

This soil is suited to corn, soybeans, small grain, hay, and pasture and to specialty crops, such as tomatoes. Erosion control, seasonal wetness, and surface crusting are the main management concerns for farming. Subsurface drains are commonly used to lower the perched water table. Erosion is a hazard if slopes are 2 to 4 percent. Including meadow crops in the cropping sequence, incorporating crop residue, and planting cover crops reduce the risk of erosion and surface crusting. Soil compaction occurs if tillage, harvesting, or grazing is done when the soil is soft and sticky as a result of wetness.

This soil is well suited to trees. Species that can tolerate some wetness should be used in new plantings. Plant competition can be reduced by spraying, mowing, and disking.

The seasonal wetness and the moderately slow permeability severely limit this soil as a site for buildings and sanitary facilities. Landscaping on building sites is needed to keep surface water away from the foundations. Local roads can be improved by artificial drainage and suitable base material. Capability subclass IIe; woodland suitability subclass 2o.

GaB—Gallman sandy loam, 2 to 6 percent slopes. This deep, gently sloping, well drained or moderately well drained soil is on low knolls and short slope breaks on stream terraces. Most areas are long and narrow and range from 4 to 30 acres in size.

Typically, the surface layer is dark brown, friable sandy loam about 8 inches thick. The subsoil is about 67 inches thick. It is mostly brown and dark brown, firm gravelly sandy clay loam, sandy loam, and gravelly clay loam.

Included with this soil in mapping are small areas of Digby soils on the lower part of slopes and some areas where the surface layer is loam and the soil is not so susceptible to soil blowing. Also included are narrow strips of Rawson soils that have moderately fine textured or fine textured glacial till or lacustrine material in the lower part.

Permeability is moderately rapid. The root zone is deep and has a moderate available water capacity. Runoff is slow or medium. Tilth is good. The shrink-swell potential is low. Reaction ranges from medium acid to neutral in the surface layer, from very strongly acid to slightly acid in the upper part of the subsoil, and from strongly acid to mildly alkaline in the lower part. Organic-matter content is moderately low.

This soil is used mainly for cash grain farming. It has good potential for farming, woodland, recreation uses, and building site development.

This soil is suited to corn, soybeans, wheat, oats, hay, pasture, and specialty crops. Because of the limited available water capacity, it is better suited to early maturing crops than to crops that mature late in summer. It dries early in spring and is well suited to tillage and grazing early in spring. It is suited to irrigation. Control of water erosion and soil blowing is the main management need. Minimum tillage and crop residue on the surface reduce the risk of soil blowing if row crops are grown. Returning crop residue to the soil and including sod crops in the cropping system reduce the risk of erosion, improve tilth, and increase water intake. Pastures and meadows of shallow-rooted legumes and grasses tend to dry out during periods when rainfall is below normal. Plant nutrients are leached from this soil at a moderately rapid rate; consequently, response is generally better to smaller, more frequent or timely applications of fertilizer and lime than to one large application.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Plant competition can be reduced by spraying, mowing, and grazing.

This soil is well suited as a site for most buildings and recreation uses. The low strength of the subsoil severely limits the use of this soil for local roads and streets, but this limitation can be overcome by providing suitable base material. Sanitary facilities are limited by the possible pollution of underground water supplies. Capability subclass IIe; woodland suitability subclass 1o.

GbB—Gallman loam, 2 to 6 percent slopes. This deep, gently sloping, well drained or moderately well drained soil is mainly on low knolls and short slope breaks on stream terraces. Most areas are long and narrow or oval and range from 2 to 35 acres in size.

Typically, the surface layer is dark brown, friable loam about 8 inches thick. The subsoil is about 67 inches thick. It is yellowish brown and brown, friable and firm loam, sandy clay loam, and gravelly clay loam in the upper part and dark brown, friable and firm sandy loam and gravelly sandy clay loam in the lower part. It is mottled below a depth of about 66 inches.

Included with this soil in mapping are small areas of Digby soils on the lower part of slopes and some areas where the surface layer is sandy loam. The hazard of soil blowing is greater and cultivation is slightly easier in the areas of sandy loam. Also included are narrow strips where slopes are 0 to 2 or 6 to 12 percent.

Permeability is moderately rapid. The root zone is deep and has a moderate available water capacity. Runoff is slow or medium. Tilth is good. The shrink-swell potential is low. Reaction ranges from medium acid to neutral in the surface layer, from very strongly acid to slightly acid in the upper part of the subsoil, and from strongly acid to mildly alkaline in the lower part. Organic-matter content is moderate.

This soil is used principally for cash grain farming. It has good potential for farming, woodland, building site development, and recreation uses.

This soil is well suited to corn, soybeans, wheat, oats, hay, pasture, and specialty crops. Because of the limited available water capacity, it is better suited to early maturing crops than to crops that mature late in summer. Row crops can be grown year after year if erosion is controlled. The soil dries early in spring and is well suited to tillage and grazing early in spring. It is suited to irrigation. The main management need is control of erosion. Minimum tillage, return of crop residue to the soil, and sod crops in the cropping system reduce the risk of erosion, improve tilth, and increase water intake. Pastures and meadows of shallow-rooted legumes and grasses tend to dry out during periods when rainfall is below normal. Plant nutrients are leached at a moderately rapid rate from this soil; consequently, response is generally better to smaller, more frequent or timely applications of fertilizer and lime than to one large application.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Plant competition can be reduced by spraying, mowing, or disking.

This soil is well suited as a site for most buildings and recreation uses. The low strength of the subsoil severely limits the use of this soil for local roads and streets, but this limitation can be overcome by providing suitable base material. Sanitary facilities are limited by the possible pollution of underground water supplies. Capability subclass IIe; woodland suitability subclass 1o.

Gn—Genesee silt loam. This deep, level and nearly level, well drained soil is in the highest position on flood plains. It is commonly flooded. Slopes range from 0 to 2 percent. Most of the acreage occurs as long, narrow areas along the larger streams. The areas range from 15 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil, to a depth of about 48 inches, is dark brown and dark yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown, stratified silt loam and loam. In some areas the surface layer is loam.

Included with this soil in mapping are narrow strips of Eel soils at a slightly lower elevation on the flood plains. Also included are small areas of Shoals soils in slight depressions near slope breaks to the uplands.

Permeability is moderate. The root zone is deep and has a high available water capacity. Crusting of the surface layer after heavy rains reduces the infiltration rate. Runoff is slow. The shrink-swell potential is low. Reaction is slightly acid or neutral in the surface layer and slightly acid to mildly alkaline in the subsoil. Organic-matter content is moderate.

Most of the acreage is used for cash grain farming. Some areas are used for permanent pasture and specialty crops. This soil has good potential for farming and woodland. It has poor potential for building site development and sanitary facilities.

The major problem in farming this soil is the flood hazard. Although the choice of crops is limited, the soil is well suited to annual field crops and specialty crops (fig. 4). Such crops as winter wheat are severely damaged by floodwater in winter and early in spring. The soil is suited to grasses and legumes for pasture. Cover crops and crop residue maintain organic-matter content, reduce crusting, and protect the surface during floods.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Machine planting of tree seedlings is practical on this soil. Spraying, mowing, and disking reduce plant competition.

Flooding seriously limits this soil as a site for most buildings and sanitary facilities. The potential for such recreation uses as picnic areas and hiking trails is good. Diking to control flooding is difficult. This soil is a good source of topsoil. Capability subclass IIw; woodland suitability subclass 1o.

GwB—Glynwood silt loam, 2 to 6 percent slopes. This deep, moderately well drained, gently sloping soil is on knolls and along drainageways on ground moraines and end moraines. Most areas are long and narrow and range from 2 to 55 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 16 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; the next part is dark yellowish brown, mottled, very firm clay; the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam. In some areas the surface layer is loam.

Included with this soil in mapping are small areas of Blount soils on toe slopes and foot slopes and in nearly level areas and some areas of Rawson soils. Also included are small areas of eroded soils and narrow strips where slopes are 6 to 9 percent.

The seasonal high water table is perched between depths of 24 and 36 inches in winter and in spring and other extended wet periods. Permeability is slow. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate. Tilth is fair. Runoff is medium. The shrink-swell potential is moderate. Reaction is medium acid to neutral in the surface layer and ranges from very strongly acid to neutral in the upper part of the subsoil and from slightly acid to moderately alkaline in the lower part. Organic-matter content is moderate.

This soil is used principally for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland. The potential for building site development and sanitary facilities is fair or poor. The potential for most recreation uses is fair or good.

This soil is suited to crops and pasture. The erosion hazard and surface crusting are the main concerns if the soil is farmed. Terraces and diversions intercept runoff on long slopes. Meadow crops in the cropping system and grassed waterways help to control erosion. Randomly spaced subsurface drains are needed in the included wetter soils. Minimizing tillage, planting cover crops, incorporating crop residue, and tilling at proper moisture levels improve tilth, increase the rate of water infiltration, and reduce the risk of erosion. Soil compaction occurs if tillage, harvesting, or grazing is done when the soil is soft and sticky as a result of wetness. Controlled grazing is needed.

Only a small acreage of this soil is wooded. The soil is well suited to woodland. Seedling mortality is a hazard during extended dry periods.

The seasonal wetness, the slow permeability, and the shrink-swell potential moderately limit this soil as a site for buildings and sanitary facilities. This soil is better suited to houses without basements than to houses with basements. Local roads can be improved by artificial drainage and suitable base material, which overcome the risk of damage caused by frost action and low strength. This soil is suitable for pond embankments. Capability subclass IIe; woodland suitability subclass 2o.

GwB2—Glynwood silt loam, 2 to 6 percent slopes, moderately eroded. This deep, gently sloping, moderately well drained soil is on the crest of low knolls and slopes adjacent to drainageways on ground moraines and end moraines. Slopes are dominantly 4 to 6 percent. Erosion has removed about half of the original surface layer. Most areas are long and narrow and range from 2 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 15 inches thick. The upper part is yellowish brown, firm silty clay loam; the next part is dark yellowish brown, mottled, very firm clay; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam. In some small areas the surface layer is loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Blount soils along drainageways and in nearly level areas and some areas of Morley soils on the crest of knolls. Also included are narrow strips where slopes are 6 to 9 percent and small areas of severely eroded soils that are in poor tilth.

The seasonal high water table is perched between depths of 24 and 36 inches in winter and in spring and other extended wet periods. Permeability is slow. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate, and the soil is droughty during extended dry periods because of water lost as runoff. Runoff is medium or rapid. Tilth is fair. The shrink-swell potential is moderate. The surface layer is medium acid to neutral. The subsoil ranges from very strongly acid in the upper part to moderately alkaline in the lower part. Organic-matter content is moderate.

This soil is used principally for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has fair potential for farming and good potential for woodland. The potential for building site development and sanitary facilities is fair or poor. The potential for most recreation uses is fair or good.

This soil is suited to cultivated crops, hay, and pasture. Controlling erosion and improving tilth are the primary concerns of management. Control of surface runoff is important in checking further loss of soil through erosion. Often, areas of this soil are managed with adjacent soils because they are so small. Terraces and diversions intercept runoff on long slopes. Meadow crops in the cropping system help to control erosion. If plowed when wet and sticky, the soil is cloddy. It puddles and crusts easily. Minimizing tillage, planting cover crops, incorporating crop residue, and tilling at proper moisture levels improve tilth, increase the rate of water infiltration, and reduce the risk of erosion. Controlled grazing is needed to prevent compaction. In places randomly spaced subsurface drains are needed in the included wetter soils.

This soil is well suited to woodland. Seedling mortality is a hazard during extended dry periods.

The seasonal wetness, the slow permeability, and the shrink-swell potential moderately limit this soil as a site for buildings and sanitary facilities. The soil is better suited to houses without basements than to houses with basements. Local roads can be improved by artificial drainage and suitable base material, which overcome the risk of damage caused by frost action and low strength. This soil is suitable for pond embankments. Capability subclass IIIe; woodland suitability subclass 2o.

GwC2—Glynwood silt loam, 6 to 12 percent slopes, moderately eroded. This deep, sloping, moderately well drained soil is on knolls and along drainageways on dissected parts of ground moraines and end moraines. Most areas are long and narrow and range from 2 to 20 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 15 inches thick. The upper part is yellowish brown, firm silty clay loam; the next part is dark yellowish brown, mottled, very firm clay; the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam.

Included with this soil in mapping are small areas of the well drained Morley soils on the upper part of slopes.

The seasonal high water table is perched between depths of 24 and 36 inches in winter and in spring and other extended wet periods. Permeability is slow. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate, and the soil is droughty during extended dry periods because of water lost as runoff. Runoff is rapid. Tilth is fair. The shrink-swell potential is moderate. The surface layer is medium acid to neutral. The subsoil ranges from very strongly acid in the upper part to moderately alkaline in the lower part. Organic-matter content is moderately low.

This soil is used principally for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. Some areas support shrubs and trees. The soil has fair potential for farming and recreation uses. The potential for building site development and sanitary facilities is fair or poor. The potential for woodland and habitat for openland and woodland wildlife is good.

This soil is suited to pasture and to most crops but is not well suited to specialty crops, such as tomatoes. The erosion hazard is severe in cultivated areas. Row crops can be included in the cropping system if erosion is controlled and good tilth is maintained. Including grasses and legumes in the cropping system helps to control erosion and maintain tilth in cultivated areas. If plowed when wet and sticky, the soil is cloddy. It puddles and crusts easily. Planting cover crops, incorporating crop residue, and tilling at proper moisture levels improve tilth, increase the rate of water infiltration, and reduce the risk of erosion. Grazing when the soil is soft and sticky results in compaction and reduces growth.

This soil is well suited to woodland. Seedling mortality is a hazard during extended dry periods. Logging roads should be protected against erosion.

The slope, the slow permeability, the shrink-swell potential, and the seasonal wetness moderately limit this soil as a site for buildings and sanitary facilities. Local roads can be improved by artificial drainage and suitable base material, which overcome the risk of damage caused by frost action and low strength. This soil is suitable for pond embankments. Capability subclass IIIe; woodland suitability subclass 2o.

HnA—Haskins loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on very slight rises on stream terraces, end moraines, and ground moraines. Most areas are long and narrow, oval, or irregularly shaped. They range from 3 to 45 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is light brownish gray and grayish brown, mottled, friable loam; the middle part is brown and dark grayish brown, mottled, firm sandy clay loam; the lower part is grayish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is dark grayish brown, mottled, firm clay loam.

Included with this soil in mapping are small areas of Blount soils formed in glacial till on till plains and Digby soils formed in glacial outwash on stream terraces. Both of these included soils are on very slight rises. Also included are small areas of Rawson soils on low knolls.

The seasonal high water table is perched near the surface in winter and in spring and other extended wet periods. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part and in the substratum. The rooting depth is influenced by the water table. The root zone is mainly moderately deep to compact glacial till or lacustrine material. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is low in the upper and middle parts of the subsoil and high in the lower part and in the substratum. Reaction ranges from strongly acid to neutral in the surface layer and generally from strongly acid or medium acid in the upper part of the subsoil to neutral or mildly alkaline in the lower part. Organic-matter content is moderate.

This soil is used mainly for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland. The potential for building site development, sanitary facilities, and recreation uses is poor.

This soil is suited to corn, soybeans, wheat, oats, hay, pasture, and specialty crops. Seasonal wetness is the main limitation to farming. Surface drains remove excess surface water. Subsurface drains are commonly used to lower the perched water table. They are more effective if placed on or above the slowly or very slowly permeable glacial till or lacustrine material in the lower part of the subsoil. The soil is droughty during extended dry periods. It is well suited to irrigation. Incorporating crop residue, planting cover crops, and applying barnyard manure increase organic-matter content and improve tilth. Tillage and harvesting are best performed at optimum moisture levels and with the kind of equipment that minimizes soil compaction. Controlled grazing is needed.

This soil is well suited to woodland. Species that can tolerate some wetness should be selected for new plantings. Plant competition can be reduced by spraying, mowing, and disking.

The seasonal wetness and the slow or very slow permeability severely limit this soil as a site for buildings and sanitary facilities. Drainage ditches and subsurface drains lower the seasonal high water table. Landscaping on building sites is needed to keep surface water away from the foundations. Local roads can be improved by artificial drainage and suitable base material. Capability subclass IIw; woodland suitability subclass 2o.

HnB—Haskins loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on low knolls on stream terraces and end moraines. Most areas are long and narrow or oval and are 3 to 12 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 26 inches thick. The upper part is light brownish gray and grayish brown, mottled, friable loam; the middle part is brown and dark grayish brown, mottled, firm sandy clay loam; and the lower part is grayish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is dark grayish brown, mottled, firm clay loam.

Included with this soil in mapping are small areas of Rawson and Glynwood soils on the upper part of slopes and the crest of low knolls. Also included are small areas of Blount soils formed in glacial till on end moraines and Digby soils formed in glacial outwash on stream terraces. Both of these included soils are on low knolls.

The seasonal high water table is perched near the surface in winter and in spring and other extended wet periods. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part and in the substratum. The rooting depth is influenced by the water table. The root zone is mainly moderately deep to compact glacial till or lacustrine material. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is low in the upper and middle parts of the subsoil and high in the lower part and in the substratum. Reaction ranges from strongly acid to neutral in the surface layer and generally from strongly acid or medium acid in the upper part of the subsoil to neutral or mildly alkaline in the lower part. Organic-matter content is moderate.

This soil is used mainly for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland. The potential for building site development, sanitary facilities, and recreation uses is poor.

This soil is suited to corn, soybeans, wheat, oats, hay, pasture, and specialty crops. Erosion, especially on long slopes, is the chief hazard and seasonal wetness the chief limitation if the soil is farmed. Returning crop residue to the soil, establishing grassed waterways, and including meadow crops in the cropping system help to control erosion. These practices also increase organic-matter content and improve soil structure and tilth. Subsurface drains lower the perched water table. These drains are more effective if placed on or above the slowly or very slowly permeable glacial till or lacustrine material in the lower part of the subsoil. The soil is droughty during extended dry periods. Soil compaction occurs if tillage, harvesting, or grazing is done when the soil is soft and sticky as a result of wetness. Controlled grazing is needed.

This soil is well suited to woodland. Species that can tolerate some wetness should be selected for new plantings. Plant competition can be reduced by spraying, mowing, and disking.

The seasonal wetness and the slow or very slow permeability severely limit the use of this soil for building site development and sanitary facilities. Drainage ditches and subsurface drains lower the perched water table. Local roads can be improved by artificial drainage and suitable base material, which overcome the risk of damage caused by frost action and low strength. Capability subclass IIe; woodland suitability subclass 2o.

McA—McGary silty clay loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on very slight rises in old shallow glacial lakes on till plains. Most areas are oval, long and narrow, or irregularly shaped and range from 2 to 35 acres in size. A few broad, irregularly shaped areas are as large as 125 acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 9 inches thick. The subsoil is mottled, firm silty clay about 32 inches thick. The upper part is brown, dark grayish brown, and grayish brown; the lower part is gray. The substratum to a depth of about 65 inches is gray and dark yellowish brown, firm and very firm silty clay. It is mottled in the upper part.

Included with this soil in mapping are narrow strips of Montgomery soils in depressions. These soils and some of the other included soils are subject to ponding. Areas along Bear Creek and Vandenbush Ditch in Granville Township are subject to flooding. In many included areas the surface layer is silt loam, tilth is better, and the soil crusts easily after heavy rains. Also included are some narrow areas where slopes are 2 to 6 percent and small areas of Blount soils that formed in glacial till.

The seasonal high water table is between depths of 1 foot and 3 feet in winter and in spring and other extended wet periods. Permeability is slow or very slow. The rooting depth is influenced by the water table. The root zone is deep and has a moderate available water capacity. Tilth is fair. Runoff is slow. The shrink-swell potential is high. Reaction is medium acid to neutral in the surface layer and the upper part of the subsoil and slightly acid to mildly alkaline in the lower part. Organic-matter content is moderate.

This soil is used mainly for cash grain farming. It has good potential for farming and woodland. The potential for building site development and sanitary facilities is poor. The potential for recreation uses is fair or poor.

Wetness limits the use of this soil for farming. Drained areas are suited to corn, soybeans, wheat, oats, hay, and pasture and to specialty crops, such as tomatoes. Surface drains remove ponded water. Subsurface drains generally help to remove the excess water from the root zone, but the movement of water into these drains is slow. The soil puddles and clods if worked when it is soft and sticky as a result of wetness. It is poorly suited to grazing early in spring because it is wet. Including meadow crops in the cropping system, returning crop residue to the soil, and planting cover crops improve tilth, increase organic-matter content, and help to control erosion. Controlled grazing is beneficial.

This soil is well suited to trees. Species selected for planting should be tolerant of some wetness. Logging can be done during the drier part of the year. Plant competition can be reduced by spraying, mowing, and disking.

The seasonal wetness, the high shrink-swell potential, and the slow or very slow permeability severely limit this soil as a site for buildings and sanitary facilities. Landscaping on building sites is needed to keep surface water away from the foundations. Local roads can be improved by artificial drainage and suitable base material. Capability subclass IIIw; woodland suitability subclass 3w.

McB—McGary silty clay loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on rises in old shallow glacial lakes on till plains. Most areas are oval, long and narrow, or irregularly shaped and range from 2 to 30 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 9 inches thick. The subsoil is mottled, firm silty clay about 32 inches thick. The upper part is brown, dark grayish brown, and grayish brown; the lower part is gray. The substratum to a depth of about 65 inches is gray and dark yellowish brown, firm and very firm silty clay. It is mottled in the upper part.

Included with this soil in mapping are small areas of Blount soils formed in glacial till on low knolls, narrow strips of Montgomery soils in depressions, and some areas along Bear Creek and Vandenbush Ditch that are subject to flooding. In many included areas the surface layer is silt loam, tilth is better, and the soil crusts easily after heavy rains. Also included are narrow strips of eroded, better drained, sloping soils along the Wabash River in Granville Township.

The seasonal high water table is between depths of 1 foot and 3 feet in winter and in spring and other extended wet periods. Permeability is slow or very slow. The rooting depth is influenced by the water table. The root zone is deep and has a moderate available water capacity. Tilth is fair. Runoff is medium. The shrink-swell potential is high. Reaction is medium acid to neutral in the surface layer and the upper part of the subsoil and slightly acid to mildly alkaline in the lower part. Organic-matter content is moderate.

This soil is used mainly for farming. It has good potential for farming and woodland. The potential for building site development and sanitary facilities is poor. The potential for recreation uses is fair or poor.

The erosion hazard and the seasonal wetness are the main limitations for farming. Row crops can be frequently included in the cropping system if erosion is controlled and good tilth is maintained. Including grasses and legumes in the cropping system, returning crop residue to the soil, and planting cover crops help to control erosion and maintain tilth in cultivated areas. Grassed waterways are beneficial. Subsurface drains generally help to remove the excess water from the root zone, but the movement of water into these drains is slow. The soil puddles and clods if worked when it is soft and sticky as a result of wetness. It is poorly suited to grazing early in spring because it is wet. Controlled grazing is needed.

This soil is well suited to trees and other vegetation grown as wildlife habitat. Species selected for planting should be tolerant of some wetness. Logging can be done during the drier part of the year. Plant competition can be reduced by spraying, mowing, and disking.

The seasonal wetness, the high shrink-swell potential, and the slow or very slow permeability severely limit this soil as a site for buildings and sanitary facilities. Landscaping on building sites is needed to keep surface water away from the foundations. Local roads can be improved by artificial drainage and suitable base material. Capability subclass IIIe; woodland suitability subclass 3w.

Mg—Millgrove silty clay loam. This deep, level and nearly level, very poorly drained soil is in low lying positions on stream terraces. It occurs as broad, irregularly shaped areas that are several hundred acres in size and as small, irregularly shaped or long and narrow areas that are 2 to 40 acres in size. Slopes range from 0 to 2 percent.

Typically, the surface layer is very dark brown, friable silty clay loam about 9 inches thick. The subsoil is about 35 inches thick. The upper part is very dark grayish brown, mottled, firm clay loam; the middle part is dark gray, mottled, firm clay loam; the lower part is dark grayish brown, mottled, firm sandy clay loam. The substratum to a depth of about 60 inches is brown, mottled, friable gravelly sandy loam.

Included with this soil in mapping are small areas of Digby soils on slight rises and, along Beaver Creek in the central part of the county and along the St. Mary's River, areas that are subject to occasional flooding. The lowest positions in depressions are subject to ponding. Also included are some areas, mainly in Dublin and Jefferson Townships, where the surface layer is loam, tilth is better, and tillage is easier and areas of similar soils in which glacial till is at a depth of 40 to 60 inches.

The seasonal high water table is at the surface in fall and winter and in spring and other extended wet periods. Permeability is moderate. The rooting depth is influenced by the water table. The root zone is deep and has a high available water capacity. Tilth is fair to good. Runoff is very slow. The shrink-swell potential is moderate in the subsoil and slow in the substratum. Reaction is medium acid to neutral in the surface layer and slightly acid to mildly alkaline in the subsoil. Organic-matter content is high.

This soil is used mainly for cash grain farming. It has good potential for farming and woodland. The potential for building site development, sanitary facilities, and recreation uses is poor.

Drained areas are well suited to all of the crops commonly grown in the county and to specialty crops. Unless adequate drainage is provided, poor stands of wheat and oats can be expected in most years. Surface drains remove surface water. Subsurface drains commonly help to remove excess water from the root zone. The soil is well suited to irrigation. Timely tillage is important because the soil puddles and clods if worked when it is soft and sticky as a result of wetness. The soil can be cultivated year after year if good tilth is maintained. Managing crop residue and planting cover crops improve tilth, help to control erosion, and increase the rate of water infiltration. Controlled grazing helps to prevent compaction.

This soil is suited to woodland. Species that can tolerate wetness should be selected for new plantings. Logging should be done during the drier part of the year. Spraying, disking, or mowing helps to reduce plant competition. Undrained areas are well suited as habitat for wetland wildlife.

The prolonged wetness and seepage severely limit this soil as a site for buildings, sanitary facilities, and recreation uses. As a result of the seepage from sanitary facilities, underground water supplies can be polluted. Suitable base material is commonly needed for roads. Also, artificial drainage is needed. Capability subclass IIw; woodland suitability subclass 2w.

Mh—Millsdale silty clay loam. This moderately deep, level and nearly level, very poorly drained soil is in depressions in ground moraines. Slopes range from 0 to 2 percent. Most areas are long and narrow and range from 30 to 95 acres in size.

Typically, the surface layer is black, friable silty clay loam about 5 inches thick. The subsurface layer is black, firm silty clay loam about 5 inches thick. The subsoil is mottled, firm clay loam about 15 inches thick. The upper part is yellowish brown; the lower part is dark grayish brown. Light gray limestone is at a depth of about 25 inches.

Included with this soil in mapping are small areas, on slight rises, of somewhat poorly drained soils that have a loam surface layer and are easier to cultivate. Also included are small quarries; areas that are in the lowest positions in depressions and are subject to ponding; and areas along Beaver Creek that are subject to rare flooding.

The seasonal high water table is perched at the surface in winter and in spring and other extended wet periods. Permeability is moderately slow. The root zone is moderately deep to limestone and has a low available water capacity. Tilth is fair. Runoff is very slow. The shrink-swell potential is high. Reaction is slightly acid to neutral in the surface layer and the upper part of the subsoil and neutral or mildly alkaline in the lower part. Organic-matter content is high.

This soil is used mainly for farming. It has fair potential for farming and good potential for woodland. The potential for building site development, sanitary facilities, and recreation uses is poor.

This soil is suited to corn, soybeans, wheat, oats, hay, and pasture if it is artificially drained. The stands of most row crops and small grain crops are poor in some years. Surface drains and open ditches remove excess surface water. Subsurface drains are needed, but bedrock interferes with installation. The soil is somewhat droughty during extended dry periods. Timely tillage is important because the soil puddles and clods if worked when it is soft and sticky as a result of wetness. Managing crop residue and planting cover crops improve tilth and help to control erosion. Hay and pasture plants that can tolerate some wetness are best suited. Controlled grazing helps to prevent compaction.

This soil is suited to trees and other vegetation grown as wildlife habitat. Species that can tolerate wetness should be selected for new plantings. Logging can be done during the drier part of the year. Spraying, disking, or mowing reduces plant competition.

The prolonged wetness, the moderate depth to bedrock, the high shrink-swell potential, and the low strength severely limit this soil as a site for buildings, sanitary facilities, and recreation uses. Local roads can be improved by artificial drainage and suitable base material. This soil is a good source of limestone. Capability subclass IIIw; woodland suitability subclass 2w.

Mn—Montgomery silty clay. This deep, level and nearly level, very poorly drained soil is in depressional areas in old shallow glacial lakes on till plains. Some areas are along drainageways that have a low gradient. Most areas are large, broad, and irregularly shaped. Areas that are only 3 to 20 acres are oval, long and narrow, or irregularly shaped.

Typically, the surface layer is very dark gray, friable silty clay about 11 inches thick. The subsoil is about 37 inches thick. The upper part is dark gray, mottled, firm silty clay; the lower part is gray, mottled, firm silty clay and silty clay loam. The substratum to a depth of about 66 inches is gray, mottled, firm silty clay loam. In many large areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas, in the lowest positions in depressions, of Edwards soils and other soils that have marl at a depth of 8 to 35 inches. These areas and other included areas along drainageways are subject to ponding and flooding. Also included are Pewamo soils on the edges of some mapped areas, small areas of McGary and Blount soils on slight rises, some areas where the surface layer is mucky silty clay, and other areas where 8 to 15 inches of local alluvial sediments overlies the surface layer.

The seasonal high water table is near the surface in winter and in spring and other extended wet periods. Permeability is slow or very slow. The rooting depth is influenced by the water table. The root zone is deep and has a high available water capacity. Tilth is poor. Runoff is very slow. Reaction is slightly acid or neutral in the surface layer and slightly acid to mildly alkaline in the subsoil. Organic-matter content is high.

This soil is used mainly for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland and poor potential for building site development, sanitary facilities, and recreation uses.

The main limitations to farming are the very poor natural drainage and the clayey surface layer. Drained areas are well suited to corn, soybeans, wheat, oats, hay, pasture, potatoes (fig. 5), and tomatoes. Stands of wheat and oats are poor in some years in areas where good drainage is not provided. Surface drains commonly remove excess surface water. Subsurface drains remove free water from the subsoil. Grade-changing structures in areas where the water from surface drains enters the deeper outlet ditches help to control erosion. This soil can be tilled only within a narrow range of moisture content if good tilth is to be maintained. It is cloddy if tilled when it is soft and sticky as a result of wetness. If pastures are grazed and trampled when too wet, the soil becomes compacted and hard. Managing crop residue and planting cover crops improve tilth and increase the rate of water infiltration.

This soil is suited to trees and other vegetation grown as habitat for wildlife. Species that can tolerate wetness should be selected for planting. Logging can be done during the drier part of the year. Plant competition can be reduced by spraying, mowing, and disking.

Building site development, sanitary facilities, and recreation uses are severely limited by the wetness, the slow or very slow permeability, the high shrink-swell potential, and the clayey surface layer. Local roads can be improved by artificial drainage and suitable base material. Undrained areas are well suited as habitat for wetland wildlife. Capability subclass IIIw; woodland suitability subclass 2w.

MrD2—Morley silt loam, 12 to 18 percent slopes, moderately eroded. This deep, moderately steep, well drained soil is on short slopes on the sides of valleys and hills on the dissected parts of ground moraines and end moraines. About half of the original surface layer has been lost through erosion. Areas are mostly long and narrow. They are mostly 2 to 10 acres but range from 2 to 50 acres.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part is brown, mottled, firm silty clay loam; the lower part is dark yellowish brown and brown, mottled, very firm silty clay. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, mottled, very firm silty clay loam and clay loam.

Included with this soil in mapping are small areas of a severely eroded soil that has a clay loam surface layer. Also included are areas where depth to the substratum is only 7 to 20 inches and narrow strips where slopes are 18 to 25 percent.

Permeability is slow. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate or high, and the soil is droughty during extended dry periods because of water lost as runoff. Runoff is very rapid. Tilth is fair. The shrink-swell potential is moderate. The subsoil ranges from strongly acid to neutral in the upper part and from neutral to moderately alkaline in the lower part. Reaction varies widely in the surface layer, depending on past liming practices. Organic-matter content is moderately low.

Most of the acreage is used for farming. Some areas on valley walls support shrubs and trees. This soil has poor potential for farming, building site development, sanitary facilities, and most recreation uses.

This soil is better suited to hay and pasture than to row crops, but row crops can be grown occasionally if erosion is controlled and good management is applied. The soil is poorly suited to specialty crops. The main concerns of management are the very severe erosion hazard and maintenance of tilth. The short slopes cause some problems in the operation of machinery and in the installation of erosion-control measures. If plowed when sticky and wet, the soil is cloddy. It puddles and crusts easily. Minimizing tillage, managing crop residue, planting cover crops, and tilling and harvesting at proper moisture levels help to control erosion and improve tilth. To control erosion in pastures, reseeding can be done with cover crops or companion crops or by trash mulch or no-till seeding methods. A thick plant cover helps to control erosion. Controlled grazing reduces soil compaction and increases plant growth.

This soil is suited to woodland. The slope moderately limits the use of equipment. Logging roads and skid trails should be protected against erosion and established across the slope wherever possible. This soil has good potential as habitat for woodland wildlife.

The slope and the slow permeability severely limit this soil as a site for most buildings and sanitary facilities. Cover should be maintained on the site as much as possible during construction to reduce the erosion hazard. Trails in recreation areas should be protected against erosion and laid out on the contour wherever possible. Capability subclass IVe; woodland suitability subclass 2r.

MrE2—Morley silt loam, 18 to 25 percent slopes, moderately eroded. This deep, steep, well drained soil is on short slopes on the sides of valleys and hills on the dissected parts of ground moraines and end moraines. About half of the original surface layer has been lost through erosion. Areas are mostly long and narrow. They are mostly 2 to 10 acres but range from 2 to 100 acres.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 18 inches thick. The upper part is brown, firm silty clay loam; the lower part is dark yellowish brown and brown, very firm silty clay. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, mottled, very firm silty clay loam and clay loam.

Included with this soil in mapping are areas of a severely eroded soil that has a clay loam surface layer and some areas that are so severely eroded that the substratum is at the surface or at a depth of 7 to 20 inches. Also included are narrow strips where slopes are 25 to 35 or 12 to 18 percent.

Permeability is slow. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate or high, but the soil is droughty during extended dry periods because of water lost as runoff. Runoff is very rapid. Tilth is fair. The shrink-swell potential is moderate. The subsoil ranges from strongly acid to neutral in the upper part and from neutral to moderately alkaline in the lower part. Reaction varies widely in the surface layer, depending on past liming practices. Organic-matter content is low.

Most of the acreage is woodland. Some areas are farmed. This soil has poor potential for most uses but has better potential for woodland and habitat for wildlife.

The steep slope and the erosion hazard severely limit the use of this soil for farming. The soil is too steep for cultivated crops but can be used for permanent pasture of grasses and legumes. Erosion is a serious hazard when the pasture is reseeded or unless an adequate plant cover is maintained. Grazing should be regulated to maintain enough vegetation to control erosion. The growth of pasture plants is limited during dry periods in summer.

This soil is well suited to woodland and to habitat for woodland wildlife. The steep slope moderately limits logging equipment. Logging roads should be protected against erosion and established across the slope wherever possible.

The steep slope severely limits this soil as a site for buildings and sanitary facilities. Cover should be maintained on the site as much as possible to reduce the erosion hazard. Trails in recreation areas should be protected against erosion and laid out on the contour wherever possible. Capability subclass VIe; woodland suitability subclass 2r.

MsD3—Morley clay loam, 9 to 18 percent slopes, severely eroded. This deep, sloping and moderately steep, well drained soil is on short slopes on the sides of valleys and hills on the dissected parts of ground moraines and end moraines. Most of the original surface layer has been lost through erosion. Areas are mostly long and narrow. They are mostly 2 to 10 acres but range from 2 to 25 acres.

Typically, the surface layer is brown, firm clay loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown, firm silty clay; the lower part is dark yellowish brown and brown, mottled, very firm clay and clay loam. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, mottled, very firm silty clay loam and clay loam.

Included with this soil in mapping are some small areas that are so severely eroded that the substratum is at the surface or at a depth of 7 to 20 inches; some small, moderately eroded areas, on the lower parts of slopes, where the surface layer is silt loam; and narrow strips where slopes are 6 to 9 or 18 to 25 percent.

Permeability is slow. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate, and the soil is droughty during extensive dry periods because of water lost as runoff. Runoff is very rapid. Tilth is poor. The shrink-swell potential is moderate. The subsoil ranges from strongly acid to neutral in the upper part and from neutral to moderately alkaline in the lower part. Reaction varies widely in the surface layer, depending on past liming practices. Organic-matter content is low.

This soil is used for farming and woodland. It has poor potential for farming and good potential for woodland. It has fair or poor potential for building site development, sanitary facilities, and most recreation uses.

Because of slope, past erosion, and a continuing hazard of erosion, this soil is poorly suited to cultivated crops. It is suited to hay and to permanent pasture of grasses and legumes. Erosion is a serious hazard when areas are reseeded or unless an adequate plant cover is maintained. Grazing should be regulated to maintain enough vegetation to control erosion and reduce soil compaction. If plowed when sticky and wet, the soil is cloddy. Using no-till or trash-mulch seeding methods to reseed meadows reduces the risk of erosion. Growth of pasture plants is limited during dry periods in summer. Applications of barnyard manure improve tilth and the water-holding capacity.

This soil is suited to trees and other vegetation grown as wildlife habitat. Seedling mortality is a hazard during dry periods.

The slope, the slow permeability, and the shrink-swell potential moderately limit this soil as a site for buildings and sanitary facilities. Local roads can be improved by providing suitable base material to overcome the risk of damage caused by low strength. The clay loam surface layer and the slope limit most recreation uses. Maintaining a plant cover on the site reduces the risk of erosion during construction. Capability subclass VIe; woodland suitability subclass 2c.

OcA—Ockley loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on low lying and high stream terraces and on outwash plains. Most areas are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is dark brown, friable loam about 8 inches thick. The subsoil is about 47 inches thick. The upper part is dark brown, firm clay loam; the lower part is mostly dark yellowish brown and brown, firm and very firm gravelly clay loam and gravelly sandy clay loam. The substratum to a depth of about 73 inches is mainly gray, loose gravelly loamy sand.

Included with this soil in mapping are small areas of Eldean soils where sand and gravel are at a depth of 20 to 40 inches. In some areas on outwash plains, the substratum has thin layers of silt loam, sandy loam, or loam. These areas are not so good as a source of sand and gravel. Also included are narrow strips where slopes are 2 to 6 percent and small areas where the surface layer is sandy loam.

Permeability is moderate in the subsoil and very rapid in the substratum. The root zone is deep and has a moderate or high available water capacity. Runoff is slow. Tilth is good. The shrink-swell potential is moderate in the subsoil and low in the substratum. Reaction ranges from strongly acid to slightly acid in the upper part of the subsoil and from medium acid to mildly alkaline in the lower part. It varies widely in the surface layer, depending on past liming practices. Organic-matter content is moderate.

This soil is used mainly for cash grain farming, for which it has good potential. It also has good potential for building site development, recreation uses, and woodland.

This soil is suited to all of the crops commonly grown in the county. It is well suited to row crops grown year after year and to specialty crops. It can be tilled and grazed early in spring and is well suited to irrigation. The main management concerns are maintaining high fertility and good soil structure. Managing crop residue and planting cover crops commonly conserve moisture and maintain organic-matter content and tilth. Minimum tillage is beneficial.

This soil is well suited to trees. Seedlings are easy to establish. Plant competition can be reduced by mowing, disking, and spraying.

Even though the shrink-swell potential and the low strength are moderate limitations, this soil is suited to building site development. These limitations can be partly overcome by extending foundations to the underlying sand and gravel and by backfilling with suitable material. Local roads can be improved by providing suitable base material. The possible contamination of ground water limits some sanitary facilities. This soil is well suited to recreation uses. It is a good source of sand and gravel. Capability class I; woodland suitability subclass 1o.

OcB—Ockley loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on stream terraces, outwash plains, and, in a few areas, on end moraines. Most areas are long and narrow, oblong, or irregularly shaped. They range from 2 to 20 acres in size.

Typically, the surface layer is dark brown, friable loam about 7 inches thick. The subsoil is about 46 inches thick. The upper part is firm, dark brown clay loam; the lower part is dark yellowish brown and brown, very firm and firm fine gravelly sandy clay loam and fine gravelly clay loam and a thin layer of fine gravelly sandy clay. The substratum to a depth of about 72 inches is gray, loose fine gravelly loamy sand.

Included with this soil in mapping are small areas of Eldean soils where sand and gravel are at a depth of 20 to 40 inches. In some included areas on outwash plains, the substratum has layers of silt loam, sandy loam, or loam. These areas are not so good as a source of sand and gravel. Also included are a few small areas where the surface layer is sandy loam, narrow strips where slopes are 6 to 12 percent, and small areas of eroded soils on the upper part of slopes. Tilth is fair in the eroded soils.

Permeability is moderate in the subsoil and very rapid in the substratum. The root zone is deep and has a moderate or high available water capacity. Runoff is medium. Tilth is good. The shrink-swell potential is moderate in the subsoil and low in the substratum. Reaction ranges from strongly acid to slightly acid in the upper part of the subsoil and from medium acid to mildly alkaline in the lower part. It varies widely in the surface layer, depending on past liming practices. Organic-matter content is moderate.

This soil is used mainly for cash grain farming, for which it has good potential. It also has good potential for building site development, recreation uses, and woodland.

This soil is suited to corn, soybeans, wheat, oats, hay, pasture, and specialty crops. Row crops can be grown year after year if erosion is controlled. The soil dries early in spring and is well suited to tillage and grazing early in spring. It is suited to irrigation and minimum tillage. The major management concern is control of erosion, especially on long slopes. Managing crop residue and planting cover crops commonly reduce the risk of erosion, conserve moisture, and maintain organic-matter content and tilth. Including close-growing crops, such as small grain, hay, or pasture plants, in the cropping sequence helps to control erosion in some areas.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Seedlings are easy to establish. Plant competition can be reduced by mowing, disking, and spraying.

Even though the shrink-swell potential and the low strength are moderate limitations, this soil is suited to building site development. These limitations can be partly overcome by extending foundations to the underlying sand and gravel and by backfilling with suitable material. Local roads can be improved by providing suitable base material. The possible contamination of ground water limits some sanitary facilities. This soil is well suited to most recreation uses. It is a good source of sand and gravel. Capability subclass IIe; woodland suitability subclass 1o.

On—Olentangy mucky silt loam. This deep, very poorly drained, level and nearly level soil is in depressions that are mainly in glacial lakes on the till plain. It is commonly flooded. Slopes range from 0 to 2 percent. Most areas are long and narrow or irregularly shaped and range from 15 to 55 acres in size.

Typically, the surface layer is black, friable mucky silt loam about 11 inches thick. Below the surface layer, to a depth of about 34 inches, are three subsurface layers. The upper layer is very dark grayish brown, friable mucky silt loam; the lower layers are brown and olive gray, friable sedimentary peat. The substratum to a depth of about 60 inches is dark greenish gray, friable sedimentary peat over dark gray, mottled, friable silty clay loam.

Included with this soil in mapping are small areas of Carlisle soils. Also included are narrow strips of soils where glacial till or lacustrine sediments are at a depth of 18 to 24 inches and other areas where these materials are below a depth of 60 inches.

Water is near the surface, and the soil is subject to ponding. Runoff is very slow. Permeability is moderate in the sedimentary peat and slow in the glacial till or lake-laid sediments in the substratum. The rooting depth is influenced by the water table. The root zone is mainly moderately deep to compact glacial till or lake-laid sediments and has a high available water capacity. Reaction ranges from extremely acid to mildly alkaline in the sedimentary peat and varies widely in the surface layer, depending on past liming practices. Organic-matter content is very high.

This soil is used mainly for farming, specialty crops, woodland, and habitat for wildlife. It has fair potential for farming. The potential for building site development, sanitary facilities, and recreation uses is poor. Undrained areas have good potential as habitat for wetland wildlife.

The very poor natural drainage and flooding are the major limitations if this soil is cropped. Drained areas are used mainly for corn, soybeans, green beans, and potatoes. Surface drains commonly remove ponded water. Subsurface drains are also used if outlets are available. Subsidence or shrinkage, which occurs as the result of oxidation of the organic material after draining, can cause displacement of subsurface drains. Controlled drainage in areas where the water level in the soil can be raised or lowered reduces the shrinkage. This soil is very easy to till. Deep tillage that brings up the sedimentary peat is not a good practice because the soil is hard, cloddy, and difficult to rewet when dry. In large areas windbreaks or ground cover help to control blowing of loose, dry soil. Applications of a large amount of lime are needed in some areas for crop production. Drained areas are suited to grasses grown for hay or pasture.

This soil is poorly suited to woodland unless it is drained. Undrained areas support water-tolerant trees and some cattails, reeds, and sedges. The wetness seriously limits the use of logging equipment. Logging can generally be done during extended dry periods.

Building site development, sanitary facilities, and recreation uses are seriously limited by flooding, wetness, and low strength. Undrained areas provide good habitat for ducks, muskrat, and other wetland wildlife. Capability subclass IIIw; woodland suitability subclass 5w.

Pm—Pewamo silty clay loam. This deep, level and nearly level, very poorly drained soil is on ground moraines and end moraines. It occurs as large, irregularly shaped areas connecting many drainageways on ground moraines. Long and narrow areas are in drainageways on end moraines. Slopes range from 0 to 2 percent. Most areas are 25 to 100 acres in size.

Typically, the surface layer is very dark gray, firm silty clay loam about 7 inches thick. The subsurface layer is very dark gray, firm silty clay loam about 6 inches thick. The subsoil is about 50 inches thick. The upper part is dark gray and gray, mottled, firm and very firm silty clay and clay; the lower part is gray, mottled, very firm clay loam.

Included with this soil in mapping are small areas, on slight rises, of Blount and Elliott soils, which are subject to surface crusting, and, in depressions, small areas of Montgomery soils and areas of soils that have marl in the subsoil. The soils in depressions are subject to ponding. Also included are some areas, adjacent to the higher lying soils, where silt loam alluvial sediments are in the surface layer and, in the southern part of the county, small areas where less clay and more sand and gravel are in the lower part of the subsoil.

The seasonal high water table is near the surface in winter and in spring and other extended wet periods. Permeability is moderately slow. The rooting depth is influenced by the water table. The root zone is deep and has a high available water capacity. The soil puddles and clods easily. Because of the position on the landscape, some areas receive runoff from adjacent soils. Runoff is very slow. The shrink-swell potential is moderate. The surface layer is slightly acid to neutral, and the subsoil is slightly acid to mildly alkaline. Organic-matter content is high.

This soil is used mainly for cash grain farming in the northern part of the county and for cash grain and livestock farming in the southern part. It has good potential for farming and woodland and poor potential for building site development, sanitary facilities, and recreation uses.

The very poor natural drainage is the main limitation for farming. Drained areas are well suited to corn, soybeans (fig. 6), wheat, oats, hay, pasture, and tomatoes. Stands of wheat and oats, in inadequately drained areas, are poor in some years. A combination of subsurface and surface drains is commonly used to improve drainage. If cropping is intensive, a large amount of crop residue should be returned to the soil (fig. 7). Tillage within a limited range of moisture content is important because this soil becomes compacted and cloddy if worked when wet and sticky. To prevent compaction, grazing should be limited to periods when the soil is not soft and sticky as a result of wetness.

This soil is well suited to woodland and to habitat for wildlife. Wetness limits the use of harvesting equipment. Tree species that can tolerate wetness should be selected for new plantings.

The prolonged wetness and the moderately slow permeability severely limit this soil as a site for buildings, sanitary facilities, and recreation uses. Local roads can be improved by artificial drainage and suitable base material. Capability subclass IIw; woodland suitability subclass 2w.

Pn—Pewamo silty clay loam, ponded. This deep, level and nearly level, very poorly drained soil is on ground moraines. It is ponded much of the year. The depth of ponded water fluctuates with the water level of Grand Lake St. Marys. Slopes range from 0 to 2 percent. Most areas are irregularly shaped and are 5 to 100 acres in size.

Typically, the surface layer is very dark gray, firm silty clay loam about 10 inches thick. The subsurface layer is very dark gray, firm silty clay loam about 3 inches thick. The subsoil is about 50 inches thick. The upper part is dark gray, mottled, very firm silty clay and clay; the lower part is gray, mottled, very firm clay and clay loam.

Included with this soil in mapping are areas of Montgomery soils in the center of depressions. Also included, on slight rises, are small areas of Blount soils, which are subject to surface crusting.

The seasonal high water table is near the surface in fall, winter, and spring. Permeability is moderately slow. The rooting depth is influenced by the water table. The root zone is deep and has a high available water capacity. The soil puddles and clods easily. The shrink-swell potential is moderate. Reaction is slightly acid to neutral in the surface layer and slightly acid to mildly alkaline in the subsoil. Organic-matter content is high.

Most of the acreage is used as woodland and as habitat for wildlife. Some areas near Grand Lake St. Marys are filled and used as sites for mobile homes and cottages. This soil has poor potential for most uses but has better potential for wetland wildlife habitat.

The ponded water and the seasonal high water table severely limit the use of this soil for farming, building site development, sanitary facilities, and recreation areas. Logging equipment is severely limited. Reforestation of areas with desirable species is difficult because seedling mortality is high and plant competition is severe. Species that can tolerate wetness should be selected for new plantings. Capability subclass Vw; woodland suitability subclass 5w.

Po—Pewamo silty clay. This deep, level and nearly level, very poorly drained soil is in depressions and along drainageways on ground moraines. It commonly occurs as the transition between soils formed in glacial till and very poorly drained soils formed in lakebed sediments. Most areas are irregularly shaped and range from 5 to 90 acres in size.

Typically, the surface layer is very dark gray, firm silty clay about 9 inches thick. The subsurface layer is very dark gray, firm silty clay about 5 inches thick. The subsoil is about 49 inches thick. The upper part is dark gray, mottled, very firm silty clay and clay; the lower part is gray, mottled, very firm clay and clay loam. In a few areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Montgomery soils in the center of depressions and some areas that are ponded during extended wet periods. Also included are small areas of the somewhat poorly drained Elliott and Blount soils on slight rises. The Blount soils are subject to surface crusting.

The seasonal high water table is near the surface in winter and in spring and other extended wet periods. Permeability is moderately slow. The rooting depth is influenced by the water table. In drained areas the root zone is deep and has a high available water capacity. The soil puddles and clods easily. Some areas receive runoff from adjacent soils. Runoff is very slow. The shrink-swell potential is moderate. Reaction is slightly acid to neutral in the surface layer and slightly acid to mildly alkaline in the subsoil. Organic-matter content is high.

This soil is used mainly for cash grain farming. It has good potential for farming and woodland and poor potential for building site development, sanitary facilities, and recreation uses.

The very poor natural drainage and the clayey surface layer are the main limitations for farming. Unless artificially drained, this soil is poorly suited to farming. Drained areas are suited to corn, soybeans, hay, and pasture. Wheat and oats are not well suited because stands are drowned out in some areas. A combination of subsurface and shallow surface drains is commonly used to improve drainage. The soil becomes dense and compact if cropped year after year unless a large amount of crop residue is returned. Timely tillage is important because the soil puddles and clods if worked when wet and sticky. To prevent compaction, grazing should be limited to periods when the soil is not soft and sticky as a result of wetness.

This soil is suited to woodland and to habitat for wildlife. Wetness limits the use of equipment. Species that can tolerate wetness should be selected for new plantings. Reforestation of areas with desirable species is difficult because seedling mortality is high and plant competition is severe.

This soil is generally not used for building site development, sanitary facilities, and recreational areas. The prolonged wetness, the clayey surface layer, and the moderately slow permeability are severe limitations. Local roads can be improved by artificial drainage and suitable base material. Capability subclass IIw; woodland suitability subclass 2w.

Ps—Pits, gravel. Gravel pits consist of surface-mined areas from which sand and gravel have been removed for use in construction. They are dominantly on stream terraces, but a few areas are on end moraines. Most pits range from 2 to 25 acres in size. Actively mined pits are continually being enlarged. Most pits have high walls on one or more sides. Some contain small ponds.

The material that is mined consists of stratified layers of gravel and sand of varying thickness and orientation. The kind and grain size of aggregates are generally uniform within any one layer but commonly differ from layer to layer. Selectivity in mining is commonly feasible.

The material remaining after mining is poorly suited to plant growth. Organic-matter content and available water capacity are very low.

Many of the gravel pits that are no longer used support weeds and trees. These could be developed as habitat for wildlife. A few of the other pits are used for disposal of trash, and some small pits have been smoothed and farmed. If these areas are used as sites for sanitary facilities, pollution of the underground water supplies is a hazard. Not assigned to a capability subclass or woodland suitability subclass.

Qu—Quarries. Quarries are areas from which limestone has been removed for construction or for agricultural purposes. Generally, the soil mantle is thin over the underlying bedrock. Quarries characteristically have high walls on all sides. They range from 2 to 100 acres in size.

The soil mantle has been stockpiled in spoil banks in some quarries. This material varies within short horizontal distances. Organic-matter content is very low, and available water capacity varies. Areas that are no longer mined should be reclaimed and seeded to reduce the risk of erosion. Grasses and trees that can tolerate a very low available water capacity and the unfavorable soil properties should be selected for seeding and planting. Not assigned to a capability subclass or woodland suitability subclass.

RmB—Rawson loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on low knolls on stream terraces and, in some areas, on end moraines and ground moraines. Most areas are long and narrow or oval and range from 2 to 12 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is brown, dark yellowish brown, and yellowish brown, mottled, firm clay loam and sandy clay loam; the lower part is dark yellowish brown, mottled, very firm clay. The substratum to a depth of about 60 inches is dark brown and brown, mottled, very firm clay loam.

Included with this soil in mapping are narrow strips of Haskins soils on foot slopes and in nearly level areas and small areas of Glynwood soils. Also included are narrow strips, on the upper part of long slopes, of moderately eroded soils where subsoil material is mixed with the surface layer and tilth is fair.

The seasonal high water table is perched between depths of 2 and 4 feet in winter and in spring and other extended wet periods. Permeability is moderate in the upper part of the subsoil and slow or very slow in the lower part and in the substratum. The root zone mainly is moderately deep to compact glacial till or lakebed sediments and has a moderate available water capacity. Runoff is medium. The shrink-swell potential is low in the upper part of the subsoil and high in the lower part and in the substratum. Reaction ranges from medium acid to neutral in the upper part of the subsoil and is neutral or mildly alkaline in the lower part. It varies widely in the surface layer, depending on past liming practices. Organic-matter content is moderate.

This soil is used mainly for cash grain farming. It has good potential for many building site developments and sanitary facilities and fair or good potential for recreation uses.

This soil is suited to corn, soybeans, wheat, oats, hay, pasture, and specialty crops. It is especially well suited to crops that mature early in the season. Erosion is the main hazard. Return of crop residue to the soil, minimum tillage, contour tillage, and meadow crops in the cropping sequence commonly help to control erosion, improve tilth, and increase the rate of water infiltration. Randomly spaced subsurface drains are used in the included wetter soils and in seep spots.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Plant competition can be reduced by spraying, mowing, and disking.

The seasonal wetness, the shrink-swell potential, and the slow or very slow permeability in the lower part of the soil severely limit this soil as a site for many buildings and sanitary facilities. Houses without basements are better suited than houses with basements.

Local roads can be improved by providing suitable base material. This soil is well suited to such recreation areas as picnic areas, golf courses, and hiking trails. Capability subclass IIe; woodland suitability subclass 2o.

Sh—Shoals silt loam. This deep, level and nearly level, somewhat poorly drained soil is on flood plains. It occupies the entire flood plain along some small streams. Along the larger streams, it is in low lying areas near slope breaks to the uplands. It is commonly flooded for brief periods in fall, winter, and spring. Slopes range from 0 to 2 percent. Areas are broad, long and narrow, or irregularly shaped. They range from 3 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 39 inches thick. The upper part is dark gray and dark yellowish brown, mottled, friable silt loam; the lower part is grayish brown, mottled, friable silt loam. The substratum to a depth of about 65 inches is light gray, stratified silt loam and loam. In some small areas the surface layer is loam or silty clay loam.

Included with this soil in mapping are small areas of Sloan soils in depressions and old stream channels and narrow strips of Eel soils adjacent to small streams. Also included are some areas where, as a result of organic material in the lower part of the subsoil, strength is low and narrow strips where slopes are 2 to 5 percent.

The seasonal high water table is between depths of 12 and 36 inches in winter and in spring and other extended wet periods. Permeability is moderate. The rooting depth is influenced by the water table. The root zone is deep and has a high available water capacity. Crusting of the surface layer after heavy rains reduces the infiltration rate. Runoff is very slow. The shrink-swell potential is low. The surface layer and subsoil are slightly acid to mildly alkaline. Organic-matter content is moderate.

Most of the acreage is used for cash grain farming. Some areas on narrow flood plains are used for hay or permanent pasture. This soil has good potential for farming and woodland and poor potential for building site development and sanitary facilities.

Flooding and seasonal wetness are limitations to farming. They delay planting in most years and limit the choice of crops. This soil is suited to corn and soybeans that can be planted after the major threat of flooding. Such crops as winter wheat can be severely damaged by floodwater. Subsurface drainage is needed, but suitable outlets are not available in some areas. The soil is suited to pasture, but maintaining soil tilth and desirable forage stands is difficult unless the soil is drained and grazing is controlled. Planting cover crops and managing crop residue maintain tilth, reduce crusting, and protect the surface in areas that are subject to scouring.

This soil is suited to trees and other vegetation grown as habitat for wildlife. Species that can tolerate some wetness should be selected for reforestation. Spraying, disking, and mowing reduce plant competition.

The flood hazard and the seasonal wetness seriously limit this soil as a site for buildings and sanitary facilities. Diking to control flooding is generally difficult. The soil has potential for such recreation uses as hiking during the drier part of the year. Capability subclass IIw; woodland suitability subclass 2o.

So—Sloan silty clay loam. This deep, level and nearly level, very poorly drained soil is on flood plains. It commonly occupies the entire flood plain along small streams. Along the larger streams, it is in depressional areas near slope breaks to the uplands. It is frequently flooded for brief periods in winter and spring. Slopes range from 0 to 2 percent. Most areas are broad, long and narrow, or irregularly shaped and range from 8 to several hundred acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 9 inches thick. The subsurface layer is very dark gray, mottled, friable silty clay loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is dark gray and gray, mottled, firm silty clay loam; the lower part is gray, mottled, friable clay loam. The substratum to a depth of about 60 inches is gray, mottled, friable, stratified loam, silt loam, silty clay loam, and sandy loam. In some small areas the surface layer is silt loam, and in other areas the surface layer and subsurface layer are thinner.

Included with this soil in mapping are narrow strips of Shoals soils on very slight rises. Also included are small areas of Wabasha soils, which dry more slowly in spring than this Sloan soil.

The seasonal high water table is near the surface in winter and in spring and other extended wet periods. Permeability is moderate or moderately slow. The rooting depth is influenced by the water table. The root zone is deep and has a high available water capacity. Tilth is fair. Runoff is very slow, and the soil is subject to ponding. The shrink-swell potential is moderate in the subsoil and low in the substratum. Reaction is slightly acid to mildly alkaline in the surface layer and the upper part of the subsoil and neutral to moderately alkaline in the lower part of the subsoil. Organic-matter content is high.

Most of the acreage is used for row crops, pasture, and woodland. The potential for farming and woodland is good. The potential for building site development, sanitary facilities, and recreation uses is poor.

Flooding and seasonal wetness limit the use of this soil for farming. Winter crops and early spring crops are usually not grown because of the flood hazard. Drained areas are suited to row crops and pasture. Surface drains commonly remove ponded water. Subsurface drains are also used in areas where suitable outlets are available. Outlets are not available in some areas because of the water level in adjacent streams. The soil can be tilled only within a narrow range of moisture content. It becomes compacted and cloddy if worked when wet and sticky. To prevent compaction, grazing should be limited to periods when the soil is not soft and sticky as a result of wetness. Planting cover crops and managing crop residue maintain tilth and protect the surface in areas that are subject to scouring.

This soil is suited to trees and other vegetation grown as habitat for wildlife. Harvesting equipment is limited during wet periods. Species that can tolerate wetness should be selected for reforestation. Spraying, mowing, and disking reduce plant competition.

The flood hazard, the prolonged wetness, and the moderate or moderately slow permeability severely limit this soil as a site for buildings, sanitary facilities, and recreation uses. Capability subclass IIIw; woodland suitability subclass 2w.

Ud—Udorthents, loamy. These soils are mainly in areas of cut and fill, where the cuts have been deep enough to remove all or nearly all of the surface layer and subsoil and the fill material is more than 20 inches deep over the original soil. Some areas have been filled or covered artificially with miscellaneous material, such as household or factory waste products. Some areas have been covered with earthy material. A few are borrow pits where the remaining material is typically similar to the material in the subsoil or substratum of adjacent soils. Slopes range from 0 to 25 percent.

Available water capacity is mainly very low, but it varies. Tilth is poor. Hard rains tend to seal the soil surface and thus reduce the infiltration rate and restrict the emergence and growth of seedlings. A seasonal high water table is evident in some areas, particularly in depressed or bowl-shaped areas where water accumulates.

The erosion hazard is very severe if the surface is bare of vegetation. In many areas smoothing and seeding are needed to reduce the risk of erosion.

The suitability of these soils for building site development and sanitary facilities varies. Not assigned to a capability subclass or woodland suitability subclass.

Wh—Wabasha silty clay. This deep, level and nearly level, very poorly drained soil is in low lying areas on flood plains and is frequently flooded. Slopes range from 0 to 2 percent. Areas are mostly long and narrow, but some are irregularly shaped. They range from 20 to several hundred acres in size.

Typically, the surface layer is very dark gray, friable silty clay about 8 inches thick. The subsoil, to a depth of about 54 inches, is gray and dark gray, mottled, firm silty clay. The substratum to a depth of about 62 inches is gray, mottled, very firm silty clay. In some areas the surface layer is silty clay loam.

Included with this soil in mapping are narrow strips of Defiance soils in slightly higher areas on the flood plains and some small areas of Sloan soils in which internal water movement is better than that in this Wabasha soil. Also included, north of the Wabash River in southern Liberty Township, are areas where sand and fine gravel are at a depth of 48 inches.

The seasonal high water table is near the surface in winter and in spring and other extended wet periods. Permeability is slow. The rooting depth is influenced by the water table. The root zone is deep and has a high available water capacity. Tilth is poor. Runoff is very slow, and water ponds in most areas after floodwater has receded. The shrink-swell potential is high. The surface layer and subsoil range from slightly acid to mildly alkaline. Organic-matter content is moderate or high.

Most of the acreage is used for cash grain farming. Some areas are used for permanent pasture or woodland. This soil has good potential for farming and fair potential for woodland. The potential for building site development, sanitary facilities, and recreation uses is poor.

This soil is suited to row crops, such as corn and soybeans, that can be planted after the period of most spring floods. It is not well suited to specialty crops or other crops that can be severely damaged by floodwater. Shallow surface drains remove ponded water. Subsurface drains can lower the water table if outlets are available. Suitable outlets are not available in many places. Timely tillage is important because the soil puddles and clods if worked when wet and sticky. Cover crops help maintain organic-matter content, improve tilth, and protect the surface during floods. Water-tolerant grasses and legumes are more suitable for pasture and hay than other plants. Controlled grazing reduces compaction and helps to prevent damage to pasture plants.

This soil is suited to woodland. Species selected for planting should be tolerant of wetness. Logging equipment is severely limited by wetness.

The flooding, the seasonal wetness, and the slow permeability seriously limit this soil as a site for buildings, sanitary facilities, and recreation uses. The potential for development of habitat for wetland wildlife is good. Capability subclass IIIw; woodland suitability subclass 3w.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture and woodland; as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

EARL V. SCOTT, district conservationist, and VAUGHN L. SIEGENTHALER, soil scientist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; 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 presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 243,000 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory (*7*). Of this total, about 14,000 acres was used for permanent pasture; about 135,000 acres for row crops, mainly corn and soybeans; about 48,000 acres for close-grown crops, mainly wheat and oats; and about 23,000 acres for rotation hay and pasture. Some of the acreage was used for such vegetables as tomatoes, potatoes, and green beans.

The potential of the soils in Mercer County for increased production of crops is good. About 23,000 acres of potentially good cropland is currently used as woodland and about 13,000 acres as pasture. In addition to the reserve capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

The acreage in crops and pasture in this county has not been affected by the use of land for urban development. In 1967, an estimated 15,000 acres of urban and built-up land was in the county. The acreage of such land has been growing at the rate of about 400 acres per year (*4*). The use of this soil survey to help make land-use decisions that will influence the future role of farming in the county is described in the section "General soil map for broad land-use planning."

Soil erosion is the major problem on slightly less than half of the cropland and pasture in Mercer County. If the slope is more than 2 percent, erosion is a hazard. Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a clayey subsoil, such as Blount and McGary soils. Erosion also reduces productivity on soils that tend to be droughty, such as Eldean soils. Second, soil erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Soil erosion and wetness are limitations on some soils in the county, especially on the Blount, Digby, Haskins, and McGary soils that have slopes of 2 to 6 percent.

In eroded spots in many gently sloping and sloping fields, preparing a good seedbed and tilling are difficult because the original friable surface soil has been eroded away. Such spots are common where the moderately eroded Glynwood and Morley soils and the severely eroded Morley soils occur.

Erosion control provides protective surface cover, reduces runoff, and increases the infiltration rate. A cropping system that keeps plant cover on the soil for extended periods can hold soil erosion losses to an amount that will not reduce the productive capacity of the soils. On livestock farms, on which pasture plants and hay are grown, legume and grass forage crops in the cropping system reduce the risk of erosion, provide nitrogen, and improve tilth.

Slopes are so short and irregular that contour tillage or terracing is not practical in most areas of Glynwood and Morley soils. On these soils a cropping system that provides substantial plant cover is needed to control erosion unless tillage is minimized. Minimizing tillage and leaving crop residue on the surface increase the rate of water infiltration and reduce the hazards of runoff and erosion. These practices are suited to many of the soils in the survey area but are less successful on eroded soils, especially on severely eroded soils. No-tillage for corn, which is common on an increasing acreage, is effective in reducing the risk of erosion on sloping soils and can be adapted to many of the soils in the survey area. It is less successful, however, on severely eroded soils.

Although terraces and diversions shorten the length of slopes, slow runoff, and reduce the risk of erosion, the soils in Mercer County are less well suited to terraces and diversions because slopes are irregular, the terrace channel is excessively wet, and the clayey subsoil would be exposed in terrace channels.

Grassed waterways are natural or constructed outlets or waterways protected by a grass cover (fig. 8). Natural drainageways are the best locations for waterways and often require a minimum of shaping to produce a good channel. They should be wide and flat so that farm machinery can cross them easily.

Contouring and contour stripcropping are helpful in controlling erosion. Because they are best suited to soils with smooth, uniform slopes, however, their use is limited in Mercer County, where slopes are generally irregular. In some areas contouring and even contour stripcropping are practical on the sloping Eldean, Glynwood, and Morley soils.

Soil blowing is a hazard on Carlisle, Edwards, and Olentangy soils. It can damage these mucks in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover or surface mulch or keeping the surface rough through proper tillage minimizes soil blowing on these soils. Also, windbreaks of suited shrubs, such as Tatarian honeysuckle or autumn-olive, are effective in reducing the risk of soil blowing.

Information about the design of erosion-control practices for each kind of soil is contained in the Technical Guide, available in the local office of the Soil Conservation Service.

Soil drainage is the major management need on slightly more than half of the acreage used for crops and pasture in the survey area. Some soils are naturally so wet that the production of crops common to the area is generally not possible without artificial drainage. These are the very poorly drained Millgrove, Millsdale, Montgomery, Pewamo, Sloan, Wabasha, Carlisle, Edwards, and Olentangy soils, which make up about 100,000 acres in the survey area.

Unless artificially drained, the somewhat poorly drained Blount, Defiance, Digby, Elliott, Haskins, McGary, and Shoals soils are so wet that crops are damaged during most years. These soils make up about 143,000 acres.

Morley soils have good natural drainage most of the year, but they tend to dry out slowly after rains. Small areas of wetter soils along drainageways and in swales are commonly included with the moderately well drained Glynwood and Rawson soils in mapping. Artificial drainage is needed in some of these wetter areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and subsurface drainage is needed in most areas of the very poorly drained soils used intensively for row crops. Drains should be more closely spaced in slowly or very slowly permeable soils than in the more permeable soils. Subsurface drainage is slow in Montgomery soils. Finding adequate outlets for tile drainage systems is difficult in many areas of Montgomery, Sloan, Wabasha, Defiance, and Shoals soils. Subsurface drainage systems are difficult to establish in Millsdale soils because bedrock is 20 to 40 inches from the surface.

Organic 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. 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 minimize the oxidation and subsidence of organic soils. Information about the design of drainage systems for each kind of soil is contained in the Technical Guide, available in the local office of the Soil Conservation Service.

Soil fertility is naturally low in many soils on the uplands in the survey area. All soils that have a light colored surface layer are naturally acid. The soils on flood plains, such as the Defiance, Eel, Genesee, Shoals, Sloan, and Wabasha soils, range from slightly acid to mildly alkaline and are naturally higher in plant nutrients than most upland soils. Montgomery, Millgrove, and Pewamo soils, in depressions and drainageways, are medium acid to neutral.

Unless limed, organic soils tend to be acid. Carlisle and Olentangy soils range from strongly acid to extremely acid and Edwards soils from medium acid to mildly alkaline. Special fertilizers may be needed because of deficiencies of boron and other trace elements.

Many upland soils are naturally strongly acid or very strongly acid, and if they have never been limed, they require applications of ground limestone to raise the pH level sufficiently for good growth of alfalfa and other crops. Available phosphorus and potash levels are naturally low in many of these soils. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the need of the crops, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are friable and porous.

Many of the soils used for crops in the survey area have a silt loam surface layer that is light in color and moderate or moderately low in organic-matter content. Generally, intense rainfall and drying crusts the surface of these soils. The crust is hard when dry and nearly impervious to water. Once the crust forms, it reduces the infiltration rate and increases runoff. Regular addition of crop residue, manure, and other organic material maintains and improves soil structure and reduces crusting.

Fall plowing is generally not a good practice on the soils with a light colored silt loam surface layer because of crusting during winter and spring. Many of these soils are nearly as dense and hard at planting time after fall plowing as they were before plowing. In addition, soils with slopes of 2 percent or more are subject to damaging erosion if they are plowed in the fall.

The Millgrove, Millsdale, Montgomery, Pewamo, Sloan, and Wabasha soils that have a dark colored surface layer contain more clay than most of the soils that have a light colored surface layer. Poor tilth is often a problem because the soils often stay wet until late in spring. If they are plowed when wet, the soils tend to be very cloddy when dry and preparing a good seedbed is difficult. Fall plowing of these soils generally results in improved tilth in spring.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Corn and soybeans are the main row crops. Grain sorghum, sunflowers, navy beans, and similar crops can be grown if economic conditions are favorable.

Wheat and oats are the most common close-growing crops (fig. 9). Rye, barley, buckwheat, and flax could be grown, and grass seed could be produced from bromegrass, fescue, timothy, and bluegrass. Also, legume seed from red clover and alsike clover could be produced.

Special crops grown commercially in the survey area are limited to tomatoes, sweet corn, potatoes, and melons (fig. 4). The acreage used for such crops and other vegetables and small fruits can be increased if economic conditions are favorable.

The soils in the county that have good natural drainage and warm early in spring are especially well suited to many vegetables and small fruits. These are the Eldean, Gallman, and Ockley soils that have slopes of less than 6 percent. There are about 1,600 acres of these soils. Crops can generally be planted and harvested earlier on these soils than on the other soils in the survey area.

When adequately drained, the mucky soils in the county are well suited to a wide range of vegetable crops. These are Carlisle, Edwards, and Olentangy soils, which make up about 300 acres in the survey area.

The latest information about growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Permanent pasture makes up about 5 percent of the acreage on farms. This low percentage is partly the result of the high percentage of forage provided by meadow crops. Some permanent pastures are on eroded soils that formerly were cultivated and in narrow strips and irregularly shaped areas of frequently flooded soils. Open woodlots are also pastured, but they generally provide poor quality grazing because forage plants are sparse. Permanent pastures near farmsteads are often used for feedlots or access lanes.

Yields of permanent pasture vary widely, but most soils in the county could be used to produce high quality permanent pasture. Sloping to steep soils, such as Glynwood and Morley soils, are commonly eroded and low in fertility, and less water is available to plants because runoff is rapid. Forage production on these soils is less. Growth is good on the gently sloping Blount, Digby, Haskins, McGary, Rawson, and Glynwood soils, but these soils are subject to erosion if the plant cover is damaged by overgrazing. Severe soil compaction occurs if grazing livestock are allowed to trample the soils during wet periods.

The Defiance, Eel, Genesee, Shoals, Sloan, and Wabasha soils on flood plains are potentially well suited to permanent pasture. Flooding during the growing season would damage cash crops but is much less damaging to permanent pastures. These alluvial soils are fertile, have a moderate or high available water capacity, and are capable of producing good grass or grass-legume pasture. Surface drains and tile drains are needed to remove excess water in areas of the somewhat poorly drained and very poorly drained soils, particularly where legumes are grown. Such drainage generally is not needed on the better drained Eel and Genesee soils.

Permanent pasture and cropland require similar management. Lime and fertilizer should be applied at rates indicated by soil tests. Control of weeds by periodic clipping and use of recommended herbicides encourages the growth of desirable pasture plants. Proper stocking rates and controlled grazing help to maintain well established permanent pastures. The latest information about seeding mixtures, herbicide treatment, and other management for specific soils can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties;

appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils 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 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (*11*). The capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

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 landforms 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 too cold or too 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, though 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 indicated in table 6. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Woodland management and productivity

Nearly all of Mercer County was forest at the time of settlement. Beech, red maple, white ash, and elm grew on the wetter soils. Northern red oak, white oak, black oak, hickory, sugar maple, and other native trees grew on the better drained soils. As the result of clearing, the acreage of woodland has been reduced to about 23,000 acres, or 8 percent of the county. Most of the remaining areas are in small farm woodlots. The steepest or wettest parts of farms have typically remained wooded. Most of the woodland has been cut over, and much of it has been grazed. As a result, a large number of hollow beech and other diseased or damaged trees of low value are in many farm woodlots.

Table 7 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland 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 insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 7 the soils are also rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

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

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by strong winds; *moderate*, that some trees are 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. Common 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 suitable for commercial wood production and that are suited to the soils.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities. Table 11, shows the kind of limitations for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

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 are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Lawns and landscaping require soils that are suitable for the establishment and maintenance of turf for lawns and ornamental trees and shrubs for landscaping. The best soils are firm after rains, are not dusty when dry, and absorb water readily and hold sufficient moisture for plant growth. The surface layer should be free of stones. If shaping is required, the soils should be thick enough over bedrock or hardpan to allow for necessary grading. In rating the soils, the availability of water for sprinkling is assumed.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile, perforated plastic tubing, or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the drain lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer (fig. 10). Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 11 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for 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 for this use 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have 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 should have a surface that is free of stones and boulders and have moderate slopes. Suitability of the soil for traps, tees, or greens was not considered in rating the soils. Irrigation is an assumed management practice.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

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

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties 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 that are planted for wildlife food and cover. Major soil properties 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, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties 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 the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, wild cherry, hawthorn, dogwood, hickory, blackberry, and black walnut. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, willows, and reed canarygrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and shallow ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties.

They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated AASHTO classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing 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, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing 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, but crops can be grown if measures to control soil blowing 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, and 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, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils 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.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Physical and chemical analyses of selected soils

Many of the soils in Mercer County were sampled and laboratory data determined by the Department of Agronomy, Ohio Agricultural Research and Development Center (OARDC), 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 classifying and correlating the selected soils and in evaluating the behavior of the soils under various land uses. Five of the profiles were selected as representative of their respective series and are described in this survey. The series names and the laboratory identification numbers are Blount (MC-20), Defiance (MC-16), Elliott (MC-13), McGary (MC-22), and Montgomery (MCi21).

In addition to Mercer County data, laboratory data are also available from nearby counties in western Ohio that have many of the same soils. All data are on file at the Department of Agronomy, OARDC, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Lands and Soil, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio. Some of these data have been published in special studies of soils in nearby counties (*9*, *13*).

Engineering test data

Several of the soils in Mercer County have been analyzed for engineering properties by the Soil Physical Studies Laboratory, Department of Agronomy, Ohio State University. Some of the determinations of moisture density were made by the Ohio Department of Transportation Soil Testing Laboratory. Six profiles are considered representative of series in the county. The series names and the laboratory identification numbers are Blount (MC-12), Haskins (MC-19), McGary (MC-22), Montgomery (MC-21), Glynwood (MC-11), and Pewamo (MC-14). The profiles of these series are described in the section "Soil series and morphology."

In addition to the Mercer County data, engineering test data are also available from nearby counties in western Ohio that have many of the same soils. All data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Lands and Soil, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*10*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Blount series

The Blount series consists of deep, somewhat poorly drained, slowly permeable or moderately slowly permeable soils formed in glacial till. These soils are on ground moraines and end moraines. Slope ranges from 0 to 6 percent.

Blount soils are commonly adjacent to Elliott, Glynwood, Morley, and Pewamo soils and are similar to McGary soils. Elliott and Pewamo soils have a mollic epipedon. Glynwood and Morley soils are better drained than Blount soils. McGary soils formed in lacustrine deposits of clay and silt.

Typical pedon of Blount silt loam, 2 to 6 percent slopes, in Washington Township, SE1/4NE1/4 sec. 3, T. 6 S., R. 1 E., 760 feet north and 130 feet west of the intersection of Burrville Road and State Route 29:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; common roots; 3 percent coarse fragments; slightly acid; abrupt smooth boundary.

B21t—7 to 12 inches; grayish brown (10YR 5/2) silty clay; many medium faint yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common roots; thin patchy dark grayish brown (10YR 4/2) clay films on vertical and horizontal faces of peds; medium and thick patchy grayish brown (10YR 5/2) silt coatings on vertical faces of peds; 3 percent coarse fragments; strongly acid; clear wavy boundary.

B22t—12 to 23 inches; dark yellowish brown (10YR 4/4) clay; many medium faint dark grayish brown (10YR 4/2) mottles; weak fine and medium prismatic structure parting to moderate medium subangular blocky; firm; few roots; grayish brown (10YR 5/2) clay films that are continuous on vertical faces of peds and thin and patchy on horizontal faces; grayish brown (10YR 5/2) coatings on vertical surfaces of prisms; 4 percent coarse fragments; slightly acid; clear wavy boundary.

B3t—23 to 30 inches; grayish brown (10YR 5/2) heavy silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; thin patchy dark grayish brown (10YR 4/2) clay films on vertical faces of peds; 8 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

C1—30 to 42 inches; brown (10YR 4/3) clay loam; common medium faint dark grayish brown (10YR 4/2) mottles; weak medium platy structure; very firm; 10 percent coarse fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—42 to 60 inches; brown (10YR 5/3) clay loam; common medium distinct dark gray (10YR 4/1) mottles; massive; very firm; 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 45 inches. The content of coarse fragments ranges, by volume, from 1 to 10 percent in the upper part of the solum and from 2 to 18 percent in the lower part and in the C horizon.

The Ap horizon is strongly acid to slightly acid in unlimed areas. The B horizon has hue of 10YR, value of 4 to 6, and chroma of dominantly 2 to 4. Subhorizons have chroma of 1 in some pedons. The B horizon is heavy silty clay loam, clay, clay loam, or silty clay. Reaction ranges from very strongly acid to neutral in the upper part and from medium acid to moderately alkaline in the lower part. The C horizon is clay loam or silty clay loam and is mildly alkaline or moderately alkaline.

Carlisle series

The Carlisle series consists of deep, very poorly drained soils in depressions. These soils formed in more than 51 inches of accumulated organic material. Permeability is moderately rapid. Slope ranges from 0 to 2 percent.

Carlisle soils are similar to Edwards and Olentangy soils and are commonly adjacent to Montgomery and Pewamo soils. Edwards soils are underlain with marl at a depth of 16 to 35 inches. Olentangy soils formed in coprogenous earth over lacustrine material or glacial till. Montgomery and Pewamo soils have a mollic epipedon. In addition, Montgomery soils formed in lacustrine sediments and Pewamo soils in glacial till.

Typical pedon of Carlisle muck, in Blackcreek Township, SE1/4SE1/4 sec. 18, T. 4 S., R. 1 E., 577 feet west and 200 feet north of the intersection of Duck Creek Road and State Route 49:

Oap—0 to 8 inches; black (N 2/0) broken face and rubbed sapric material; about 2 percent fiber, 1 percent rubbed; moderate fine granular structure; very friable; many fine roots; 50 percent mineral material; very strongly acid; clear wavy boundary.

Oa2—8 to 22 inches; black (5YR 2/1) broken face and rubbed sapric material; about 2 percent fiber, 1 percent rubbed; weak fine subangular blocky structure; very friable; few fine roots; 50 percent mineral material; strongly acid; clear wavy boundary.

Oa3—22 to 36 inches; black (10YR 2/1) broken face, black (5YR 2/1) rubbed sapric material; about 20 percent fiber, 2 percent rubbed; weak fine subangular blocky structure; very friable; few fine roots; medium acid; abrupt smooth boundary.

Oa4—36 to 48 inches; dark reddish brown (5YR 3/3) broken face, dark reddish brown (5YR 3/2) rubbed sapric material; about 30 percent fiber, 9 percent rubbed; massive; very friable; moderately alkaline; clear wavy boundary.

Oa5—48 to 59 inches; dark reddish brown (5YR 2/2) broken face, dark reddish brown (5YR 3/2) rubbed sapric material; about 25 percent fiber, 5 percent rubbed; massive; very friable; moderately alkaline; abrupt smooth boundary.

Oa6—59 to 63 inches; dark reddish brown (5YR 3/4) broken face, dark brown (7.5YR 3/2) rubbed sapric material; about 10 percent fiber, less than 2 percent rubbed; massive; very friable; slight effervescence; moderately alkaline; abrupt wavy boundary.

The organic deposit is more than 51 inches thick. In unlimed areas reaction is very strongly acid or strongly acid in the surface tier, strongly acid to neutral in the subsurface tier, and neutral or mildly alkaline in the bottom tier.

The surface tier has hue of 10YR to 5YR or N, value of 2 or 3, and chroma of 0 to 3. It is 10 to 60 percent mineral material. The subsurface and bottom tiers have hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 to 4. Before rubbing, the fiber content ranges from 0 to 30 percent within a depth of 51 inches. After rubbing, it ranges from 0 to 10 percent.

Defiance series

The Defiance series consists of deep, somewhat poorly drained, slowly permeable or very slowly permeable soils on flood plains. These soils formed in fine textured and moderately fine textured recent alluvium. Slope ranges from 0 to 2 percent.

Defiance soils are similar to Shoals and Wabasha soils and are commonly adjacent to Wabasha soils. Shoals soils are of mixed mineralogy and contain less clay throughout than Defiance soils. Wabasha soils are very poorly drained.

Typical pedon of Defiance silty clay, in Union Township, NE1/4NW1/4 sec. 25, T. 4 S., R. 3 E., 200 feet west and 3,780 feet north of the intersection of Mercer Road and Gallman Road:

Ap—0 to 10 inches; dark gray (10YR 4/1) silty clay; weak medium subangular blocky structure; firm; many fine roots; neutral; abrupt smooth boundary.

A12—10 to 20 inches; dark gray (10YR 4/1) silty clay; few fine faint dark grayish brown (10YR 4/2) mottles; moderate fine and medium subangular and angular blocky structure; firm; many fine roots; thin continuous very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) vertical and horizontal coatings on faces of peds; neutral; clear wavy boundary.

B21g—20 to 27 inches; gray (10YR 5/1) silty clay; many fine distinct dark brown (10YR 4/3) mottles; weak medium subangular blocky structure; firm; common fine roots; medium continuous grayish brown (10YR 5/2) vertical and horizontal coatings on faces of peds; few fine dark brown (7.5YR 3/2) iron and manganese concretions; neutral; clear wavy boundary.

B22—27 to 44 inches; yellowish brown (10YR 5/4) silty clay; common fine faint yellowish brown (10YR 5/6) and common fine distinct gray (10YR 5/1) mottles; weak coarse and very coarse subangular blocky structure; firm; few fine roots; few fine dark brown (7.5YR 3/2) iron and manganese stains; thin continuous dark gray (10YR 4/1) and grayish brown (10YR 5/2) vertical and horizontal coatings on faces of peds; neutral; diffuse wavy boundary.

B3g—44 to 47 inches; dark gray (10YR 4/1) silty clay; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine angular blocky structure; firm; medium patchy dark gray (10YR 4/1) coatings on faces of peds; neutral; diffuse wavy boundary.

C—47 to 60 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct grayish brown (10YR 5/2) and common fine faint yellowish brown (10YR 5/6) mottles; weak thick platy laminations; firm; few fine distinct very dark brown (10YR 2/2) iron and manganese concretions; mildly alkaline.

The solum ranges from 47 to 61 inches in thickness and from slightly acid to mildly alkaline.

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, value of 4 or 5, and chroma of 1 to 4. It is silty clay, heavy silty clay loam, heavy clay loam, or clay. The C horizon is dominantly silty clay but has thin strata of silty clay loam or silt loam in some pedons. It is neutral or mildly alkaline.

Digby series

The Digby series consists of deep, somewhat poorly drained soils on stream terraces and, in a few areas, on till plains. These soils formed in loamy material that is 28 to 48 inches deep over stratified, calcareous gravelly, sandy, and loamy deposits. Permeability is moderate in the solum and rapid in the substratum. Slope ranges from 0 to 6 percent.

Digby soils are commonly adjacent to Gallman and Millgrove soils and are similar to Blount and Haskins soils. Blount soils formed in glacial till and contain more clay in the argillic horizon than Digby soils. Gallman soils do not have a dominant chroma of 2 or less in the matrix or on faces of peds in the argillic horizon. Haskins soils have contrasting fine textured or moderately fine textured glacial till or lacustrine material within a depth of 40 inches. Millgrove soils have a mollic epipedon and have a dominant low chroma in the subsoil.

Typical pedon of Digby loam, 0 to 2 percent slopes, in Union Township, NE1/4NW1/4 sec. 25, T. 4 S., R. 3 E., 5,180 feet north and 400 feet west of the intersection of Gallman and Mercer Roads:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak fine granular structure; friable; many fine roots; 2 percent fine gravel; neutral; abrupt smooth boundary.

B1g—8 to 14 inches; grayish brown (10YR 5/2) loam; common medium faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; common fine roots; 2 percent fine gravel; slightly acid; clear wavy boundary.

B21tg—14 to 24 inches; grayish brown (10YR 5/2) clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; common fine roots; thin patchy brown (10YR 4/3) clay films on vertical and horizontal faces of peds; 2 percent fine gravel; slightly acid; gradual smooth boundary.

B22t—24 to 36 inches; dark yellowish brown (10YR 4/4) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few fine roots; thin patchy brown (10YR 4/3) clay films on vertical and horizontal faces of peds; 5 percent fine gravel; neutral; gradual smooth boundary.

B23tg—36 to 44 inches; grayish brown (10YR 5/2) clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; firm; few fine roots; thin patchy brown (10YR 4/3) clay films on vertical and horizontal faces of peds; 5 percent fine gravel; neutral; clear wavy boundary.

IIC1—44 to 48 inches; dark grayish brown (10YR 4/2) gravelly sand; many coarse faint brown (10YR 5/3) mottles; single grained; loose; some clay bridging between sand grains; 20 percent fine gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIC2—48 to 60 inches; gray (10YR 6/1) gravelly sandy loam; single grained; loose; 25 percent fine gravel; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 28 to 48 inches. The content of coarse fragments ranges, by volume, from 2 to 15 percent in the A horizon and from 2 to 20 percent in the B horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. Reaction ranges from medium acid to neutral. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is clay loam or sandy clay loam. Reaction ranges from very 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, value of 5 or 6, and chroma of 1 or 2. It is gravelly sandy loam, gravelly loamy sand, or gravelly sand. Reaction is mildly alkaline or moderately alkaline.

Edwards series

The Edwards series consists of deep, very poorly drained soils in depressions. These soils formed in well decomposed organic material over marl at a depth of 16 to 35 inches. Permeability is moderately rapid in the organic material and varies in the marl. Slope ranges from 0 to 2 percent.

Edwards soils are commonly adjacent to Montgomery and Pewamo soils and are similar to Carlisle and Olentangy soils. Carlisle soils formed in more than 51 inches of accumulated organic material. Montgomery and Pewamo soils have a mollic epipedon. In addition, Montgomery soils formed in lacustrine material and Pewamo soils in glacial till. Olentangy soils formed in coprogenous earth over lacustrine material or glacial till.

Typical pedon of Edwards muck, in Blackcreek Township, NW1/4SE1/4 sec. 18, T. 4 S., R. 1 E., 1,990 feet north and 1,320 feet east of the intersection of Steller and Duck Creek Roads:

Oap—0 to 10 inches; black (N 2/0) broken face and rubbed sapric material; about 2 percent fiber, 1 percent rubbed; moderate fine subangular blocky structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

Oa2—10 to 14 inches; black (N 2/0) broken face and rubbed sapric material; about 25 percent fiber, 1 percent rubbed; weak fine subangular blocky structure; very friable; common fine roots; slightly acid; clear wavy boundary.

Oa3—14 to 20 inches; black (10YR 2/1) broken face and rubbed sapric material; about 3 percent fiber, 1 percent rubbed; weak fine platy structure; very friable; few fine roots; neutral; gradual wavy boundary.

Oa4—20 to 28 inches; black (10YR 2/1) broken face and rubbed sapric material; about 2 percent fiber, 1 percent rubbed; weak medium platy structure; very friable; mildly alkaline; abrupt wavy boundary.

Lca1—28 to 47 inches; light gray (10YR 7/2) marl; common fine faint very pale brown (10YR 7/4) mottles; massive; friable; strong effervescence; moderately alkaline; diffuse wavy boundary.

Lca2—47 to 60 inches; light gray (10YR 7/1) marl; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 35 inches.

The surface tier has hue of 10YR or N, value of 2, and chroma of 0 to 2. The organic part of the subsurface tier has hue of 10YR, 7.5YR, or N; value of 2 or 3; and chroma of 0 to 3. The surface tier and the organic part of the subsurface tier have a fiber content of 2 to 30 percent before rubbing and range from medium acid to mildly alkaline. The Lca horizon has hue of 10YR, value of 6 to 8, and chroma of 1 or 2. It is mildly alkaline or moderately alkaline.

Eel series

The Eel series consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in medium textured and moderately coarse textured recent alluvium that washed mainly from soils formed in calcareous glacial till. Slope ranges from 0 to 2 percent.

The Eel soils in Mercer County have more strongly expressed structure in the subsoil than is defined as the range for the Eel series, are deeper to carbonates, and do not have the fine stratification or the mottles with chroma of 2 so close to the surface. These differences, however, do not alter the use or behavior of the soils.

Eel soils are commonly adjacent to Genesee, Shoals, and Sloan soils. Genesee soils do not have mottles with chroma of 2 or less within a depth of 20 inches. Shoals and Sloan soils have a dominant chroma of 2 or less in one or more horizon in the upper 30 inches. In addition, Sloan soils have a mollic epipedon.

Typical pedon of Eel silt loam, in Gibson Township, NW1/4NE1/4 sec. 15, T. 15 N., R. 1 E., 700 feet south and 1,400 feet west of the intersection of St. Peter and Fort Recovery-Minster Roads:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; very friable; many fine roots; mildly alkaline; abrupt smooth boundary.

B21—8 to 19 inches; dark brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; many fine roots; mildly alkaline; clear wavy boundary.

B22—19 to 28 inches; dark brown (10YR 4/3) silt loam; many medium faint dark grayish brown (10YR 4/2) mottles; weak fine granular structure; very friable; common fine roots; mildly alkaline; gradual wavy boundary.

B23—28 to 36 inches; dark brown (10YR 4/3) silt loam; many medium faint dark grayish brown (10YR 4/2) mottles; moderate fine granular structure; very friable; common fine roots; mildly alkaline; clear wavy boundary.

B24—36 to 42 inches; dark brown (10YR 4/3) silt loam; many medium faint dark grayish brown (10YR 4/2) mottles; moderate medium angular blocky structure; friable; few fine roots; mildly alkaline; clear wavy boundary.

C—42 to 68 inches; dark gray (10YR 4/1) sandy loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium angular blocky structure; friable; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 66 inches. The depth to carbonates commonly is about 50 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is slightly acid to mildly alkaline. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4 and has mottles with chroma of 1 or 2 within a depth of 24 inches. It is silt loam, loam, or light silty clay loam. Reaction ranges from slightly acid to moderately alkaline. The C horizon is stratified silt loam, loam, or sandy loam. It is mildly alkaline or moderately alkaline.

Eldean series

The Eldean series consists of deep, well drained soils on stream terraces and on outwash terraces on end moraines. These soils formed in outwash material underlain by stratified sand and gravel at a depth of 20 to 40 inches. Permeability is moderate in the subsoil and rapid or very rapid in the substratum. Slope ranges from 2 to 12 percent.

Eldean soils are similar to Gallman, Ockley, and Rawson soils, but they contain more clay in the subsoil. Also, Gallman and Ockley soils have a thicker solum and Rawson soils have glacial till or lacustrine material in the lower part of the solum and in the substratum.

Typical pedon of Eldean loam, 2 to 6 percent slopes, in Granville Township, SE1/4SW1/4 sec. 19, T. 7 S., R. 2 E., 125 feet north and 1,565 feet west of the intersection of Lange Road and Post Road:

Ap—0 to 9 inches; brown (10YR 4/3) heavy loam; weak medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

B21—9 to 16 inches; dark brown (7.5YR 4/4) clay; weak medium subangular blocky structure; firm, sticky; common roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds; 10 percent gravel; neutral; clear wavy boundary.

B22t—16 to 22 inches; dark brown (7.5YR 4/4) clay; weak coarse subangular blocky structure; firm, sticky; common roots; medium patchy brown (7.5YR 4/2) clay films on faces of peds; 10 percent gravel; neutral; clear wavy boundary.

B23t—22 to 28 inches; dark brown (7.5YR 4/4) clay; weak coarse subangular blocky structure; firm, slightly sticky; few roots; medium very patchy brown (7.5YR 4/2) clay films on faces of peds; 5 percent gravel; neutral; clear wavy boundary.

B24t—28 to 31 inches; brown (7.5YR 4/2) gravelly clay; weak medium subangular blocky structure; firm; few roots; few weathered limestone fragments; 25 percent fine gravel; mildly alkaline; clear wavy boundary.

B3—31 to 35 inches; brown (7.5YR 4/2) gravelly clay loam; weak medium and fine subangular blocky structure; friable; few roots; 40 percent fine gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.

B32—35 to 37 inches; brown (7.5YR 4/2) gravelly loam; weak medium subangular blocky structure; very friable; 45 percent fine gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC1—37 to 55 inches; grayish brown (10YR 5/2) fine gravelly loamy sand; single grained; loose; 35 percent fine gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC2—55 to 60 inches; yellowish brown (10YR 5/4) loamy fine sand; single grained; loose; 10 percent fine gravel; strong effervescence; moderately alkaline; clear wavy boundary.

IIC3—60 to 70 inches; yellowish brown (10YR 5/4) gravelly loamy sand; single grained; loose; 25 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches; it is commonly 30 to 40 inches. The content of coarse fragments generally increases with increasing depth; it ranges, by volume, from 0 to 10 percent in the Ap horizon, from 5 to 25 percent in the lower part of the B2 horizon, and from 10 to 60 percent in the B3 and C 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 B2 horizon has hue of 10YR to 5YR, value of 3 to 5, and chroma of 2 to 4. The fine earth texture is heavy clay loam, sandy clay, or clay. The B3 horizon has colors similar to those of the B2 horizon and has a fine earth texture of clay loam or loam. It is neutral to moderately alkaline. The C horizon has a fine earth texture of sand or loamy sand. It is neutral to moderately alkaline.

Elliott series

The Elliott series consists of deep, somewhat poorly drained, moderately slowly permeable soils on ground moraines. These soils formed in glacial till. Slope ranges from 1 to 4 percent.

Elliott soils are commonly adjacent to Blount, Glynwood, McGary, Montgomery, Morley, and Pewamo soils. Blount, Glynwood, McGary, and Morley soils do not have a mollic epipedon. Glynwood and Morley soils have a higher dominant chroma in the upper 10 inches of the argillic horizon than Elliott soils. McGary and Montgomery soils formed in lacustrine deposits of clay and silt. Pewamo and Montomery soils have a dominant low chroma in the subsoil.

Typical pedon of Elliott silt loam, 1 to 4 percent slopes, in Dublin Township, NE1/4NW1/4 sec. 27, T. 4 S., R. 2 E., 800 feet east and 4,070 feet north of the intersection of Lombard Road and State Route 707:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) heavy silt loam; moderate medium subangular blocky structure; friable; many fine roots; 1 percent coarse fragments; neutral; abrupt smooth boundary.

A12—8 to 11 inches; very dark grayish brown (10YR 3/2) heavy silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure parting to weak fine subangular blocky; friable; few roots; 2 percent coarse fragments; neutral; clear wavy boundary.

A13—11 to 14 inches; very dark grayish brown (10YR 3/2) heavy silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few roots; very dark gray (10YR 3/1) coatings on faces of peds; 2 percent coarse fragments; neutral; clear wavy boundary.

B1—14 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few roots; few very dark grayish brown (10YR 3/2) coatings on faces of peds; 3 percent coarse fragments; neutral; clear wavy boundary.

B21t—18 to 22 inches; yellowish brown (10YR 5/4) heavy silty clay loam; few fine faint yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to strong medium subangular blocky; firm; thin patchy dark gray (10YR 4/1) clay films on horizontal and vertical faces of peds; 3 percent coarse fragments; neutral; clear wavy boundary.

B22t—22 to 26 inches; brown (10YR 5/3) clay; few medium faint yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; very firm; thin continuous very dark gray (10YR 3/1) clay films on some vertical faces of peds; 5 percent coarse fragments; mildly alkaline; clear wavy boundary.

B3t—26 to 30 inches; yellowish brown (10YR 5/4) light silty clay; few fine faint yellowish brown (10YR 5/6) mottles; moderate coarse angular blocky structure parting to moderate medium subangular blocky; very firm; thin patchy grayish brown (10YR 5/2) films on vertical faces of peds; 6 percent coarse fragments; slight effervescence; mildly alkaline; diffuse wavy boundary.

C—30 to 60 inches; brown (10YR 4/3) clay loam; few fine faint brown (10YR 5/3) mottles; massive with weak structural breaks; very firm; thin patchy gray (10YR 6/1) coatings on vertical faces of peds; 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 45 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is medium acid to neutral. It is 10 to 16 inches thick. The B horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay loam, silty clay, or clay. It is medium acid to neutral in the upper part and neutral or mildly alkaline in the lower part. The C horizon is silty clay loam or clay loam. It is mildly alkaline or moderately alkaline.

Gallman series

The Gallman series consists of deep, well drained or moderately well drained soils on stream terraces. These soils formed in poorly sorted outwash material having a high content of fine gravel. Permeability is moderately rapid. Slope ranges from 2 to 6 percent.

Gallman soils are commonly adjacent to Digby and Millgrove soils and are similar to Eldean, Ockley, and Rawson soils. Digby soils have a dominant chroma of 2 or less either on faces of peds or in one subhorizon of the argillic horizon. Eldean soils have a thinner solum than Gallman soils and contain more clay in the subsoil. Ockley soils have a thinner B3 horizon than Gallman soils, are shallower to carbonates, and have highly calcareous gravel and sand in the C horizon. Millgrove soils have a mollic epipedon and have a dominant low chroma in the subsoil. Rawson soils have moderately fine textured and fine textured glacial till or lacustrine material in the lower part of the solum and in the substratum.

Typical pedon of Gallman loam, 2 to 6 percent slopes, in Dublin Township, Blackloon Reserve, T. 4 S., R. 2 E., 1,372 feet west and 1,425 feet north of the intersection of River Trail and Blackloon Roads:

Ap—0 to 8 inches; dark brown (10YR 4/3) loam; weak fine and medium granular structure; friable; many roots; 2 percent fine gravel; neutral; abrupt smooth boundary.

B1t—8 to 11 inches; yellowish brown (10YR 5/4) heavy loam; weak fine and medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 4/4) clay films on faces of peds; patchy pale brown (10YR 6/3) coatings; 2 percent fine gravel; slightly acid; clear smooth boundary.

B21t—11 to 20 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; common roots; thin patchy dark brown (10YR 3/3) clay films on faces of peds; very patchy pale brown (10YR 6/3) coatings; 3 percent fine gravel; very strongly acid; clear wavy boundary.

B22t—20 to 30 inches; brown (7.5YR 4/4) gravelly clay loam; few fine faint strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm, sticky; few roots; thin patchy dark brown (7.5YR 4/2) clay films on faces of peds; very patchy pale brown (10YR 6/3) coatings; 15 percent fine gravel from shale and crystalline rock; very strongly acid; abrupt wavy boundary.

IIB23t—30 to 37 inches; dark brown (7.5YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; few roots; thin patchy dark brown (7.5YR 4/2) clay films and bridging; 8 percent fine gravel, dominantly from black shale; strongly acid; clear wavy boundary.

IIB31t—37 to 52 inches; dark brown (7.5YR 3/2) gravelly sandy clay loam; massive; firm, sticky; few roots; continuous dark brown (7.5YR 3/2) clay bridging; 15 percent fine gravel, dominantly from black shale; slightly acid; gradual wavy boundary.

IIB32t—52 to 66 inches; dark brown (10YR 3/3) gravelly sandy clay loam; massive; firm, sticky; patchy very dark grayish brown (10YR 3/2) bridging; 25 percent fine gravel, dominantly from black shale; neutral; gradual diffuse boundary.

IIIB33—66 to 75 inches; dark brown (7.5YR 4/4) sandy loam; few fine faint strong brown (7.5YR 5/6) mottles; massive; friable; some thin clay bridging; 2 percent fine gravel; thin lenses of silt loam; neutral; abrupt wavy boundary.

The thickness of the solum and the depth to carbonates range from 55 to 115 inches. The content of coarse fragments, dominantly fine gravel, ranges from 0 to 10 percent in the A horizon and from 2 to 30 percent in the B horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam or sandy loam and is medium acid to neutral. A thin A2 horizon is in some pedons. The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, sandy loam, sandy clay loam, clay loam, or the gravelly analogs of these textures. The B3 horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is sandy clay loam, sandy loam, loamy sand, or the gravelly analogs of these textures. Reaction ranges from slightly acid to mildly alkaline.

Genesee series

The Genesee series consists of deep, well drained, moderately permeable soils in the highest positions on flood plains. These soils formed in medium textured and moderately coarse textured recent alluvium washed mainly from soils formed in calcareous glacial till. Slope ranges from 0 to 2 percent.

The Genesee soils in Mercer County have more strongly expressed structure in the subsoil than is defined as the range for the Genesee series. Also, they do not have fine stratification. These differences, however, do not alter the use and behavior of the soils.

Genesee soils are commonly adjacent to Eel, Shoals, and Sloan soils. Eel soils have mottles with chroma of 2 or less within a depth of 24 inches. Shoals soils have a dominant chroma of 2 or less in one horizon between the Ap horizon and a depth of 30 inches. Sloan soils have a mollic epipedon and a dominant chroma of 2 or less between the Ap horizon and a depth of 30 inches.

Typical pedon of Genesee silt loam, in Washington Township, SE1/4SE1/4 sec. 21, T. 6 S., R. 1 E., 1,800 feet west and 500 feet north of the intersection of Menchhofer and McMillan Roads:

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; moderate fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

B21—10 to 19 inches; dark brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; many fine roots; dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; gradual wavy boundary.

B22—19 to 30 inches; dark brown (10YR 4/3) heavy silt loam; moderate fine and medium subangular blocky structure; friable; common fine roots; dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; diffuse wavy boundary.

B23—30 to 48 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; neutral; gradual wavy boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) stratified silt loam and loam; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 48 inches.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 3. It is slightly acid or neutral. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Gray mottles are below a depth of 24 inches in some pedons. The B horizon is dominantly silt loam but ranges to loam and light silty clay loam. It is commonly slightly acid or neutral, but in some pedons it is mildly alkaline in the lower part. The C horizon is stratified silt loam, loam, and sandy loam. It is mildly alkaline or moderately alkaline.

Glynwood series

The Glynwood series consists of deep, moderately well drained, slowly permeable soils formed in glacial till. These soils are on ground moraines and end moraines. Slope ranges from 2 to 12 percent.

Glynwood soils are commonly adjacent to Blount, Elliott, Morley, and Pewamo soils on the landscape. In Blount and Elliott soils, one subhorizon of the argillic horizon or the coatings on faces of peds in the argillic horizon have a dominant low chroma. Elliott and Pewamo soils have a mollic epipedon. Pewamo soils have a dominant low chroma in the subsoil. Morley soils do not have chroma of 2 or less in the upper 10 inches of the argillic horizon.

Typical pedon of Glynwood silt loam, 2 to 6 percent slopes, in Granville Township, NW1/4SE1/4 sec. 19, T. 7 S., R. 2 E., 825 feet east and 2,310 feet north of the intersection of Post Road and Lange Road:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable; many roots; medium acid; abrupt smooth boundary.

B1—9 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; firm; many roots; few fine very dark brown (10YR 2/2) concretions of iron and manganese; medium continuous pale brown (10YR 6/3) coatings on faces of peds; 1 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—12 to 20 inches; dark yellowish brown (10YR 4/4) clay; few fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; very firm; common roots; few fine black (10YR 2/1) concretions of iron and manganese; thin patchy brown (10YR 5/3) clay films on faces of peds; 2 percent coarse fragments; medium acid; clear wavy boundary.

B3t—20 to 25 inches; yellowish brown (10YR 5/4) heavy clay loam; few fine distinct gray (10YR 5/1) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few roots; grayish brown (10YR 5/2) clay films that are thin and patchy on vertical faces of peds and thin and very patchy on horizontal faces; few white (10YR 8/1) secondary lime coatings; 2 percent coarse fragments; mildly alkaline; clear wavy boundary.

C1—25 to 31 inches; yellowish brown (10YR 5/4) clay loam; weak medium prismatic structure parting to weak thick platy; firm; thin very patchy brown (10YR 5/3) clay films on vertical faces of peds; grayish brown (10YR 5/2) coatings on faces of peds; white (10YR 8/1) secondary lime coatings; 2 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

C2—31 to 60 inches; yellowish brown (10YR 5/4) clay loam; weak thick platy structure; firm; 4 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 40 inches; it is commonly 25 to 30 inches. The content of coarse fragments ranges, by volume, from 0 to 8 percent in the upper part of the solum and from 2 to 10 percent in the lower part and in 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 B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is dominantly clay or silty clay, but it has subhorizons of heavy clay loam or heavy silty clay loam in some pedons. It is very strongly acid to neutral in the upper part and slightly acid to moderately 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 or silty clay loam and is mildly alkaline or moderately alkaline.

Haskins series

The Haskins series consists of deep, somewhat poorly drained soils on stream terraces, end moraines, and ground moraines. These soils formed in moderately permeable, medium textured and moderately fine textured outwash overlying slowly permeable or very slowly permeable, fine textured or moderately fine textured glacial till or lacustrine material. Slope ranges from 0 to 6 percent.

Haskins soils are commonly adjacent to Blount and Rawson soils and are similar to Blount and Digby soils. Blount soils formed in glacial till and contain more clay in the argillic horizon than Haskins soils. Digby soils do not have contrasting fine textured or moderately fine textured material within a depth of 40 inches. Rawson soils do not have a dominant chroma of 2 or less in the matrix or on faces of peds in the argillic horizon.

Typical pedon of Haskins loam, 0 to 2 percent slopes, in Dublin Township, T. 4 S., R. 2 E., 2,640 feet south and 1,320 feet west of the intersection of Mercer-Van Wert County Line Road and Godfrey Reserve Road:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak and moderate fine granular structure; friable; many fine roots; 2 percent fine gravel; strongly acid; abrupt smooth boundary.

B1g—8 to 14 inches; light brownish gray (10YR 6/2) loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; common fine roots; 2 percent fine gravel; strongly acid; clear wavy boundary.

B21tg—14 to 20 inches; grayish brown (10YR 5/2) heavy loam; few medium faint yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; common fine roots; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds; 4 percent fine gravel; medium acid; diffuse wavy boundary.

B22t—20 to 28 inches; brown (10YR 5/3) sandy clay loam; many medium faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; firm; few fine roots; thin patchy grayish brown (10YR 5/2) clay films on vertical and horizontal faces of peds; 4 percent fine gravel; medium acid; diffuse wavy boundary.

B23tg—28 to 36 inches; dark grayish brown (10YR 4/2) sandy clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium patchy dark grayish brown (10YR 4/2) clay films on vertical and horizontal faces of peds; 6 percent fine gravel; slightly acid; abrupt wavy boundary.

IIB3tg—36 to 41 inches; grayish brown (10YR 5/2) clay loam; common medium distinct yellowish brown (10YR 5/4) and very dark brown (10YR 2/2) mottles; weak medium and coarse subangular blocky structure; firm; thin patchy dark grayish brown (10YR 4/2) clay films on vertical faces of peds; 6 percent coarse fragments; neutral; diffuse wavy boundary.

IIC—41 to 60 inches; dark grayish brown (10YR 4/2) clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; massive; firm; 8 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 42 inches. The gravel content ranges from 2 to 12 percent in the A and B2 horizons and from 0 to 10 percent in the B3 and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It ranges from strongly acid to neutral. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is dominantly sandy clay loam and clay loam, but it has subhorizons of loam in some pedons. Reaction is strongly acid or medium acid in the upper part and medium acid to neutral in the lower part; the pH value generally increases with increasing depth. The IIB3 horizon has hue of 10YR, value of 5, and chroma of 2 or 3. It is clay loam, silty clay loam, silty clay, or clay. Reaction is neutral or mildly alkaline. The C horizon is clay loam, silty clay loam, or silty clay. It is dominantly mildly alkaline or moderately alkaline but is neutral in some pedons.

McGary series

The McGary series consists of deep, somewhat poorly drained soils in old shallow glacial lakes on till plains. These soils formed in lake-deposited clay and silt. Permeability is slow or very slow. Slope ranges from 0 to 6 percent.

McGary soils are similar to Blount and Elliott soils and are commonly adjacent to Montgomery soils. Blount and Elliott soils formed in glacial till. Elliott and Montgomery soils have a mollic epipedon. Also, Montgomery soils have a dominant low chroma in the subsoil.

Typical pedon of McGary silty clay loam, 2 to 6 percent slopes, in Granville Township, NW1/4N1/2 sec. 29, T. 13 N., R. 3 E., 1,870 feet west and 150 feet north of the intersection of Cranberry and Huwer Roads:

Ap—0 to 9 inches; brown (10YR 4/3) silty clay loam; weak coarse granular structure; friable; few roots; few fine dark brown (7.5YR 4/4) and yellowish red (5YR 5/6) iron and manganese concretions; slightly acid; abrupt smooth boundary.

B21t—9 to 13 inches; brown (10YR 4/3) silty clay; common fine faint dark yellowish brown (10YR 4/4) and few fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; thin patchy gray (10YR 5/1) clay films on vertical faces of peds; few fine dark brown (7.5YR 4/4) iron and manganese concretions; few fine very dark gray (5YR 3/1) manganese stains; slightly acid; clear wavy boundary.

B22tg—13 to 18 inches; dark grayish brown (10YR 4/2) silty clay; common fine and medium distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few roots; thin patchy gray (10YR 6/1) clay films on vertical faces of peds; few very fine yellowish red (5YR 5/6) concretions; neutral; clear wavy boundary.

B23tg—18 to 26 inches; grayish brown (10YR 5/2) silty clay; common medium faint yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few roots; thin patchy gray (10YR 5/1) clay films on vertical faces of peds; thin patchy gray (10YR 6/1) silt coatings along vertical prism faces; few slickensides; common fine very dark gray (5YR 3/1) manganese concretions; mildly alkaline; clear wavy boundary.

B24tg—26 to 32 inches; gray (10YR 5/1) silty clay; common coarse distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin patchy gray (10YR 5/1) clay films on vertical faces of peds; thin patchy gray (10YR 6/1) silt coatings on vertical prism faces; few fine very dark gray (5YR 3/1) manganese stains; slight effervescence; mildly alkaline; gradual wavy boundary.

B3g—32 to 41 inches; gray (10YR 5/1) silty clay; few fine distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate coarse subangular blocky; firm; few fine roots; thin continuous gray (10YR 5/1) clay films on vertical faces of peds; common fine oval white (10YR 8/1) calcareous concretions; slight effervescence; mildly alkaline; gradual wavy boundary.

C1g—41 to 49 inches; gray (10YR 5/1) silty clay; common coarse distinct yellowish brown (10YR 5/4) mottles; weak coarse platy structure; firm; thin patchy white (10YR 8/1) secondary lime coatings on fine cleavages; many fine and medium round, oval, and oblong light gray (10YR 7/1) and white (10YR 8/1) calcareous concretions; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—49 to 65 inches; dark yellowish brown (10YR 4/4) silty clay; weak very coarse platy structure; very firm; thin patchy light gray (N 7/0) secondary lime coatings on vertical and horizontal surfaces; many fine and medium oval white (10YR 8/1) calcareous concretions; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 42 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It is medium acid to neutral. The B horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam, silty clay, or clay. Reaction ranges from medium acid to neutral in the upper part and from slightly acid to mildly alkaline in the lower part; the pH value generally increases with increasing depth. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is stratified clay, silty clay, or heavy silty clay loam.

Millgrove series

The Millgrove series consists of deep, very poorly drained, moderately permeable soils in low lying positions on stream terraces. These soils formed in moderately fine textured and fine textured outwash overlying stratified, calcareous sandy, gravelly, and loamy deposits of varying thickness. Slope ranges from 0 to 2 percent.

Millgrove soils are commonly adjacent to Digby and Gallman soils and are similar to Millsdale, Montgomery, and Pewamo soils. Digby and Gallman soils do not have a mollic epipedon or dominant low chroma matrix colors in the subsoil. Millsdale soils have limestone bedrock at a depth of 20 to 40 inches. Montgomery soils formed in lacustrine deposits and Pewamo soils in glacial till.

Typical pedon of Millgrove silty clay loam, in Dublin Township, T. 4 S., R. 2 E., Godfrey's Reserve, 1,750 feet south and 2,650 feet west of the intersection of Shelby and Frysinger Roads:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silty clay loam; moderate fine and medium subangular blocky structure; friable; many fine roots; 2 percent gravel; slightly acid; abrupt smooth boundary.

B21tg—9 to 17 inches; very dark grayish brown (10YR 3/2) clay loam; many fine distinct dark yellowish brown (10YR 4/4) mottles; strong medium subangular blocky structure; firm; common fine roots; thin patchy clay films on vertical faces of peds; 10 percent gravel; neutral; clear wavy boundary.

B22tg—17 to 30 inches; dark gray (10YR 4/1) clay loam; many coarse distinct brown (10YR 4/3) and yellowish brown (10YR 5/4) mottles; strong medium blocky structure; firm; common fine roots; thin patchy clay films on horizontal and vertical faces of peds; 10 percent gravel; neutral; diffuse wavy boundary.

B3g—30 to 44 inches; dark grayish brown (10YR 4/2) sandy clay loam; common fine distinct yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; firm; few fine roots; thin patchy clay films on vertical faces of peds; 10 percent gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.

C—44 to 60 inches; brown (10YR 4/3) gravelly sandy loam; many coarse distinct gray (10YR 5/1 and 10YR 6/1) mottles; massive; friable; 15 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 42 to 54 inches. The content of coarse fragments ranges from 2 to 10 percent in the Ap horizon, from 5 to 20 percent in the B horizon, and from 10 to 50 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is medium acid to neutral. The B horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 1 or 2. It is clay loam, sandy clay, gravelly clay loam, gravelly sandy clay loam, or sandy clay loam. Reaction 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. The fine earth texture is sandy loam, loam, or loamy sand. Reaction is mildly alkaline or moderately alkaline.

Millsdale series

The Millsdale series consists of moderately deep, very poorly drained, moderately slowly permeable soils on ground moraines. These soils formed in 20 to 40 inches of glacial till over limestone bedrock. Slope ranges from 0 to 2 percent.

Millsdale soils are similar to Millgrove and Pewamo soils, but they are shallower over bedrock than those soils. Also, Millgrove soils formed in outwash material and contain less clay in the argillic horizon.

Typical pedon of Millsdale silty clay loam, in Jefferson Township, SE1/4SW1/4 sec. 5, T. 6 S., R. 2 E., 740 feet west and 125 feet north of the intersection of Karch and Swamp Roads:

Ap1—0 to 5 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) rubbed; moderate medium granular structure; friable; common roots; 1 percent angular coarse fragments; neutral; abrupt smooth boundary.

Ap2—5 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) rubbed; weak coarse angular blocky structure; firm; common roots; 2 percent angular coarse fragments; neutral; clear smooth boundary.

B21t—10 to 13 inches; yellowish brown (10YR 5/4) heavy clay loam; many fine distinct dark gray (10YR 4/1) mottles; moderate fine angular blocky structure; firm; few fine roots; thin patchy organic clay films on faces of peds; continuous dark gray (10YR 4/1) coatings on faces of peds; 2 percent angular coarse fragments; neutral; clear smooth boundary.

B22t—13 to 17 inches; yellowish brown (10YR 5/4) heavy clay loam; few fine faint yellowish brown (10YR 5/6) and brownish yellow (10YR 6/8) mottles; moderate fine and medium angular blocky structure; firm; thin patchy dark gray (10YR 4/1) clay films on faces of peds; dark grayish brown (10YR 4/2) coatings on faces of peds; 3 percent angular coarse fragments; neutral; clear wavy boundary.

B23tg—17 to 20 inches; dark grayish brown (2.5Y 4/2) clay loam; common fine distinct yellowish brown (10YR 5/6) and many fine faint olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; firm; thin patchy dark gray (10YR 4/1) clay films on faces of peds; few very dark gray (10YR 3/1) organic coatings on faces of peds; few igneous pebbles; 10 percent limestone fragments; neutral; clear wavy boundary.

IIB3g—20 to 25 inches; dark grayish brown (2.5Y 4/2) clay loam; common fine distinct yellowish brown (10YR 5/6) and many fine faint olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; firm; pale brown (10YR 6/3) weathered material on surfaces of limestone fragments; 30 percent limestone fragments; light gray (10YR 7/2) limestone ghosts; slight effervescence; mildly alkaline; abrupt irregular boundary.

IIR—25 inches; light gray (10YR 7/2) limestone bedrock; pale brown (10YR 6/3) weathered material on upper surface.

The thickness of the solum, or the depth to limestone bedrock, ranges from 20 to 40 inches. The mollic epipedon is 10 to 15 inches thick.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1. It is slightly acid or neutral. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 to 4. It is heavy silty clay loam or clay loam. Reaction is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part.

Montgomery series

The Montgomery series consists of deep, very poorly drained soils in depressional areas in old shallow glacial lakes on till plains. These soils formed in calcareous, lacustrine, stratified silty clay, clay, or silty clay loam. Permeability is slow or very slow. Slope ranges from 0 to 2 percent.

Montgomery soils are similar to Pewamo, Millgrove, and Wabasha soils and are commonly adjacent to McGary soils. Pewamo soils formed in glacial till. McGary soils do not have a mollic epipedon or a dominant low chroma throughout the subsoil. Millgrove soils formed in outwash deposits and contain less clay in the subsoil than Montgomery soils. Wabasha soils are subject to frequent flooding and do not have a mollic epipedon. Also, the content of organic matter in Wabasha soils varies with increasing depth.

Typical pedon of Montgomery silty clay, in Granville Township, SE1/4NE1/4 sec. 32, T. 13 N., R. 3 E., 1,430 feet south and 1,585 feet west of the intersection of Watkins Road and U.S. Route 127:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay; weak medium subangular blocky structure; friable; common roots; few fine yellowish brown (10YR 5/4) iron and manganese concretions; neutral; abrupt smooth boundary.

A12—9 to 11 inches; very dark gray (10YR 3/1) silty clay; weak coarse and medium subangular blocky structure; friable; common roots; few fine yellowish brown (10YR 5/4) iron and manganese concretions; neutral; clear wavy boundary.

B21g—11 to 18 inches; dark gray (10YR 4/1) silty clay; common fine distinct yellowish brown (10YR 5/4) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common roots; thin patchy gray (10YR 5/1) coatings on vertical faces of peds; neutral; clear wavy boundary.

B22g—18 to 29 inches; dark gray (10YR 4/1) silty clay; common fine and medium distinct dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium and fine subangular and angular blocky; firm; few roots; thin patchy gray (10YR 6/1) silt coatings on vertical faces of peds; few fine dark brown (7.5YR 4/4) iron and manganese concretions; neutral; gradual wavy boundary.

B23g—29 to 41 inches; gray (10YR 5/1) silty clay; common medium distinct dark yellowish brown (10YR 4/4) and fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; firm; few fine dark olive gray (5Y 3/2) manganese stains; dark gray (10YR 4/1) coatings in root channels; few slickensides; gradual wavy boundary.

B3g—41 to 48 inches; gray (10YR 5/1) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; thin continuous gray (10YR 5/1) silt coatings in old root channels; thin patchy gray (10YR 5/1) silt coatings on vertical faces of peds; few dark olive gray (5Y 3/2) manganese stains; diffuse wavy boundary.

Cg—48 to 66 inches; gray (10YR 5/1) silty clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; inherited weak coarse platy structure; firm; thin patchy gray (10YR 5/1) silt coatings on vertical and horizontal very weak structural breaks; thin continuous gray (10YR 5/1) silt coatings in old root channels; few dark olive gray (5Y 3/2) manganese stains; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 26 to 60 inches. The mollic epipedon is 10 to 16 inches thick.

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, value of 4 to 6, and chroma of 1 or 2. It is dominantly silty clay or silty clay loam, but some pedons have thin subhorizons of clay. Reaction ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 0 to 2. It is silty clay, clay, or silty clay loam and is mildly alkaline or moderately alkaline.

Morley series

The Morley series consists of deep, well drained, slowly permeable soils formed in glacial till. These soils are on the dissected parts of ground moraines and end moraines. Slope ranges from 12 to 25 percent.

Morley soils are commonly adjacent to Blount, Elliott, and Glynwood soils and are similar to Rawson soils. In Blount and Elliott soils one or more subhorizons of the B horizon or the faces of peds in the argillic horizon have a dominant chroma of 2 or less. Also, Elliott soils have a mollic epipedon. Glynwood soils have mottles with chroma of 2 or less in the upper 10 inches of the argillic horizon. Rawson soils contain less clay in the argillic horizon than Morley soils and formed in outwash over glacial till or lacustrine material.

Typical pedon of Morley silt loam, 12 to 18 percent slopes, moderately eroded, in a meadow in Recovery Township, SW1/4SW1/4 sec. 8, T. 7 S., R. 1 E., 60 feet east and 2,675 feet south of the intersection of State Route 49 and Zehringer Road:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; common roots; 2 percent coarse fragments; slightly acid; abrupt smooth boundary.

B1t—6 to 12 inches; brown (10YR 4/3) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common roots; thin patchy dark brown (10YR 4/3) clay films on vertical faces of peds; 3 percent coarse fragments; 2 percent fine black shale fragments; slightly acid; clear wavy boundary.

B2t—12 to 21 inches; dark yellowish brown (10YR 4/4) heavy silty clay; few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very firm; few roots; thin continuous dark brown (10YR 4/3) clay films on vertical faces of peds and thin patchy clay films on horizontal faces; few fine very dark grayish brown (10YR 3/2) concretions of iron and manganese; 1 percent fine black shale fragments; 4 percent coarse fragments; neutral; clear wavy boundary.

B3t—21 to 27 inches; brown (10YR 4/3) silty clay; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; very thin patchy dark brown (10YR 4/3) clay films on vertical faces of peds; few fine very dark grayish brown (10YR 3/2) concretions of iron and manganese; 2 percent fine black shale fragments; 6 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

C1—27 to 42 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; common light gray (10YR 7/2) secondary lime coatings; 4 percent fine black shale fragments; 6 percent coarse fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—42 to 60 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct dark grayish brown (10YR 4/2) mottles; massive; very firm; 6 percent fine black shale fragments; 7 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 38 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is silt loam or clay loam. It is strongly acid to slightly acid. The B horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is silty clay, clay, clay loam, or silty clay loam. It is strongly acid to neutral in the upper part and neutral to moderately alkaline in the lower part. The C horizon is clay loam or silty clay loam. It is mildly alkaline or moderately alkaline.

Ockley series

The Ockley series consists of deep, well drained soils on stream terraces and outwash plains. These soils formed in medium textured and moderately fine textured glacial outwash overlying stratified sand and gravel. Permeability is moderate in the subsoil and very rapid in the substratum. Slope ranges from 0 to 6 percent.

Ockley soils are similar to Eldean, Gallman, and Rawson soils. Eldean soils contain more clay in the subsoil than Ockley soils, have a thinner solum, and are 20 to 40 inches deep to sand and gravel. Gallman soils have a thicker solum than Ockley soils. Rawson soils have moderately fine textured and fine textured glacial till or lacustrine material in the lower part of the solum and in the substratum.

Typical pedon of Ockley loam, 2 to 6 percent slopes, in Washington Township, SE1/4NE1/4 sec. 15, T. 6 S., R. 1 E., 260 feet west and 1,895 feet south of the intersection of Burrville Road and Leininger Road:

Ap—0 to 7 inches; dark brown (10YR 4/3) loam; moderate fine granular structure; friable; many fine roots; 5 percent gravel; slightly acid; abrupt smooth boundary.

B21t—7 to 14 inches; dark brown (7.5YR 4/4) clay loam; weak medium subangular blocky structure; firm; common fine roots; thin patchy dark brown (7.5YR 3/2) clay films on faces of peds, lining pores, and bridging sand grains; 10 percent fine gravel; medium acid; clear wavy boundary.

B22t—14 to 27 inches; dark brown (10YR 4/3) clay loam; weak medium prismatic structure parting to weak medium subangular blocky; firm; common fine roots; thin continuous dark brown (7.5YR 3/2) clay films on faces of peds, lining pores, and bridging sand grains; 10 percent fine gravel; medium acid; clear wavy boundary.

B23t—27 to 35 inches; dark yellowish brown (10YR 4/4) fine gravelly clay loam; weak coarse subangular blocky structure; very firm; few fine roots; thin continuous dark brown (7.5YR 3/2) clay films on faces of peds, lining pores, and bridging sand grains; 15 percent gravel; slightly acid; gradual wavy boundary.

B24t—35 to 38 inches; dark yellowish brown (10YR 4/4) fine gravelly sandy clay; weak medium and coarse subangular blocky structure; very firm; few fine roots; thin continuous dark brown (7.5YR 3/2) clay films on faces of peds, lining pores, and bridging sand grains; 15 percent gravel; slightly acid; clear wavy boundary.

B31t—38 to 43 inches; dark yellowish brown (10YR 4/4) fine gravelly sandy clay loam; weak medium subangular blocky structure; firm; thin patchy dark brown (7.5YR 3/2) clay films bridging sand grains and filling voids; 20 percent gravel; neutral; clear wavy boundary.

B32t—43 to 53 inches; brown (7.5YR 4/4) fine gravelly sandy clay loam; weak fine subangular blocky structure; firm; very thin patchy dark brown (7.5YR 3/2) clay films bridging sand grains; 20 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIC—53 to 72 inches; gray (10YR 6/1) fine gravelly loamy sand; single grained; loose; 25 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 42 to 60 inches. The content of coarse fragments ranges, by volume, from 0 to 15 percent in the upper part of the solum and from 18 to 35 percent in the lower part.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 3. It is slightly acid or medium acid. The upper part of the B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or clay loam and is strongly acid or medium acid. The lower part has hue of 10YR or 7.5YR, value of 2 to 5, and chroma of 2 to 4. It is dominantly gravelly sandy clay loam or gravelly clay loam, but some pedons have subhorizons of fine gravelly sandy clay or gravelly sandy loam. Reaction in the lower part ranges from medium acid to mildly alkaline. The C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. It is gravelly loamy sand or gravelly sand. It is mildly alkaline or moderately alkaline.

Olentangy series

The Olentangy series consists of deep, very poorly drained soils in depressional areas associated mainly with glacial lakes on till plains. These soils formed in accumulated organic material, mainly coprogenous earth, over medium textured or moderately fine textured glacial till or lacustrine material. Permeability is moderate in the coprogenous earth and slow in the mineral material. Slope ranges from 0 to 2 percent.

Olentangy soils are similar to Carlisle and Edwards soils and are commonly adjacent to Montgomery soils. Carlisle soils formed in more than 51 inches of accumulated organic material. Edwards soils are underlain with marl at a depth of 16 to 35 inches. Montgomery soils have a mollic epipedon and formed in lacustrine sediments.

Typical pedon of Olentangy mucky silt loam, in Granville Township, NW1/4NW1/4 sec. 30, T. 13 N., R. 3 E., 1,550 feet west and 2,920 feet north of the intersection of Rose and Huwer Roads:

OAp—0 to 11 inches; black (10YR 2/1) mucky silt loam; moderate medium and coarse granular structure; friable; many fine roots; strongly acid; clear smooth boundary.

OA12—11 to 15 inches; very dark grayish brown (10YR 3/2) mucky silt loam; 8 percent fiber, a trace rubbed; moderate thin platy and moderate medium subangular blocky structure; friable; common fine roots; common fine gypsum crystals; extremely acid; gradual wavy boundary.

IILco1—15 to 25 inches; brown (7.5YR 4/2) sedimentary peat; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; common fine gypsum crystals on rind of prisms; extremely acid; gradual wavy boundary.

IILco2—25 to 34 inches; olive gray (5Y 4/2) sedimentary peat; weak coarse prismatic structure; friable; yellowish brown (10YR 5/6) linings along root channels; brown (10YR 4/3) rind, 10 millimeters thick, on prisms; common fine gypsum crystals on rind surfaces; extremely acid; gradual wavy boundary.

IILco3—34 to 40 inches; dark greenish gray (5GY 4/1) sedimentary peat; massive; friable; slightly acid; abrupt smooth boundary.

IIICg—40 to 60 inches; dark gray (5Y 4/1) silty clay loam; few fine faint olive brown (2.5Y 4/4) mottles; massive; friable; few white snail shells; slight effervescence; mildly alkaline.

The thickness of the coprogenous earth and the depth to lacustrine sediments or glacial till range from 24 to 50 inches.

The OA horizon ranges from extremely acid to strongly acid in unlimed areas. The Lco horizon has hue of 7.5YR to 5GY, value of 4 or 5, and chroma of 1 or 2. Reaction ranges from extremely acid to mildly alkaline. The IIIC horizon is silty clay loam or silt loam and is mildly alkaline or moderately alkaline.

Pewamo series

The Pewamo series consists of deep, very poorly drained, moderately slowly permeable soils on ground moraines and in narrow drainageways on end moraines. These soils formed in glacial till. Slope ranges from 0 to 2 percent.

Pewamo soils are commonly adjacent to Blount and Glynwood soils and are similar to Elliott, Millsdale, and Montgomery soils. Blount and Glynwood soils do not have a mollic epipedon. In addition, Glynwood soils have a higher dominant chroma in the subsoil than Pewamo soils. Blount and Elliott soils do not have a dominant low chroma in the subsoil. Millgrove soils formed in outwash material and contain less clay in the argillic horizon than Pewamo soils. Millsdale soils are underlain with limestone bedrock at a depth of 20 to 40 inches. Montgomery soils formed in lacustrine deposits.

Typical pedon of Pewamo silty clay loam, in Jefferson Township, NE1/4NW1/4 sec. 33, T. 5 S., R. 2 E., 2,230 feet north and 2,250 feet east of the intersection of Fairground Road and State Route 118:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium granular structure; firm; common roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

A12—7 to 13 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium subangular blocky structure; firm; common roots; 2 percent coarse fragments; neutral; clear wavy boundary.

B21gt—13 to 20 inches; dark gray (10YR 4/1) silty clay; many medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common roots; thin patchy (10YR 3/2) clay films on vertical faces of peds; 3 percent coarse fragments; neutral; gradual wavy boundary.

B22gt—20 to 31 inches; dark gray (10YR 4/1) clay; common medium distinct yellowish brown (10YR 5/6) mottles; strong medium subangular blocky structure; very firm; few roots; thin patchy (10YR 3/2) clay films on vertical and horizontal faces of peds; 4 percent coarse fragments; neutral; diffuse wavy boundary.

B23gt—31 to 50 inches; gray (10YR 6/1) clay; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; few roots; thin patchy (10YR 4/2) clay films on vertical faces of peds; 5 percent coarse fragments; mildly alkaline; clear irregular boundary.

B3g—50 to 68 inches; gray (10YR 6/1) clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very firm; 10 percent coarse fragments; slight effervescence; mildly alkaline; diffuse irregular boundary.

The thickness of the solum ranges from 36 to 70 inches. The depth to carbonates ranges from 36 to 56 inches. The content of coarse fragments ranges from 2 to 14 percent throughout the solum. The mollic epipedon is 10 to 14 inches thick.

The Ap and A12 horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. They are silty clay loam or silty clay and are slightly acid or neutral. The B2t horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It has higher chroma mottles. Texture is clay, silty clay, or heavy silty clay loam. Reaction is slightly acid to mildly alkaline.

Rawson series

The Rawson series consists of deep, moderately well drained soils on stream terraces, end moraines, and ground moraines. These soils formed in moderately permeable, medium textured and moderately fine textured outwash over slowly permeable or very slowly permeable, moderately fine textured or fine textured glacial till or lacustrine material. Slope ranges from 2 to 6 percent.

Rawson soils are commonly adjacent to Haskins soils and are similar to Eldean, Gallman, Morley, and Ockley soils. Eldean, Gallman, and Ockley soils formed in glacial outwash and do not have contrasting fine textured or moderately fine textured glacial till or lacustrine material within a depth of 40 inches. The argillic horizon in Eldean and Morley soils contains more clay than that in Rawson soils. Haskins soils have a dominant chroma of 2 or less either on faces of peds or in one subhorizon of the argillic horizon. Morley soils formed in glacial till.

Typical pedon of Rawson loam, 2 to 6 percent slopes, in Union Township, NE1/4NE1/4 sec. 4, T. 4 S., R. 3 E., 1,190 feet west and 725 feet south of the intersection of Mercer-Van Wert County Line Road and Hickernell Road:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; moderate medium granular structure; friable; many fine roots; 2 percent fine gravel; neutral; abrupt smooth boundary.

B1t—9 to 15 inches; brown (10YR 4/3) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; common fine roots; thin patchy brown (10YR 5/3) clay films on faces of peds; 5 percent fine gravel; slightly acid; clear wavy boundary.

B21t—15 to 20 inches; brown (10YR 4/3) sandy clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; common fine roots; thin continuous brown (10YR 5/3) clay films on faces of peds; 8 percent fine gravel; medium acid; clear wavy boundary.

B22t—20 to 25 inches; dark yellowish brown (10YR 4/4) sandy clay loam; few medium distinct grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; 10 percent fine gravel; medium acid; diffuse wavy boundary.

B23t—25 to 32 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; firm; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; 12 percent fine gravel; neutral; abrupt wavy boundary.

IIB3t—32 to 39 inches; dark yellowish brown (10YR 4/4) clay; common medium distinct dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; very firm; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; 8 percent coarse fragments; mildly alkaline; clear wavy boundary.

IIC1—39 to 46 inches; dark brown (10YR 4/3) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; massive; very firm; 10 percent coarse fragments; slight effervescence; moderately alkaline; diffuse wavy boundary.

IIC2—46 to 60 inches; brown (10YR 4/3) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; very firm; 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 42 inches. The gravel content ranges from 2 to 10 percent in the Ap horizon and the upper part of the B2 horizon, from 2 to 16 percent in the lower part of the B2 horizon, and from 0 to 10 percent in the IIB3 and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is strongly acid to neutral. The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, sandy clay loam, or gravelly sandy clay loam. Reaction is medium acid to neutral. The IIB3 horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is clay loam, silty clay loam, clay, or silty clay. The C horizon is clay loam, silty clay loam, or silty clay. It is mildly alkaline or moderately alkaline.

Shoals series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in medium textured recent alluvium that washed mainly from soils formed in calcareous glacial till. Slope ranges from 0 to 2 percent.

Shoals soils are commonly adjacent to Eel, Genesee, and Sloan soils and are similar to Defiance soils. Eel and Genesee soils do not have a subhorizon with dominant chroma of 2 or less between the Ap horizon and a depth of 30 inches. Sloan soils have a mollic epipedon and have a dominant chroma of 2 or less between the Ap horizon and a depth of 30 inches. Defiance soils contain more clay in the subsoil than Shoals soils and are of illitic mineralogy.

Typical pedon of Shoals silt loam, in Washington Township, SE1/4NE1/4 sec. 10, T. 6 S., R. 1 E., 720 feet north and 1,140 feet west of the intersection of Pine Road and Burrville Road:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21g—9 to 20 inches; dark gray (10YR 4/1) silt loam; many fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine and medium subangular blocky structure; friable; many fine roots; neutral; diffuse wavy boundary.

B22—20 to 27 inches; dark yellowish brown (10YR 4/4) silt loam; many medium distinct dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; friable; common fine roots; neutral; gradual wavy boundary.

B23g—27 to 42 inches; grayish brown (10YR 5/2) silt loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; moderate fine and medium subangular blocky structure; friable; few fine roots; neutral; gradual wavy boundary.

B24g—42 to 48 inches; grayish brown (10YR 5/2) silt loam; few medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

C1g—48 to 56 inches; light gray (10YR 6/1) stratified silt loam and loam; many medium distinct yellowish brown (10YR 5/4) mottles; friable; mildly alkaline; diffuse wavy boundary.

C2g—56 to 65 inches; light gray (10YR 6/1) stratified loam and silt loam; many fine and medium dark yellowish brown (10YR 4/4) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 50 inches; it is dominantly 40 to 50 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 B2 horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is dominantly silt loam or loam, but some pedons have subhorizons of light silty clay loam. Reaction is slightly acid to mildly alkaline. The C horizon is neutral or mildly alkaline.

Sloan series

The Sloan series consists of deep, very poorly drained, moderately permeable or moderately slowly permeable soils on flood plains. These soils formed in medium textured, moderately coarse textured, and moderately fine textured recent alluvium that washed mainly from soils formed in highly calcareous glacial till. Slope ranges from 0 to 2 percent.

Sloan soils are commonly adjacent to Eel, Genesee, and Shoals soils and are similar to Wabasha soils. Eel, Genesee, and Shoals soils do not have a mollic epipedon and do not have a dominant chroma of 2 or less between the Ap horizon and a depth of 30 inches. Wabasha soils contain more clay in the subsoil than Sloan soils, are of illitic mineralogy, and have a surface layer that is too light in color or too thin to qualify as a mollic epipedon.

Typical pedon of Sloan silty clay loam, in Recovery Township NW1/4SE1/4 sec. 6, T. 7 S., R. 1 E., 2,600 feet south and 1,980 feet west of the intersection of State Route 49 and Siegrist-Jutte Road:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine and medium angular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—9 to 15 inches; very dark gray (10YR 3/1) light silty clay loam; few medium distinct dark yellowish brown (10YR 3/4) mottles; moderate medium angular blocky structure; friable; many fine roots; neutral; gradual wavy boundary.

B21g—15 to 21 inches; dark gray (10YR 4/1) light silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; few dark concretions; neutral; gradual wavy boundary.

B22g—21 to 34 inches; gray (10YR 5/1) and dark gray (10YR 4/1) light silty clay loam; many medium distinct brown (7.5YR 4/4) and few fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine roots; few dark concretions; neutral; clear smooth boundary.

IIB3g—34 to 45 inches; gray (10YR 5/1) light clay loam; many coarse prominent strong brown (7.5YR 5/6) mottles; massive; friable; mildly alkaline; gradual wavy boundary.

IICg—45 to 60 inches; gray (10YR 5/1) stratified loam, silt loam, silty clay loam, and sandy loam; many coarse prominent yellowish brown (10YR 5/4, 5/6) mottles; massive; friable; mildly alkaline; calcareous.

The thickness of the solum ranges from 20 to 50 inches; it is dominantly 40 to 50 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The Ap and A1 horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. They are slightly acid to mildly alkaline. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam, silt loam, loam, or clay loam. Reaction is slightly acid to mildly alkaline in the upper part and neutral to moderately alkaline in the lower part. The C horizon is stratified silt loam, sandy loam, silty clay loam, or loam. It is neutral to moderately alkaline.

Wabasha series

The Wabasha series consists of deep, very poorly drained, slowly permeable soils on flood plains. These soils formed mainly in fine textured recent alluvium. Slope ranges from 0 to 2 percent.

Wabasha soils are commonly adjacent to Defiance soils and are similar to Montgomery and Sloan soils. In Defiance soils one horizon between the Ap horizon and a depth of 30 inches has a dominant chroma of more than 2. Montgomery soils formed in lacustrine silt and clay and have a mollic epipedon and an argillic horizon. Sloan soils have a mollic epipedon, are of mixed mineralogy, and contain less clay throughout than Wabasha soils.

Typical pedon of Wabasha silty clay, in Jefferson Township, NE1/4SE1/4 sec. 6, T. 6 S., R. 2 E., 1,250 feet south and 340 feet west of the intersection of State Route 29 and Gause Road:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay; weak medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B1g—8 to 14 inches; dark gray (10YR 4/1) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; common fine roots; neutral; gradual wavy boundary.

B21g—14 to 20 inches; gray (10YR 5/1) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; common fine roots; patchy very dark gray (10YR 3/1) coatings on faces of peds; neutral; clear wavy boundary.

B22g—20 to 29 inches; dark gray (10YR 4/1) silty clay; many medium distinct brown (10YR 4/3) mottles; moderate medium subangular blocky structure; firm; common fine roots; patchy very dark gray (10YR 3/1) coatings on faces of peds; 1 percent pebbles; mildly alkaline; diffuse wavy boundary.

B23g—29 to 42 inches; dark gray (10YR 4/1) silty clay; common medium distinct brown (10YR 4/3) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; 1 percent pebbles; neutral; clear wavy boundary.

B24g—42 to 50 inches; dark gray (10YR 4/1) silty clay; many medium distinct strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; few fine roots; 1 percent pebbles; neutral; diffuse wavy boundary.

B25g—50 to 54 inches; gray (10YR 5/1) silty clay; many medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; 1 percent pebbles; mildly alkaline; clear wavy boundary.

Cg—54 to 62 inches; gray (10YR 5/1) silty clay; many medium distinct dark yellowish brown (10YR 4/4) mottles; massive; very firm; 1 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches.

The Ap horizon has hue of 2.5Y or 10YR, value of 2 or 3, and chroma of 1 or 2. It is slightly acid to mildly alkaline and is 6 to 8 inches thick. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 0 to 2. It is clay or silty clay and is slightly acid to mildly alkaline. The C horizon is dominantly clay or silty clay, but some pedons have thin layers of heavy silty clay loam. This horizon is mildly alkaline or moderately alkaline.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*12*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aqualf (*Aqu*, meaning water, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Ochraqualfs (*Ochr*, meaning light colored surface layer, *aqualf*, the suborder of Alfisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups 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 *Aeric* identifies the subgroup that is dryer than the typical great group. An example is Aeric Ochraqualfs.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, mesic Aeric Ochraqualfs.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

Prepared by RICHARD L. CHRISTMAN, Ohio Divison of Lands and Soil.

Soils form through the physical and chemical weathering of deposited or accumulated geologic material. The important factors in soil formation are parent material, climate, living organisms, topography, and time.

Climate, living organisms, and vegetation are the active factors in soil formation. Their effect on the parent material is modified by topography and by the length of time the parent material has been acted upon. The relative importance of each factor differs from place to place. In places one factor dominates and is responsible for most of the soil properties, but normally the interaction of all five factors determines the kind of soil that forms in any given place.

Parent material

The soils of Mercer County formed largely in parent material of glacial origin, including glacial till, alluvium, lacustrine sediments, and outwash deposits.

Glacial drift, or till and outwash sand and gravel, is the most extensive parent material in the county. Morley, Glynwood, Blount, and Pewamo soils formed in weathered till. The till is somewhat homogeneous and uniform in texture, and the soils that formed in this parent material have a somewhat uniform, fine textured and moderately fine textured subsoil.

Outwash sand and gravel were deposited by melt water along glacial streams in the county. Gallman, Eldean, and similar soils formed in this material. Dark brown and brown colors became evident as the parent material of these soils weathered. Rawson and Haskins soils formed in a thin layer of outwash underlain with glacial till. Millgrove and Digby soils are grayer than other soils formed in glacial outwash because drainage is restricted and aeration is poor.

Lacustrine material, or old sediments on lake bottoms, is in small areas in the county and in a large area of the Montgomery-McGary map unit in the southeastern part of the county. Montgomery and McGary soils formed in stratified clays and silts that are characteristic of these areas.

Floodwater deposits are the youngest parent material in the county. These deposits still accumulate when fresh sediments are added by stream overflow. The sediments are from the surface layer of higher lying soils on uplands. Eel, Genesee, Shoals, and Sloan soils formed in moderately coarse textured to moderately fine textured alluvium on first bottoms. Defiance and Wabasha soils formed in fine textured and moderately fine textured sediments on first bottoms.

Climate

The climate of Mercer County has favored physical change, chemical weathering of parent material, and biological activity.

Rainfall has been abundant enough for percolation to leach carbonates to a moderate depth, as is evidenced in Blount, Glynwood, and other soils. It has been frequent enough for wetting and drying cycles to favor the translocation of clay minerals and the formation of soil structure, as is evidenced in Morley and Ockley soils.

The range in temperature has favored both physical change and chemical weathering of parent material.

Freezing and thawing have aided in formation of soil structure. Warm summer temperatures have favored chemical reactions in the weathering of primary minerals.

Both rainfall and temperature have promoted plant growth and subsequent accumulation of a moderate or high organic-matter content in Elliott, Pewamo, Montgomery, and similar soils.

Living organisms

In Mercer County the vegetation at the time of settlement was hardwoods. The common trees were probably beech, oak, ash, and elm. Also evident were grassy clearings on better drained sites and marshy openings in poorly drained swales.

Soils formed in forested areas are light colored and naturally acid. Examples are Blount, Glynwood, and Morley soils. In the grassy clearings the soils are dark colored and less acid. Elliott soils are an example. In the marshy swales are Pewamo, Montgomery, Millgrove, and Millsdale soils.

Small animals, insects, worms, and roots channel the soil and make it more permeable. Animals also mix the soil material and contribute organic matter. Worm channels or casts are abundant in the surface layer of Elliott soils, which are moderate in organic-matter content. Crawfish channels are most prevalent in the very poorly drained soils, such as the Pewamo, Millgrove, Millsdale, and Montgomery soils.

Management is influencing future soil formation in many areas through artificial drainage of wet soils; irrigation of dry soils; changes in the dominant vegetation; applications of lime and fertilizer, which affect soil chemistry; and transportation or removal of soil.

Topography

Topography helps to account for the formation of different kinds of soil from the same kind of parent material, as is illustrated by comparing Morley, Glynwood, Blount, and Pewamo soils. The well drained Morley and the moderately well drained Glynwood soils are moderately deep to calcareous till. The somewhat poorly drained Blount soils formed in nearly level and gently sloping areas where runoff is slow and medium. Nearby, the very poorly drained, dark colored Pewamo soils formed in level and nearly level areas and in swales where organic residue accumulated because of a seasonal high water table. In the depressional areas where water was ponded for many years in postglacial periods, the accumulation of wet vegetation has resulted in organic soils, such as those of the Carlisle and Edwards series.

Time

The length of time that the parent material has been in place and that the forces of climate and vegetation have been active is an important factor in soil formation. It has influenced the degree of weathering of minerals and the formation of soil structure.

All of the glacial till and outwash material has weathered for approximately the same amount of time. Differences in soils, therefore, are caused mainly by differences in microclimate, topography, and vegetation. Genesee, Eel, and other soils on flood plains constantly receive new floodwater deposits. Thus, they have had little chance to develop horizons other than those having an accumulation of organic matter.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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	More than 9

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

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 frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

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 coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Coprogenous. Designating the influence of animal excrement, as of the earthworm, in forming soil, especially humus.

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. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Delta. An alluvial deposit, commonly triangular in shape, formed largely beneath water and deposited at the mouth of a river or stream.

Depth to rock. Bedrock at a depth that adversely affects 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 for 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, as for example in "hillpeats" and "climatic moors."

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 running 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 a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Favorable. Favorable soil features for the specified use.

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.

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.*

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.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of 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. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered 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.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Frost action. Freezing and thawing of soil moisture. Frost action can damage 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 assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, 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 by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

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 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (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, which is the upper limit of saturation.

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.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

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 A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

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.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

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.

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.

Landslide. The rapid downhill movement of a mass of soil and loose rock generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy 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. 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 mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three single 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.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

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.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

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. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in 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 a semisolid to a plastic state.

Ponding. Temporary accumulation of water in closed depressions or in flat areas in the upper part of drainage basins.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is 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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Soil scientists regard as soil only the part of the regolith that is modified by organisms and other soil-building forces. Most engineers describe the whole regolith, even to a great depth, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that 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: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0

to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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).

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. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. 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."

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 or management.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, 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. 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 condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within 1 year; specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in a glacial lake or other body of still water in front of a glacier.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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 a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Illustrations

Figure 1.—Corn on Blount silt loam, 0 to 2 percent slopes.

Figure 2.—Wooded area of Blount silt loam, 2 to 6 percent slopes. Trees are mixed oak, predominantly white oak and red oak.

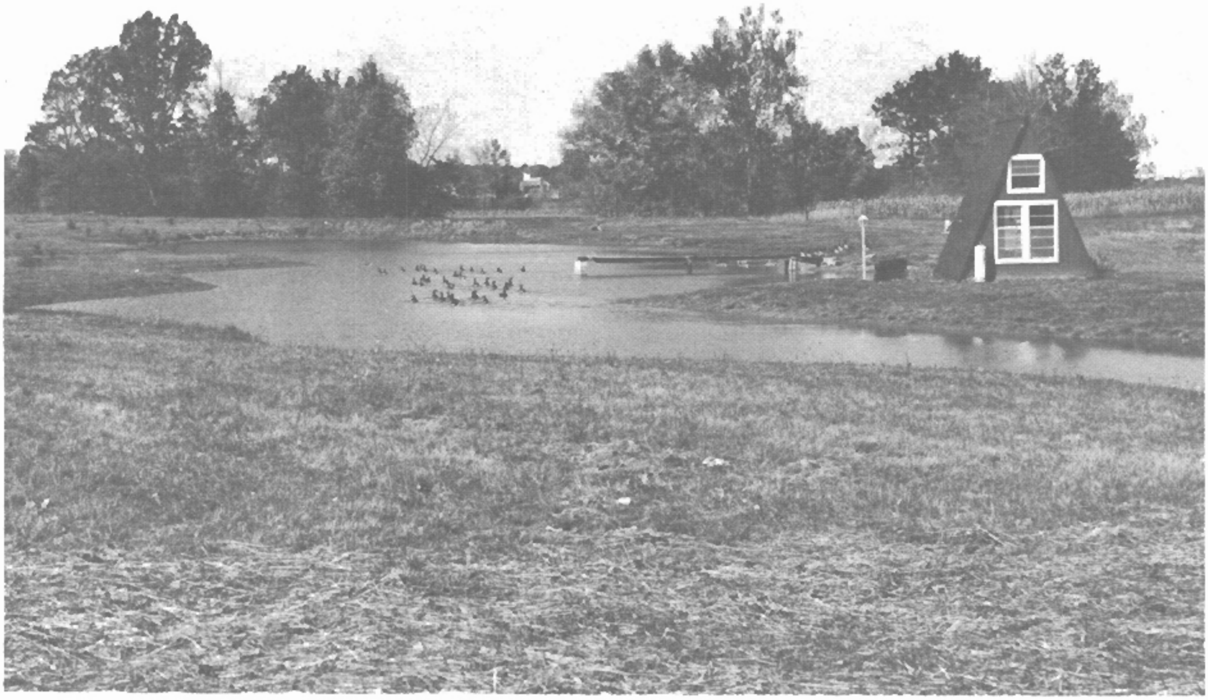

Figure 3.—Pond constructed in a drainageway in Blount silt loam, 2 to 6 percent slopes. The pond helps to control storm water runoff and reduces the hazard of downstream erosion.

Figure 4.—Muskmelons on Genesee silt loam. This soil is well suited to specialty crops.

Figure 5.—Potatoes in a drained area of Montgomery silty clay.

Figure 6.—Soybeans on Pewamo silty clay loam. The light colored Blount soils are in the background.

Figure 7.—Preparing a seedbed for wheat by disking soybean residue on Pewamo silty clay loam. Returning crop residue to the soil improves tilth and maintains organic-matter content.

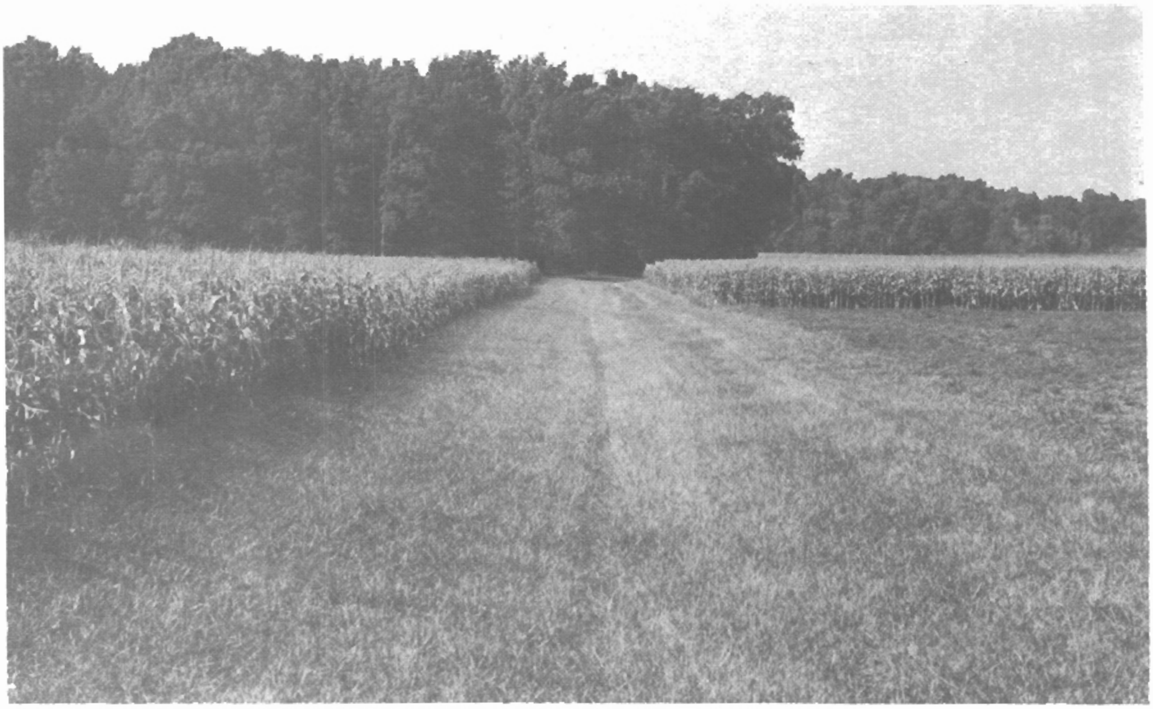

Figure 8.—Grassed waterway on Pewamo and Blount soils. Grassed waterways help to control erosion and runoff.

Figure 9.—Harvesting wheat on Pewamo silty clay loam and Blount silt loam, 0 to 2 percent slopes. Wheat is one of the small grains commonly grown in the county.

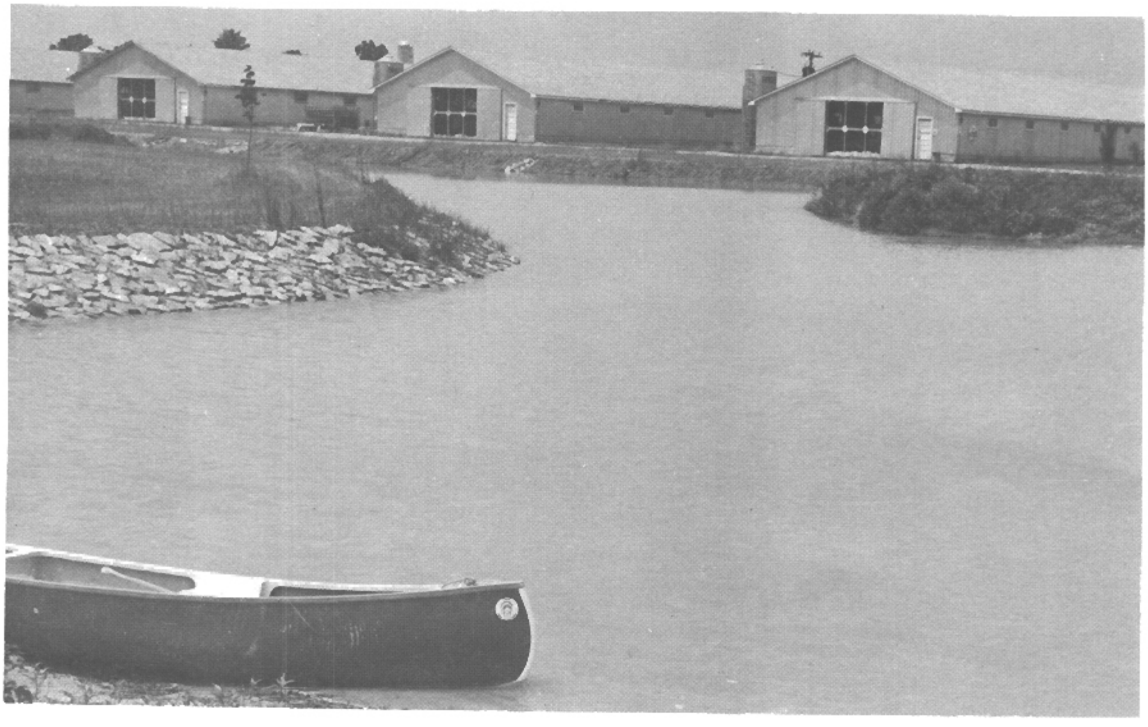

Figure 10.—A dugout pond on Pewamo and Blount soils. Dugout ponds provide recreation opportunities and are a potential water supply for livestock and firefighting.