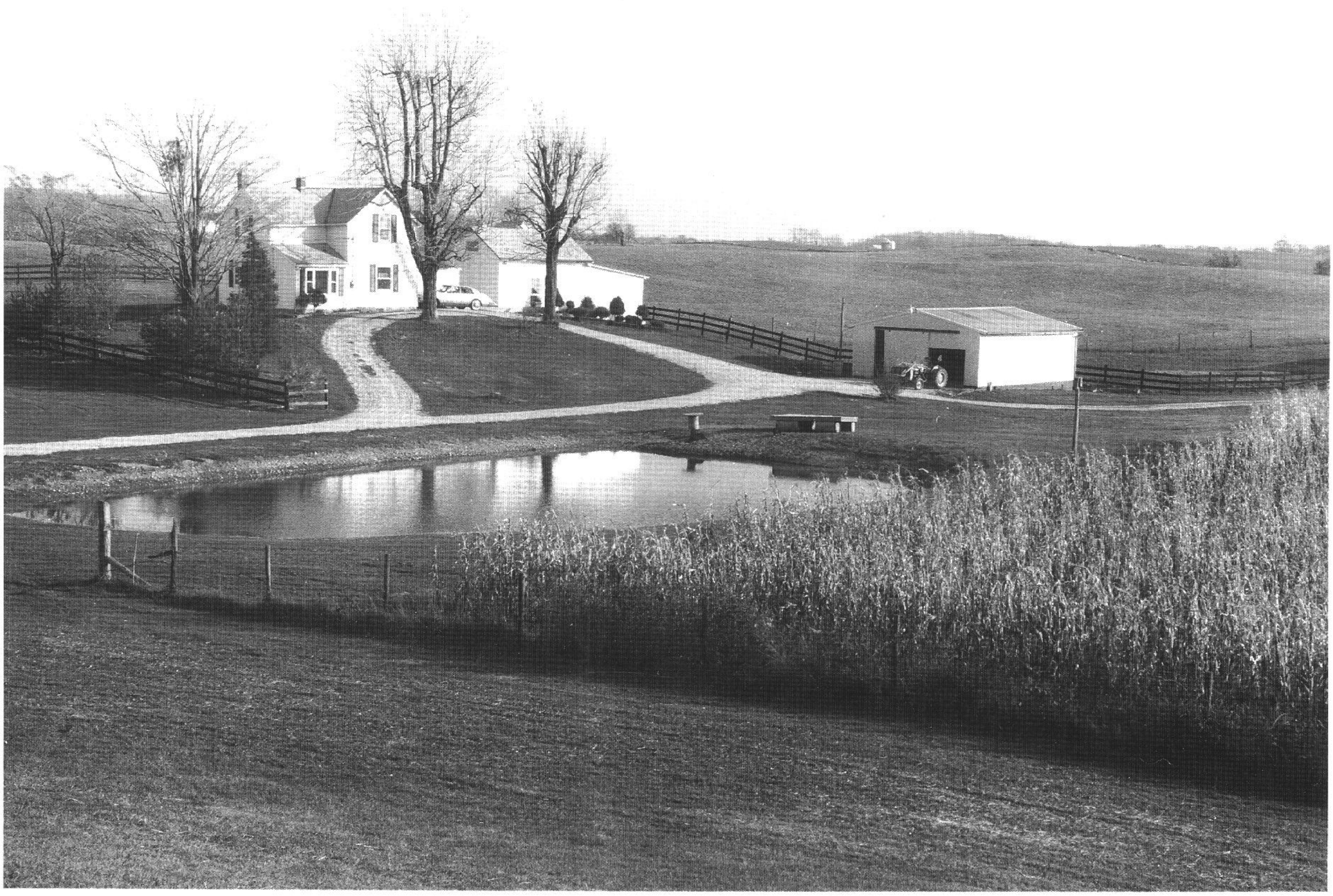
United States Department of Agriculture

Soil Conservation Service

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

Soil Survey of Morrow County, Ohio



How To Use This Soil Survey

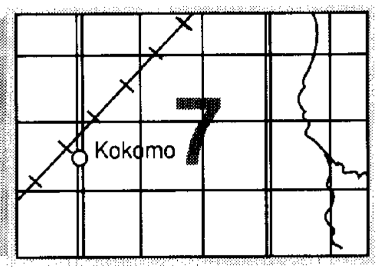
General Soil Map

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

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

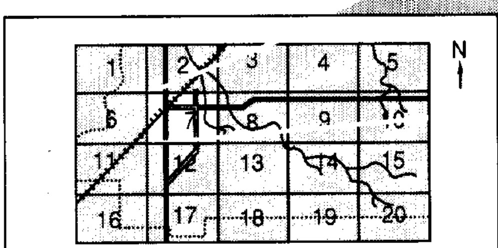
Detailed Soil Maps

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



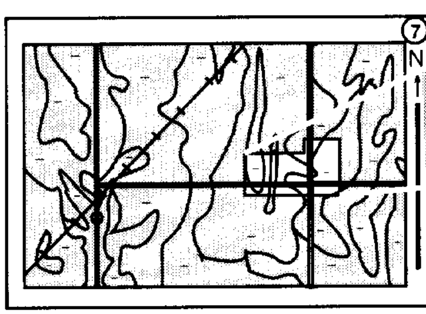
MAP SHEET

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



INDEX TO MAP SHEETS

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



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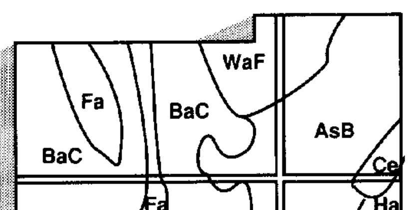

AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Morrow Soil and Water Conservation District. Financial assistance was provided by the Morrow County Commissioners.

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

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

Cover: An area of Centerburg silt loam, 6 to 12 percent slopes, in Morrow County used as cropland and for building site development.

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Issued September 1993

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Foreword

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

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

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

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

Joseph C. Branco
State Conservationist
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Soil Survey of Morrow County, Ohio

By R.M. Gehring, D.N. McClure, and S.C. Hacker, Soil Conservation Service

Fieldwork by R.M. Gehring, D.N. McClure, S.C. Hacker, and N.H. Martin, Soil Conservation Service

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

MORROW COUNTY is in central Ohio (fig. 1). It has an area of 258,112 acres, or 403 square miles. Mt. Gilead, which is in the center of the county, is the county seat and the largest town in the county. In 1980, the population of the county was 26,476 and the population of Mt. Gilead was 2,894 *(23)*. The headwaters of the Kokosing and Olentangy Rivers and Big Walnut and Alum Creeks are in the county.

Most of the land is used for cash-grain farming. The main crops are soybeans, corn, and small grain. Nonfarm development has increased in recent years. Most of this development has been in the southern part of the county because of the proximity to Columbus.

Figure 1.—Location of Morrow County in Ohio.

General Nature of the County

This section gives general information about the county. It describes history; climate; geology; agriculture; and physiography, relief, and drainage.

History

The earliest known residents of Morrow County were the Mound Builders. Early settlers in Chester and Canaan Townships discovered several examples of the mounds that the Indians built. After the Mound Builders, the Iroquois, Delaware, Shawnee, Wyandot, and Ottawa Indian tribes inhabited the survey area.

In 1807, the earliest permanent settlement was established within the present limits of Chester Township, along the banks of the Kokosing River. During the next several years, much of the county was settled by people from Knox, Perry, and Muskingum Counties and from Connecticut, Maryland, New Jersey, Pennsylvania, and Virginia.

On February 24, 1848, Morrow County was officially formed from the outlying parts of Marion, Richland, Knox, and Delaware Counties.

Initially, the settlers cultivated the soils along streams and in the higher areas of moraines. They started farms by clearing 3- to 5-acre plots of woodland and planting corn, flax, wheat, or pasture species. Later, as more of the woods were cleared, they brought in livestock, drained wet spots, and planted orchards. Most of the early crops were consumed locally because the roads were in too poor condition to be used to transport the crops. In 1848, the transportation problem was partly solved when a railroad was built through the villages of Cardington and Edison *(14)*.

Warren G. Harding, the 29th President of the United States, was born near Blooming Grove on November 2, 1865. He served in the Ohio Senate, as Lieutenant Governor of Ohio, and in the United States Senate before being elected President in 1920.

Morrow County has remained a dominantly rural county. Because the county is close to nearby metropolitan areas, however, residential development has increased in recent years.

Climate

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

Morrow County is cold in the winter and quite warm in the summer. Precipitation in the winter, mainly in the form of snow, results in a good accumulation of soil moisture by spring and thus minimizes drought during the summer in most of the soils. The normal annual precipitation is adequate for all of the crops that are suited to the temperature and growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Marion, Ohio, in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 27 degrees F and the average daily minimum temperature is 19 degrees. The lowest temperature on record, which occurred at Marion on February 26, 1963, is -23 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 2, 1966, is 101 degrees.

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

The total annual precipitation is about 34 inches. Of this, about 20 inches, or nearly 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 3.94 inches at Marion on July 10, 1969. Thunderstorms occur on about 40 days each year. Tornadoes and severe thunderstorms strike occasionally. These storms are generally local in extent and of short duration and cause damage in scattered, small areas.

The average seasonal snowfall is about 26 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 25 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 70 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 13 miles per hour, in winter.

Geology

During the Pleistocene epoch of the Cenozoic era, Morrow County was covered by several large continental glaciers. The last glacier to cover the county was the Wisconsin glacier, which melted about 15,000 to 16,000 years ago. The Wisconsin-age glacial drift completely covers the earlier glacial deposits, and all of the surface drift is Wisconsin age *(8)*. The drift is as much as 300 feet or more thick in the eastern part of the county and ranges from 22 to 167 feet in thickness in the western part *(15)*.

The glacial till that covers the western third of Morrow County has more limestone and dolomite than that in the rest of the county, and the glacial till that covers the eastern two-thirds of the county has more sandstone and shale. In the western third of the county the glacial till is highly calcareous. It is only slightly calcareous in the rest of the county.

Morrow County is traversed by four end moraines—the Mississinewa, the Broadway, the Powell, and the Johnstown. These end moraines represent periods when the glacial fronts were stationary for a considerable length of time, allowing thick masses of debris to form at the front edge of the ice. They generally are expressed topographically by a very definite ridge or by a series of low, hummocky mounds. The material in these moraines is a mixture of sand, silt, and clay and erratic boulders of various sizes. Ground moraines are the flatter areas between the end moraines *(9)*.

Most of the sorted deposits are along drainageways. These deposits of sand and gravel were laid down as the glaciers melted and the meltwater carried and deposited outwash material along the edge of the streams flowing from the face of the glacier.

The bedrock underlying the glacial drift is sandstone and shale of Devonian and Mississippian age *(4)*. Shale bedrock is exposed on the very steep hillsides along Alum Creek in the southern part of the county. Sandstone bedrock crops out on some of the steep hillsides along drainageways in the northeastern part of the county and along the Allegheny escarpment, which runs north to south through the center of the county.

Agriculture

Morrow County had 1,010 farms in 1984, compared with 1,560 in 1970 *(6)*. While the number of farms decreased, the average size of the farms increased to 172 acres. The acreage of woodland and pasture has decreased in recent years because some of it has been converted to cultivated land.

In 1984, the principal crops harvested were soybeans on 52,800 acres, corn on 46,000 acres, wheat on 10,000 acres, and hay on 12,000 acres. The sale of grain is the major source of farm income. Beef and dairy cattle, hogs, and sheep are also raised. Morrow County ranks ninth in the state in the number of sheep raised.

In the western half of Morrow County, the soils are generally nearly level to gently sloping. Most farms are cash-grain operations, and most operators are full-time farmers.

In the eastern half of the county, the soils are generally gently sloping to moderately steep. Farming is more diversified than in the western half. More livestock is being raised, more hay is grown, and a larger acreage is in pasture. Farms typically are smaller in size, and many farmers also work away from the farm. Most of the dairies in the county are in the eastern half.

Physiography, Relief, and Drainage

Morrow County is in two physiographic provinces. The western half of the county is in the Interior Low Plains province and the eastern half is in the Allegheny Plateau province *(7)*. The Allegheny escarpment, which runs north to south, separates the two provinces.

In the western half of the county, the greatest extent of relief is along drainageways. The average relief is about 15 feet, and the maximum relief is about 50 feet. In the eastern half of the county, the average relief is about 50 feet and the maximum relief is about 100 feet.

Several streams drain the county. They include the Kokosing River in the eastern part, Big Walnut Creek and Alum Creek in the central part, Whetstone Creek in the western part, and the tributaries of the Olentangy River in the northwestern part. Morrow County is in two major watersheds—the Muskingum River Basin, which includes the Kokosing River and Clear Fork Basins, and the Scioto River Basin, which includes the Big Walnut Creek and Olentangy River Basins *(15)*.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

Survey Procedures

The general procedures followed in making this survey are described in the "National Soils Handbook" of the Soil Conservation Service. The soil maps made for conservation planning on individual farms prior to the start of the project soil survey were among the references used.

Before the fieldwork began, preliminary boundaries of slopes and landforms were stereoscopically plotted on aerial photographs taken in 1981 at a scale of 1:40,000 and enlarged to a scale of 1:15,840. USGS topographic maps, at a scale of 1:24,000, were studied to relate land and image features. A reconnaissance was then made by pickup truck before the surface was traversed.

As they mapped the county, soil scientists traversed the landscape on foot to examine the soils. In areas where the soil pattern is very complex, such as the Centerburg-Bennington and Amanda-Centerburg associations, the traverses were at intervals as close as 200 yards. In areas where the soil pattern is relatively simple, such as the Blount-Pewamo and Glynwood-Blount associations, the traverses were about a quarter of a mile apart.

As the traverses were made, the soil scientists divided the landscape into segments based on the use and management of the soils. For example, a hillside would be separated from a swale or a gently sloping ridgetop from a very steep side slope.

In most areas soil examinations along the traverses were made at points 100 to 800 yards apart, depending on the landscape and soil pattern *(12)*.

Observations of such items as landforms, blown-down trees, vegetation, roadbanks, and animal burrows were made continuously without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. With the aid of a hand auger, spade, or hydraulic probe truck, the soil material was examined to a depth of about 6 feet or to bedrock within a depth of 6 feet. The pedons described as typical were studied in pits that were dug with shovels and spades.

At the beginning of the survey, sample areas were selected to represent the major landscapes in the county. The rate of mapping in these areas was roughly half of that in the rest of the county. Extensive notes were taken on the composition of map units in these preliminary study areas. These notes were modified as mapping progressed and a final assessment of the composition of the individual map units was made. Some transects were made by the hydraulic probe truck to determine the composition of map units and to help select sites for representative pedons.

Samples for chemical analysis and for analysis of engineering properties were taken from representative sites of several of the soils in the county. The chemical analysis was made by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The results of the analysis are stored in a computerized data file at the laboratory. The analysis of engineering properties was made by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section, Columbus, Ohio. A description of the laboratory procedures can be obtained on request from the laboratories. The results of laboratory analyses also can be obtained from the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the State Office of the Soil Conservation Service, Columbus, Ohio.

After completion of the soil mapping on aerial photographs, map unit delineations were transferred by hand to another set of the same photographs during map finishing. Surface drainage was mapped in the field. Cultural features were recorded from visual observations.

General Soil Map Units

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

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

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

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in soil series concepts and the application of the latest soil classification system.

Soils Formed in Glacial Till on Uplands

These soils make up about 96 percent of the county. They are very poorly drained to well drained soils in landscape positions ranging from nearly level depressions and broad flats on ground moraines to moderately steep side slopes on end moraines and dissected parts of ground moraines. These soils are used mainly as cropland, pasture, and woodland. The seasonal wetness, ponding, erosion, the slope, and the moderately slow or slow permeability are the major management concerns.

1. Blount-Pewamo Association

Nearly level and gently sloping, somewhat poorly drained and very poorly drained soils formed in moderately fine textured glacial till

These soils generally are on extensive broad flats, in depressions, and along drainageways on ground moraines. In some areas they are on slight rises and on low knolls and ridges that have drainageways and a few closed depressions. Most areas are transected by drainage ditches and small streams.

This association makes up about 17 percent of the county. It is about 50 percent Blount soils, 30 percent Pewamo soils, and 20 percent soils of minor extent (fig. 2).

Blount soils are nearly level and gently sloping and are somewhat poorly drained. They are on slight rises, on low knolls and ridges, and on broad flats. Permeability is slow or moderately slow. The seasonal high water table is between depths of 12 and 36 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is silty clay and clay. The potential for frost action is high. The content of organic matter is moderate.

Pewamo soils are nearly level and very poorly drained. They are on the lower part of broad flats, along drainageways, and in depressions. Permeability is moderately slow. The seasonal high water table is near or above the surface during wet periods. Typically, the surface layer is silty clay loam. The subsoil also is silty clay loam. The potential for frost action is high. The content of organic matter also is high.

The minor soils in this association include the moderately well drained Glynwood soils, the well drained Gallman soils, and the somewhat poorly drained Sleeth soils. Sleeth and Gallman soils have less clay in the subsoil and underlying material than the major soils. They are on slight rises and low knolls on terraces along streams. Glynwood soils are in gently sloping and moderately sloping areas along drainageways.

Most areas of this association are used for corn, soybeans, or small grain. A few small areas are used as pasture or woodland. If drained, these soils are well suited to cultivated crops. They are moderately well suited, poorly suited, or generally unsuited to buildings and poorly suited or generally unsuited to septic tank absorption fields.

The wetness and compaction are the main limitations affecting farming. Ponding is common on the Pewamo

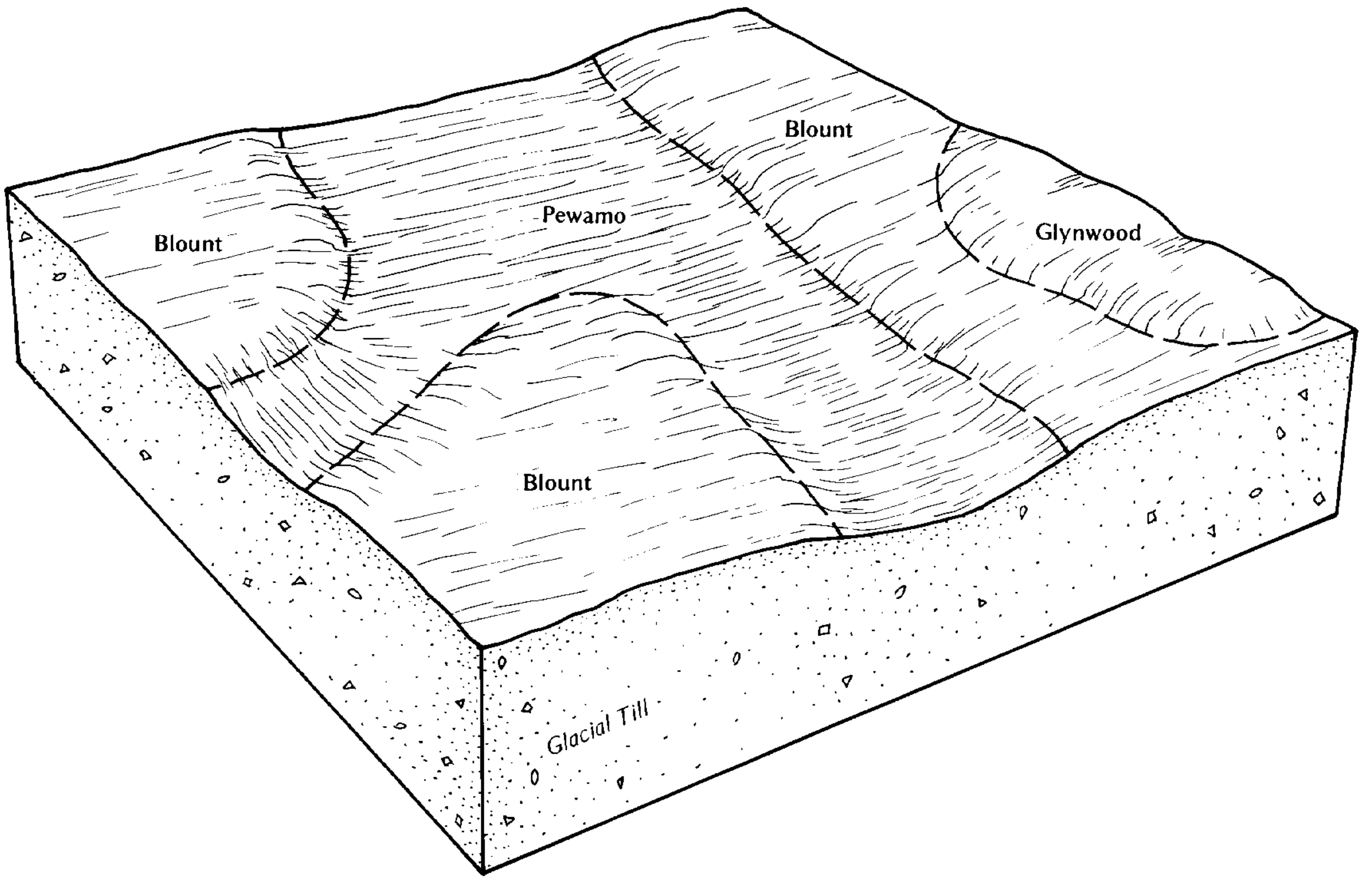

Figure 2.—Typical pattern of soils in the Blount-Pewamo association.

soils in winter and spring and after intense rains. The ponding, the wetness, the moderately slow or slow permeability, low strength, and the high potential for frost action are the main limitations affecting building site development and septic tank absorption fields.

2. Glynwood-Blount Association

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

These soils are in hummocky areas on end moraines and dissected parts of ground moraines. Most areas have long and gentle slopes and numerous waterways. Narrow flood plains are along the larger streams.

This association makes up 11 percent of the county. It is about 40 percent Glynwood soils, 25 percent Blount soils, and 35 percent soils of minor extent.

Glynwood soils are gently sloping and moderately sloping and are moderately well drained. They are on side slopes along drainageways and on nearby knolls and ridges. Permeability is slow. The seasonal high water table is between 24 and 42 inches during extended wet periods. Typically, the surface layer is clay loam. The subsoil is clay. The potential for frost action is high. The content of organic matter is moderately low.

Blount soils are nearly level and gently sloping and are somewhat poorly drained. They are on broad flats and slight rises. Permeability is slow or moderately slow. The seasonal high water table is between depths of 12 and 36 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is silty clay and clay. The potential for frost action is high. The content of organic matter is moderate.

The minor soils in this association include the well drained Gallman and Morley soils, the somewhat poorly drained Shoals soils, and the very poorly drained Pewamo soils. Gallman soils have less clay in the subsoil and underlying material than the major soils.

They are on stream terraces. Morley soils are on the steeper parts of the slopes. Pewamo soils are in depressions. Shoals soils formed in alluvium and are on flood plains along the major streams.

The soils in this association are used mainly for corn, soybeans, or small grain. A few small areas are used as pasture or woodland. If protected against erosion and adequately drained, the nearly level and gently sloping soils are well suited or moderately well suited to cultivated crops. The moderately sloping soils are poorly suited to cultivated crops. The soils in this association are moderately well suited to buildings and poorly suited to septic tank absorption fields.

Erosion, wetness, and compaction are the main limitations affecting farming. The wetness, the moderately slow or slow permeability, low strength, and the high potential for frost action are the main limitations affecting building site development and septic tank absorption fields.

3. Centerburg-Bennington Association

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

These soils generally are in gently undulating to gently rolling areas on ground moraines and end moraines. In some areas they are on low knolls and ridges that have drainageways and a few depressions. Most areas are transected by small streams.

This association makes up about 40 percent of the county. It is about 50 percent Centerburg soils, 25 percent Bennington soils, and 25 percent soils of minor extent (fig. 3).

Centerburg soils are gently sloping and moderately sloping and are moderately well drained. They are on knolls and ridges and on side slopes along drainageways. Permeability is moderately slow. The seasonal high water table is between depths of 18 and

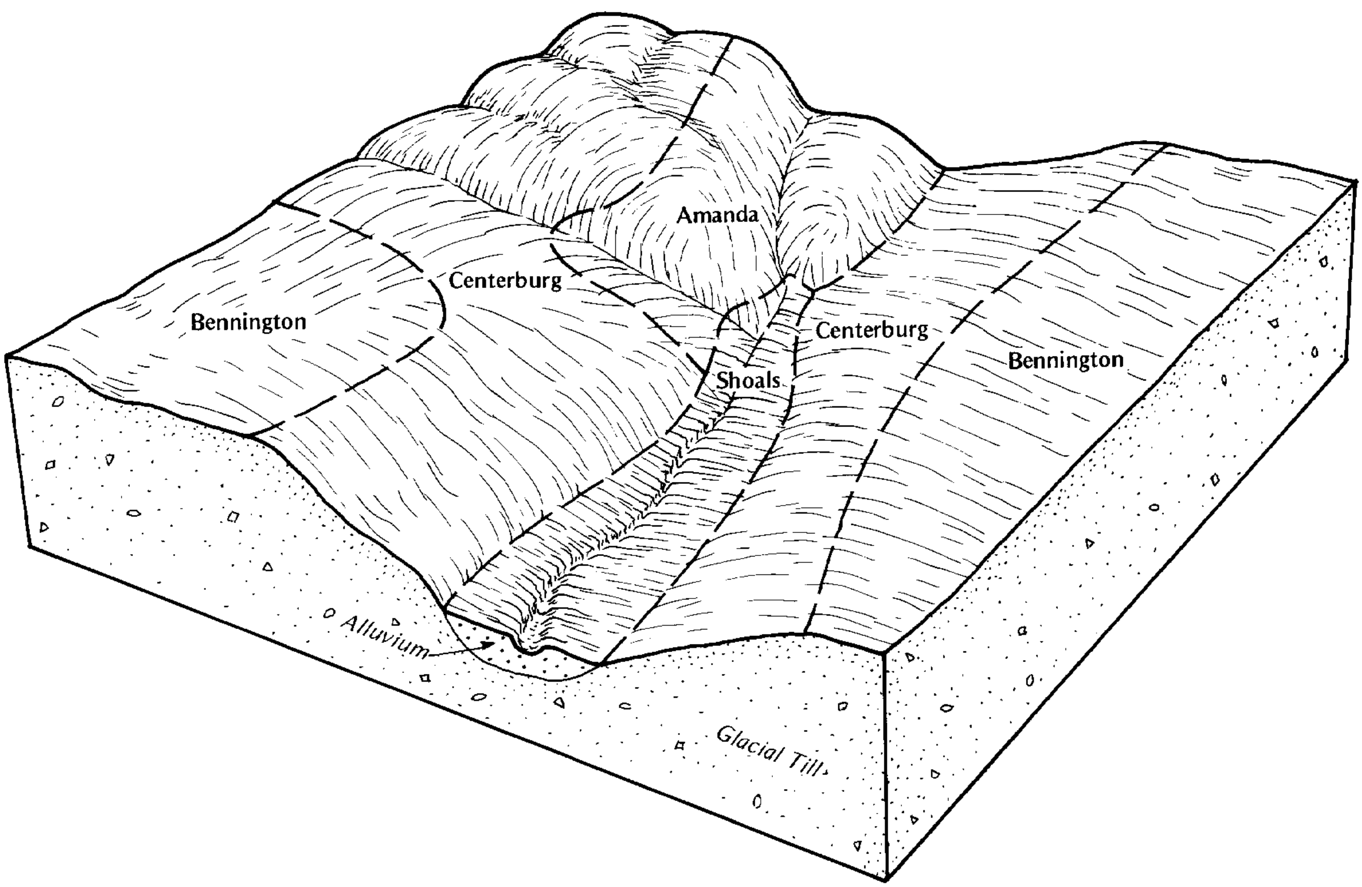

Figure 3.—Typical pattern of soils in the Centerburg-Bennington association.

36 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is clay loam and silt loam. The potential for frost action is high. The content of organic matter is moderate or moderately low.

Bennington soils are nearly level and gently sloping and are somewhat poorly drained. They are on flats, low knolls, and ridges in the uplands. Permeability is slow. The seasonal high water table is between depths of 12 and 30 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is silty clay loam and loam. The potential for frost action is high. The content of organic matter is moderate.

The minor soils in this association include Amanda, Condit, and Shoals soils. The well drained Amanda soils are on hillslopes and side slopes along streams. The poorly drained Condit soils are in minor depressions and along drainageways. The somewhat poorly drained Shoals soils formed in alluvium and are on narrow flood plains.

Most areas of this association are used for corn, soybeans, or small grain. A few small areas are used as pasture or woodland. If protected against erosion and adequately drained, these soils are well suited to cultivated crops. They are moderately well suited to buildings and poorly suited to septic tank absorption fields.

Erosion, the wetness, and the moderate or moderately low content of organic matter are the main limitations affecting farming. The wetness, the moderately slow or slow permeability, low strength, and the high potential for frost action are the main limitations affecting building site development and septic tank absorption fields.

4. Amanda-Centerburg Association

Gently sloping to moderately steep, well drained and moderately well drained soils formed in medium textured glacial till

These soils are in undulating to hilly areas on ground moraines and end moraines. In most areas they are on gently sloping and moderately sloping knolls and ridges along drainageways. Most areas are transected by small streams.

This association makes up about 12 percent of the county. It is about 45 percent Amanda soils, 35 percent Centerburg soils, and 20 percent soils of minor extent (fig. 4).

Amanda soils are gently sloping to moderately steep and are well drained. They are on knolls and ridges and on side slopes along drainageways. Permeability is moderately slow. The seasonal high water table is below a depth of 48 inches. Typically, the surface layer is silt loam. The subsoil is clay loam, loam, and silt loam. The potential for frost action is moderate or moderately low. The content of organic matter also is moderate or moderately low.

Centerburg soils are gently sloping and moderately sloping and are moderately well drained. They are on knolls and ridges and on hillslopes along drainageways. Permeability is moderately slow. The seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is clay loam and silt loam. The potential for frost action is high. The content of organic matter is moderate or moderately low.

The minor soils in this association include Bennington, Condit, and Shoals soils. The somewhat poorly drained Bennington soils are on slight rises and low knolls. The poorly drained Condit soils are in depressions and along drainageways. The somewhat poorly drained Shoals soils formed in alluvium and are on flood plains along narrow streams.

Most areas of this association are used for corn, soybeans, or small grain. Many of the steeper areas are used as pasture or woodland. If protected against erosion, the gently sloping and moderately sloping soils are well suited or moderately well suited to cultivated crops. The soils in this association are well suited to woodland. The gently sloping and moderately sloping soils are moderately well suited or well suited to buildings and moderately well suited or poorly suited to septic tank absorption fields. The strongly sloping and moderately steep soils are poorly suited or generally unsuited to buildings and septic tank absorption fields.

Erosion, runoff, and the moderate or moderately low content of organic matter are the main limitations affecting farming. The moderately slow permeability, the slope, and the wetness are the main limitations affecting building site development and septic tank absorption fields.

5. Wadsworth-Condit Association

Nearly level and gently sloping, somewhat poorly drained and poorly drained soils formed in moderately fine and medium glacial till

These soils are generally on broad flats on ground moraines. In some areas they are on slight rises and low knolls and in a few closed depressions.

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

Wadsworth soils are nearly level and gently sloping and are somewhat poorly drained. They are on broad flats, slight rises, and low knolls and ridges. They have

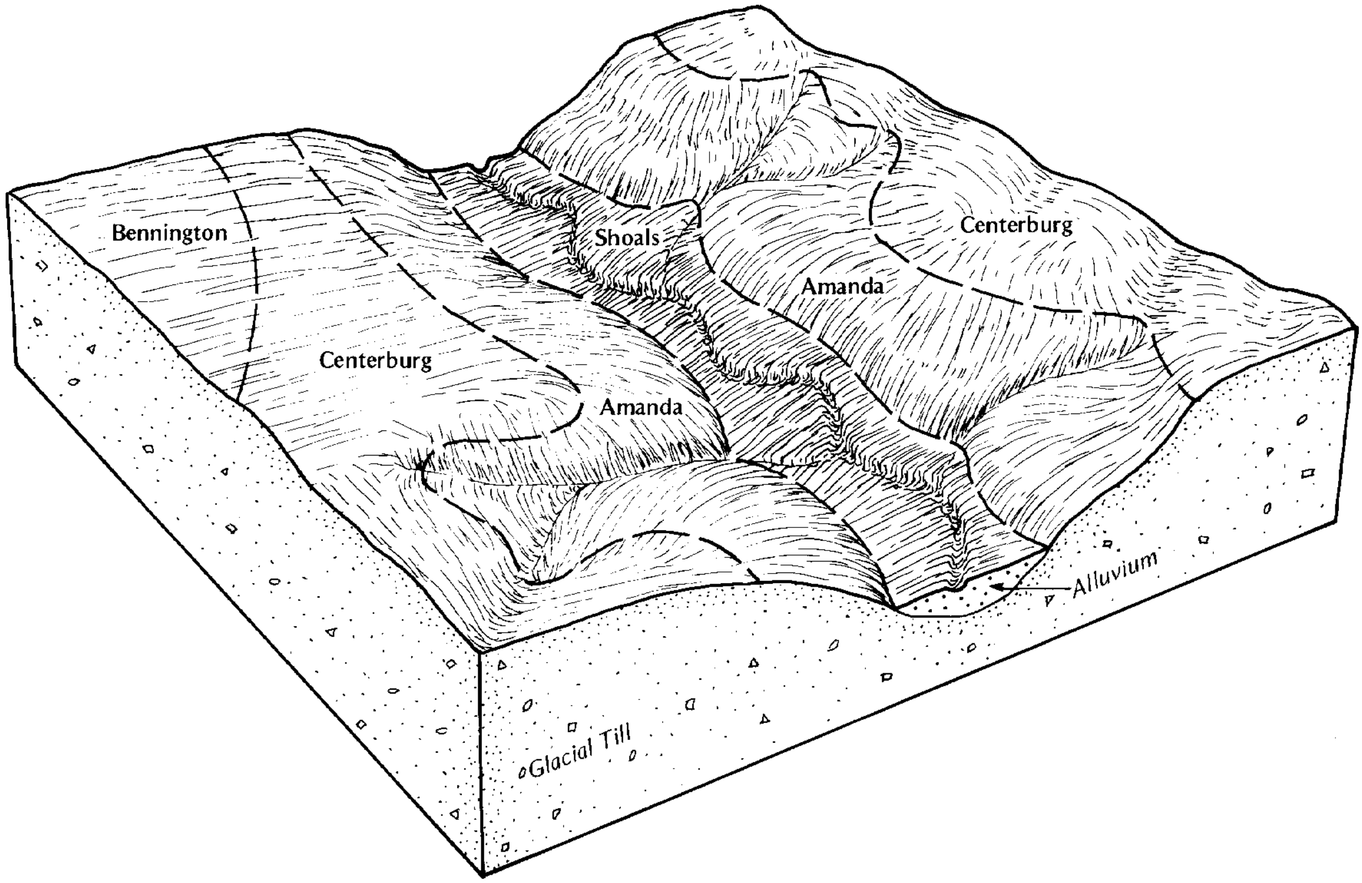

Figure 4.—Typical pattern of soils in the Amanda-Centerburg association.

a fragipan. Permeability is moderately slow or moderate above the fragipan and slow or very slow in the fragipan. The seasonal high water table is between depths of 12 and 24 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is silty clay loam, loam, and clay loam. The potential for frost action is high. The content of organic matter is moderate.

Condit soils are nearly level and poorly drained. They are on the lower part of broad flats, along drainageways, and in depressions. Permeability is slow. The seasonal high water table is near or above the surface during wet periods. Typically, the surface layer is silt loam. The subsoil is clay loam. The potential for frost action is high. The content of organic matter is moderate.

The minor soils in this association include the moderately well drained Centerburg and Rittman soils on low knolls and ridges and the somewhat poorly drained Shoals soils on narrow flood plains along small streams.

Most areas of this association are used for corn, soybeans, or small grain. A few small areas are used as pasture or woodland. If drained, these soils are moderately well suited to cultivated crops and no-till farming. They are poorly suited or generally unsuited to most kinds of building site development and generally unsuited to septic tank absorption fields.

Wetness, ponding, and compaction are the main limitations affecting farming. The ponding, the wetness, and the slow or very slow permeability are limitations affecting building site development and septic tank absorption fields.

6. Rittman-Bennington Association

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

These soils are on broad, undulating plains on end moraines and ground moraines that have low hills and ridges. Most areas are transected by small streams.

This association makes up about 5 percent of the county. It is about 50 percent Rittman soils, 35 percent Bennington soils, and 15 percent soils of minor extent.

Rittman soils are gently sloping and moderately sloping and are moderately well drained. They are on undulating knolls, ridges, and the steeper hillslopes. They have a fragipan at a depth of 18 to 36 inches. The fragipan restricts root growth and water movement. Permeability is moderate above the fragipan and slow in the fragipan. The seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is clay loam and loam. The potential for frost action is high. The content of organic matter is moderate or moderately low.

Bennington soils are nearly level and gently sloping and are somewhat poorly drained. They are on slight rises, on low knolls, and in nearly level areas. Permeability is slow. The seasonal high water table is between depths of 12 and 30 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is silty clay loam and loam. The potential for frost action is high. The content of organic matter is moderate.

The minor soils in this association include Condit, Shoals, and Wooster soils. The somewhat poorly drained Shoals soils are on flood plains. The poorly drained Condit soils are in depressions and along drainageways. The well drained Wooster soils are on the steeper parts of slopes.

Most areas of this association are used for corn, soybeans, or small grain. Some areas are used for small woodlots and pasture. If protected against erosion and adequately drained, these soils are moderately well suited or well suited to cultivated crops. They are moderately well suited to buildings and poorly suited to septic tank absorption fields.

Erosion, wetness, and compaction are the main limitations affecting farming. The wetness, the slow permeability, and the high potential for frost action are the main limitations affecting building site development and septic tank absorption fields.

7. Canfield-Wooster Association

Gently sloping to moderately steep, moderately well drained and well drained soils formed in medium textured glacial till

These soils are on low knolls, slopes along drainageways, and convex ridgetops on end moraines and ground moraines. Most areas are transected by small, narrow streams.

This association makes up about 5 percent of the county. It is about 55 percent Canfield soils, 15 percent Wooster soils, and 30 percent soils of minor extent.

Canfield soils are moderately well drained and are gently sloping and moderately sloping. They are on knolls and side slopes. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. The seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is loam. The potential for frost action is high. The content of organic matter is moderate to low.

Wooster soils are well drained and are gently sloping to moderately steep. They are on side slopes and ridgetops. They have a fragipan. Permeability is moderately slow in the fragipan. The seasonal high water table is between depths of 30 and 48 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is loam, clay loam, silt loam, and gravelly loam. The content of organic matter is moderate or moderately low.

The minor soils in this association include the poorly drained Condit soils, the somewhat poorly drained Shoals and Bennington soils, and the well drained Chili soils. Condit soils are in depressions. Shoals soils formed in alluvium and are on narrow flood plains. Bennington soils are in low areas and at the base of slopes. Chili soils formed in outwash and are on terraces along streams.

Most of the gently sloping and moderately sloping soils in this association are used for corn, soybeans, or small grain. Most of the strongly sloping and moderately steep soils are used as pasture or woodland. The gently sloping soils are well suited to cultivated crops, but the moderately sloping to moderately steep soils are moderately well suited, poorly suited, or generally unsuited. The gently sloping and moderately sloping soils are moderately well suited or well suited to most kinds of building site development and moderately well suited or poorly suited to septic tank absorption fields. The strongly sloping and moderately steep soils are poorly suited or generally unsuited to septic tank absorption fields.

Compaction, erosion, and the moderate or moderately low content of organic matter are the major limitations affecting farming. The slope, the wetness, and the moderately slow or slow permeability are limitations affecting building site development and septic tank absorption fields.

8. Rittman-Wooster Association

Gently sloping to moderately steep, moderately well drained and well drained soils formed in moderately fine and medium textured glacial till

These soils are generally in undulating to hilly areas on end moraines and ground moraines that have low hills and ridges. In some areas they are on steep hillslopes along narrow valleys.

This association makes up about 5 percent of the county. It is about 55 percent Rittman soils, 25 percent Wooster soils, and 20 percent soils of minor extent.

Rittman soils are moderately well drained and are gently sloping and moderately sloping. They are on ridgetops and side slopes in the uplands. They have a fragipan at a depth of 18 to 36 inches. The fragipan restricts root growth and water movement. Permeability is moderate above the fragipan and slow in the fragipan. The seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is clay loam and loam. The potential for frost action is high. The content of organic matter is moderate or moderately low.

Wooster soils are gently sloping to moderately steep and are well drained. They are on hillslopes along drainageways and on the steeper ridges. They have a fragipan at a depth of 24 to 36 inches. The fragipan restricts plant roots and water movement. Permeability is moderate above the fragipan and moderately slow in the fragipan. The seasonal high water table is between depths of 30 and 48 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil is loam, clay loam, silt loam, and gravelly loam. The potential for frost action is moderate. The content of organic matter is moderate or moderately low.

The minor soils in this association include the somewhat poorly drained Bennington and Shoals soils and the well drained Chili soils. Bennington soils are in low areas and at the base of slopes. Shoals soils formed in alluvium and are on flood plains along narrow streams. Chili soils are on terraces along larger streams.

Most areas of this association are used for corn, soybeans, or small grain. A few small areas are used as pasture, and most of the steeper areas are wooded. If protected against erosion, the gently sloping and moderately sloping soils are well suited or moderately well suited to cultivated crops. The strongly sloping and moderately steep soils are poorly suited or generally unsuited to cultivated crops. The soils in this association are well suited to woodland. The gently sloping and moderately sloping soils are moderately well suited or well suited to buildings and poorly suited or moderately well suited to septic tank absorption fields.

Erosion and compaction are the main limitations affecting farming. The restricted permeability, the wetness, and the slope are the main limitations affecting building site development and septic tank absorption fields.

Soils Formed in Loess, Outwash, and Alluvium on Outwash Plains, Terraces, and Flood Plains

These soils make up about 4 percent of the county. They are very poorly drained to well drained soils on nearly level flood plains and gently sloping and moderately sloping terraces and outwash plains. These soils are used mainly as cropland. Flooding, the wetness, and erosion are the major land use limitations.

9. Shoals-Gallman-Sloan Association

Nearly level to moderately sloping, somewhat poorly drained, well drained, and very poorly drained soils formed in moderately fine to coarse textured alluvium and moderately fine to moderately coarse textured outwash

These soils generally are on narrow flood plains and on outwash plains and terraces. In some areas they are on slight rises, on low knolls, on ridges along drainageways, and along a few narrow drainageways.

This association makes up about 1 percent of the county. It is about 30 percent Shoals soils, 20 percent Gallman soils, 10 percent Sloan soils, and 40 percent soils of minor extent.

Shoals soils are nearly level and somewhat poorly drained. They are on narrow flood plains. Permeability is moderate. The seasonal high water table is between depths of 6 and 18 inches during extended wet periods. Typically, the surface layer is silt loam. The underlying material is silt loam, loam, and clay loam. The potential for frost action is high. The content of organic matter is moderately low.

Gallman soils are gently sloping and moderately sloping and are well drained. They are on ridges, hillslopes, and low knolls on outwash plains and terraces. Permeability is moderately rapid. Typically, the surface layer is silt loam. The subsoil is silty clay loam, clay loam, loam, silt loam, and gravelly clay loam. The potential for frost action is moderate. The content of organic matter is moderately low.

Sloan soils are nearly level and very poorly drained. They are on flood plains. Permeability is moderately slow or moderate. Typically, the surface layer is silty clay loam. The subsoil is silty clay loam, clay loam, and loam. The seasonal high water table is near the surface during extended wet periods. The potential for frost action is high. The content of organic matter also is high.

The minor soils in this association include the well drained Colyer Variant soils, the moderately well drained Glynwood and Lobdell soils, and the somewhat poorly drained Sleeth soils. Colyer Variant soils are on steep slope breaks to the uplands. Glynwood soils are on slopes in the uplands. Lobdell soils are in the slightly higher areas on the flood plains. Sleeth soils are on slight rises and broad flats on terraces along streams.

Most areas of this association are used for corn, soybeans, or small grain. Some areas are used as pasture or woodland. If protected against erosion, these soils are well suited or moderately well suited to cultivated crops. The soils on flood plains are generally unsuited to buildings and septic tank absorption fields. Gallman soils are well suited to buildings and septic tank absorption fields.

Flooding, the wetness, and erosion are the main limitations affecting farming. The flooding, the potential for frost action, and the slope are limitations affecting building site development and septic tank absorption fields.

10. Ockley-Lobdell Association

Nearly level to moderately sloping, well drained and moderately well drained soils formed in loess, moderately fine textured to coarse textured outwash, and medium textured to coarse textured alluvium

These soils are on undulating kame terraces and broad flood plains.

This association makes up about 1 percent of the county. It is about 55 percent Ockley soils, 20 percent Lobdell soils, and about 25 percent soils of minor extent.

Ockley soils are gently sloping and moderately sloping and are well drained. They are on knolls, ridges, and side slopes on stream terraces. Permeability is moderate in the subsoil and very rapid in the underlying material. Typically, the surface layer is silt loam. The subsoil is silty clay loam, gravelly clay loam, and gravelly sandy loam. The potential for frost action is moderate. The content of organic matter is moderate or moderately low.

Lobdell soils are nearly level and moderately well drained. They are on flood plains. Permeability is moderate. The seasonal high water table is between depths of 24 and 42 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil also is silt loam. The potential for frost action is high. The content of organic matter is moderate.

The minor soils in this association include the well drained Amanda soils and the somewhat poorly drained Sleeth and Shoals soils. Amanda soils are on slope breaks to the uplands. Sleeth soils are in low areas on nearly level stream terraces. Shoals soils are in the lower areas on the flood plains.

Most areas of this association are used for corn, soybeans, or small grain. A few small areas are used as pasture or woodland. If protected against erosion and flooding, these soils are moderately well suited or well suited to cultivated crops. The soils on terraces are well suited to buildings and septic tank absorption fields, but the soils on the flood plains are generally unsuited.

Erosion, flooding, and the moderate or moderately low content of organic matter are the main limitations affecting farming. Occasional flooding is a problem during the spring thaw and extended wet periods. The flooding and the instability of cutbanks are the main limitations affecting building site development and septic tank absorption fields.

11. Chili-Shoals-Lobdell Association

Nearly level to moderately sloping, well drained to somewhat poorly drained soils formed in coarse textured outwash and moderately fine to coarse textured alluvium

These soils are on narrow flood plains along small streams and on hummocky terraces.

This association makes up about 2 percent of the county. It is about 35 percent Chili soils, 20 percent Shoals soils, 10 percent Lobdell soils, and about 35 percent soils of minor extent.

Chili soils are gently sloping and moderately sloping and are well drained. They are on stream terraces. Permeability is moderately rapid. Typically, the surface layer is loam. The subsoil is loam, gravelly loam, and very gravelly loam. The potential for frost action is moderate. The content of organic matter also is moderate.

Shoals soils are nearly level and somewhat poorly drained. They are on narrow flood plains. Permeability is moderate. The seasonal high water table is between depths of 6 and 18 inches during extended wet periods. Typically, the surface layer is silt loam. The underlying material is silt loam, loam, and clay loam. The potential for frost action is high. The content of organic matter is moderate.

Lobdell soils are nearly level and moderately well drained. They are on flood plains. Permeability is moderate. The seasonal high water table is between depths of 24 and 42 inches during extended wet periods. Typically, the surface layer is silt loam. The subsoil also is silt loam. The potential for frost action is high. The content of organic matter is moderate.

The minor soils in this association include the well drained Amanda, Tioga, and Wooster soils, the moderately well drained Centerburg soils, and the somewhat poorly drained Sleeth soils. Amanda soils are on slope breaks to the uplands. Wooster soils have a fragipan and are in the uplands. Centerburg soils formed in glacial till and are in the uplands. Tioga soils are in the better drained positions on the flood plains.

Sleeth soils are in low areas on nearly level stream terraces.

Most areas of this association are used for corn, soybeans, or small grain. A few small areas are used as pasture or hayland. If protected from flooding and erosion, these soils are moderately well suited or well suited to cultivated crops. The soils on terraces are well suited to buildings and septic tank absorption fields. The soils on flood plains are generally unsuited to buildings and septic tank absorption fields.

Flooding, erosion, and wetness are the main limitations affecting farming. The flooding is an occasional problem during spring thaw and extended wet periods. The flooding and the instability of cutbanks are the main limitations affecting building site development and septic tank absorption fields.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Centerburg silt loam, 2 to 6 percent slopes, is a phase of the Centerburg series.

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

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

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Most differences result from a better knowledge of soils or from modifications and refinements in soil series concepts. Some differences result from the predominance of different soils in map units consisting of soils of two or more series and from variations in the range in slope allowed within the map units in different surveys.

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

Soil Descriptions

AdB—Amanda silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on knolls and the higher parts of end moraines and ground moraines. Most areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown and dark yellowish brown, firm silty clay loam, clay loam, and loam about 48 inches thick. The underlying material to a depth of about 80 inches is dark yellowish brown, calcareous, firm loam glacial till. In some areas the soil is moderately well drained. In other areas the surface layer is eroded. In a few areas the upper part of the subsoil is gravelly.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington soils are in low spots and at the base of knolls. The Chili soils are on knolls in hummocky areas. Their subsoil and underlying material have more sand and gravel than those in the Amanda soil. The poorly drained Condit soils are in depressions and along drainageways. Included soils make up 15 percent of some areas.

Runoff is medium on the Amanda soil. The content of organic matter is moderate. A perched seasonal high water table is below a depth of 48 inches during extended wet periods. Permeability is moderately slow. The available water capacity is high. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are used as cropland. A few areas are pastured, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Controlling erosion and increasing the rate of water infiltration and the content of organic matter are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, planting cover crops, and returning crop residue to the soil help to control erosion and increase the rate of water infiltration and the content of organic matter. Grassed waterways help to control runoff and erosion. The soil is well suited to no-till farming.

This soil is well suited to woodland. Plant competition is a severe limitation. It can be controlled by removing vines and the less desirable trees and shrubs.

This soil is well suited to most kinds of building site development. Low strength, frost action, the shrink-swell potential, and the wetness are moderate limitations. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength. Properly designing foundations and footings can help to prevent the structural damage caused by shrinking and swelling. Installing drains along the foundations and coating the exterior basement walls minimize the damage caused by wetness. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has medium potential for septic tank absorption fields if the size of the absorption area is increased to compensate for the moderately slow permeability and if a perimeter drain is installed to lower the seasonal high water table.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture suitability group is A-1.

AdC2—Amanda silt loam, 6 to 12 percent slopes, eroded. This deep, moderately sloping, well drained soil is on side slopes and knolls on hummocky end moraines and on ground moraines. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has a higher content of clay than the original surface layer. Most areas range from 5 to 100 acres in size and are long and narrow or circular.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, friable silt loam and loam. The lower part is strong brown and yellowish brown, firm clay loam and loam. The underlying material to a depth of about 80 inches is yellowish brown, calcareous, very firm loam glacial till. In some areas the soil is moderately well drained. In other areas the surface layer or the upper part of the subsoil is gravelly. In places the soil is only slightly eroded.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington soils are on the lower parts of some slopes. The Chili soils are along streams. Their subsoil and underlying material have more sand and gravel than those in the Amanda soil. The poorly drained Condit soils are along drainageways. Also included, in Peru Township, are a few small areas of Colyer Variant soils on shoulder slopes. These soils have shale bedrock within 40 inches of the surface. Included soils make up 20 percent of some areas.

Runoff is rapid on the Amanda soil. The content of organic matter is moderately low. A perched seasonal high water table is below a depth of 48 inches during extended wet periods. Permeability is moderately slow. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are used as cropland. Some areas are pastured, and a few are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. It has resulted in deterioration of tilth and has lowered the content of organic matter in the surface layer. Controlling erosion, improving tilth, and increasing the rate of water infiltration and the content of organic matter are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, planting cover crops, returning crop residue to the soil, farming on the contour, and including grasses and legumes in the cropping system help to control erosion, improve tilth, and increase the rate of water infiltration and the content of organic matter. Grassed waterways help to slow runoff and control erosion. If erosion is controlled and improved management practices or a conservation tillage system is used, row crops can be included in the rotation half of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. Planting trees by mechanical methods is possible on this soil. Plant competition is a severe limitation. It can be controlled by removing vines and the less desirable trees and shrubs.

This soil is well suited to most kinds of building site development. Low strength, frost action, the shrink-swell potential, the wetness, and the slope are moderate limitations. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength. Installing drains along the foundations and coating basement walls minimize the damage caused by the wetness. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. Properly designing foundations and footings can help to prevent the structural damage caused by shrinking and swelling. The soil has medium potential for septic tank absorption fields if the size of the absorption area is increased to compensate for the moderately slow permeability and if a perimeter drain is installed to lower the seasonal high water table. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture suitability group is A-1.

AdD2—Amanda silt loam, 12 to 18 percent slopes, eroded. This deep, strongly sloping, well drained soil is on hillslopes and side slopes along streams on end moraines and ground moraines. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has a higher content of clay than the original surface layer. Most areas range from 2 to 30 acres in size and are long and narrow.

Typically, the surface layer is dark yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, friable silt loam and loam. The lower part is strong brown and yellowish brown, firm clay loam and loam. The underlying material to a depth of about 80 inches is yellowish brown, calcareous, very firm loam glacial till. In a few areas the soil is moderately well drained. In places the surface layer and the upper part of the subsoil are gravelly.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington soils are at the base of slopes and in seeps. The Chili soils are along streams. Their subsoil and underlying material have more sand and gravel than those in the Amanda soil. The poorly drained Condit soils are along drainageways. Also included are small areas of severely eroded soils on the steeper parts of hillsides and some areas where sandstone or shale bedrock is at a depth of 40 to 60 inches. Included soils make up less than 15 percent of most areas.

Runoff is very rapid on the Amanda soil. The content of organic matter is moderately low. A perched seasonal high water table is below a depth of 48 inches during extended wet periods. Permeability is moderately slow. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are pastured. A few areas are used as cropland, and a few are wooded.

This soil is poorly suited to corn and small grain and is generally unsuited to soybeans. It is moderately well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. It has resulted in deterioration of tilth and has lowered the content of organic matter in the surface layer. Controlling erosion, increasing the rate of water infiltration and the content of organic matter, and improving tilth are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, farming on the contour, planting cover crops, and including grasses and legumes in the rotation help to control erosion and maintain the rate of water infiltration, the content of organic matter, and tilth. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation one-fourth of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. Plant competition is a severe limitation. The hazard of erosion and the equipment limitation are moderate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Establishing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion.

This soil is poorly suited to most kinds of building site development. The slope is the main limitation. Extensive land shaping is generally necessary. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. A perimeter drain is needed to lower the seasonal high water table. Installing an interceptor drain upslope from the absorption field reduces the amount of surface and subsurface water entering the site.

The land capability classification is IVe. The woodland ordination symbol is 5R. The pasture suitability group is A-1.

AdE2—Amanda silt loam, 18 to 25 percent slopes, eroded. This deep, moderately steep, well drained soil is on hillslopes and side slopes along streams on end moraines and ground moraines. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has a higher content of clay than the original surface layer. Most areas range from 2 to 10 acres in size and are long and narrow.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, friable silt loam and loam. The lower part is strong brown and yellowish brown, firm clay loam and loam. The underlying material to a depth of about 80 inches is yellowish brown, calcareous, very firm loam glacial till. In a few areas the upper part of the subsoil is gravelly. In some areas the soil is severely eroded. In some places the surface layer is gravelly.

Included with this soil in mapping are small areas of Bennington and Shoals soils. The somewhat poorly drained Bennington soils are at the base of slopes, in seeps, and along drainageways. The somewhat poorly drained Shoals soils are along small streams. Also included are areas of soils where sandstone or shale bedrock is at a depth of 40 to 80 inches and areas that have slopes of 25 to 40 percent. Included soils make up less than 15 percent of most areas.

Runoff is very rapid on the Amanda soil. The content of organic matter is moderately low. A perched seasonal high water table is below a depth of 48 inches during extended wet periods. Permeability is moderately slow. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Many areas of this soil are wooded. Some areas are pastured.

This soil is generally unsuited to corn, soybeans, and small grain. The excessive slope and the hazard of erosion are the main management concerns. The soil is poorly suited to grasses and legumes for hay or pasture.

This soil is well suited to woodland. Plant competition is a severe limitation. The hazard of erosion and the equipment limitation are moderate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Establishing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Operating mechanical tree planters and mowers is difficult because of the slope.

This soil is generally unsuited to most kinds of building site development. The slope is a severe limitation. The soil has very low potential for septic tank absorption fields, which will not function properly because of the slope. An aerobic system having a subsurface sand filter is needed. Installing an interceptor drain upslope from the system helps to prevent surface and subsurface water from entering the site.

The land capability classification is VIe. The woodland ordination symbol is 5R. The pasture suitability group is A-2.

BeA—Bennington silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on ground moraines and end moraines. It is commonly on slight rises that are 1 or 2 feet higher than the nearby wetter soils. Most areas range from 2 to 200 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown, mottled, friable and firm silty clay loam, and the lower part is yellowish brown, mottled, firm loam. The underlying material to a depth of about 80 inches is yellowish brown, mottled, calcareous, firm loam glacial till. In some areas the subsoil is thinner and has more clay. In other areas the surface layer is dark. In places the subsoil has more silt and less sand.

Included with this soil in mapping are small areas of Centerburg, Condit, Milford, and Pewamo soils. The moderately well drained Centerburg soils are on knolls and side slopes. The poorly drained Condit and very poorly drained Milford and Pewamo soils are along drainageways and in depressions. Included soils make up about 15 percent of most areas.

Runoff is slow on the Bennington soil. The content of organic matter is moderate. The surface layer crusts after hard rains. The crust reduces the rate of water infiltration. The potential for frost action is high. A perched seasonal high water table is between depths of 12 and 30 inches after prolonged rainy periods. Permeability is slow. The available water capacity is moderate. The root zone is moderately deep or deep to dense glacial till.

Figure 5.—A subsurface drainage system helps to maintain a good stand of wheat on Bennington silt loam, 0 to 2 percent slopes.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Improving drainage and minimizing soil compaction and crusting are the major management concerns. Subsurface drains are commonly installed to improve drainage (fig. 5). Water moves laterally above the slowly permeable substratum. Carefully timing tillage and returning crop residue to the soil can minimize compaction and improve tilth. If the soil is tilled in the fall, leaving the surface rough or ridged hastens drying in the spring. If adequately drained, the soil is well suited to no-till farming.

This soil is well suited to woodland. The species selected for planting should be those that can withstand some wetness.

This soil is moderately well suited to most kinds of building site development. The wetness, frost action, and low strength are limitations. The wetness can be partly overcome by installing a surface and subsurface drainage system. The soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating the exterior basement walls help to minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength. The soil has low potential for septic tank absorption fields if the size of the absorption area is increased to compensate for the slow permeability. Perimeter drains are needed to lower the seasonal high water table. An artificial outlet for perimeter drains may be needed where natural outlets are inadequate.

The land capability classification is IIw. The woodland ordination symbol is 4A. The pasture suitability group is C-1.

BeB—Bennington silt loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on slightly dissected parts of ground moraines and on knolls in hummocky areas of end moraines. Most areas range from 2 to 20 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown, mottled, friable and firm silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The underlying material to a depth of about 80 inches is yellowish brown, mottled, calcareous, firm loam glacial till. In some areas the subsoil has layers of silt loam or sandy loam. In a few areas the soil is eroded.

Included with this soil in mapping are small areas of Centerburg, Condit, Milford, and Pewamo soils. The moderately well drained Centerburg soils are on knolls and side slopes. The poorly drained Condit and very poorly drained Milford and Pewamo soils are along drainageways. Included soils make up about 15 to 20 percent of most areas.

Runoff is medium on the Bennington soil. Areas at the base of slopes receive runoff and seepage from the higher adjacent soils. The content of organic matter is moderate. The surface layer crusts after hard rains. The crust reduces the rate of water infiltration. The potential for frost action is high. A perched seasonal water table is between depths of 12 and 30 inches after prolonged rainy periods. Permeability is slow. The available water capacity is moderate. The root zone is moderately deep or deep to dense glacial till.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Improving drainage and controlling erosion are the major management concerns. Winter cover crops, a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, and grassed waterways help to control erosion. Returning crop residue to the soil and delaying tillage until just before planting can increase the rate of water infiltration. Subsurface drainage helps to lower the seasonal high water table. If the soil is adequately drained, deep-rooted crops improve soil structure and internal water movement. The soil is well suited to no-till farming.

This soil is well suited to woodland. The species selected for planting should be those that can withstand some wetness.

This soil is moderately well suited to most kinds of building site development. The wetness, frost action, and low strength are limitations. Installing drains along the foundations and coating the exterior basement walls help to minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength. The soil has medium potential for septic tank absorption fields if the absorption area is enlarged to compensate for the slow permeability and a perimeter drain is installed to lower the seasonal high water table.

The land capability classification is IIe. The woodland ordination symbol is 4A. The pasture suitability group is C-1.

BoA—Blount silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on ground moraines and end moraines. It is on low rises or on upland flats. Most areas range from 2 to 200 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown and dark grayish brown, mottled, firm silty clay and clay about 26 inches thick. The underlying material to a depth of about 80 inches is dark yellowish brown, mottled, calcareous, firm clay loam glacial till. In some areas the subsoil has less clay. In a few areas, the soil is poorly drained and the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Glynwood, Milford, Pewamo, and Sleeth soils. Glynwood soils are moderately well drained and are on knolls and the more sloping parts of the till plain. The very poorly drained Milford and Pewamo soils are in depressions and along drainageways. The Sleeth soils are in the slightly higher landscape positions. Their subsoil and underlying material have more sand and gravel than those in the Blount soil. Also included along streams in slightly higher positions on the landscape are small areas of soils that have more sand and gravel in the surface layer and the upper part of the subsoil than those in the Blount soil. Included soils make up about 15 percent of most areas.

Runoff is slow on the Blount soil. The content of organic matter is moderate. The surface layer crusts after hard rains. The crust reduces the rate of water infiltration. The potential for frost action is high. A perched seasonal high water table is between depths of

12 and 36 inches after prolonged rainy periods. Permeability is slow or moderately slow. The root zone generally is moderately deep to compact glacial till. The available water capacity is moderate.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Lowering the seasonal high water table, increasing the rate of water infiltration, minimizing soil compaction, and improving fertility are the major management concerns. Subsurface drainage systems are commonly installed to lower the water table. Applying a conservation tillage system that leaves crop residue on the surface most of the year, tilling within the proper range in moisture content, returning crop residue to the soil, and planting deep-rooted legumes and grasses in rotation with cultivated crops help to minimize compaction and improve tilth and the rate of water infiltration. If adequately drained, the soil is well suited to no-till farming.

This soil is moderately well suited to woodland. Seedling mortality and the windthrow hazard are severe limitations. Planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is moderately well suited to most kinds of building site development. The wetness, frost action, and low strength are severe limitations. The soil is better suited to dwellings without basements than to dwellings with basements. Installing storm and foundation drains and coating the exterior basement walls help to minimize water damage. Providing suitable base material can minimize the damage to local roads and streets caused by low strength and frost action. The soil has low potential for septic tank absorption fields if the size of the absorption area is increased to compensate for the moderately slow or slow permeability. Perimeter drains help to lower the water table. An artificial outlet for perimeter drains may be needed where natural outlets are inadequate.

The land capability classification is IIw. The woodland ordination symbol is 3C. The pasture suitability group is C-1.

BoB—Blount silt loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on ground moraines and end moraines. Some areas have concave slopes that receive runoff from adjacent soils. Other areas are on convex knolls or ridges. In some areas this soil is at the head of minor drainageways where surface water begins to collect in channels. Most areas range from 2 to 80 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown and dark grayish brown, mottled, firm silty clay and clay about 25 inches thick. The underlying material to a depth of about 80 inches is dark yellowish brown, mottled, calcareous, firm clay loam glacial till. In some areas the subsoil contains less clay. In some flat areas the soil is poorly drained.

Included with this soil in mapping are small areas of Glynwood, Milford, Pewamo, and Sleeth soils. Glynwood soils are moderately well drained and are on knolls and the more sloping parts of the till plain. The very poorly drained Milford and Pewamo soils are in depressions and along drainageways. The Sleeth soils are in the slightly higher landscape positions and along streams. Their subsoil and underlying material have more sand and gravel than those in the Blount soil. Also included in some hummocky areas are small areas of soils that have more sand and gravel in the surface layer and the upper part of the subsoil than those in the Blount soil. Included soils make up 10 to 15 percent of most areas.

Runoff is medium on the Blount soil. The content of organic matter is moderate. The surface layer crusts after hard rains, and the rate of water infiltration is reduced. Erosion is a hazard, especially in areas that have long slopes. The potential for frost action is high. Permeability is slow or moderately slow. A perched seasonal high water table is between depths of 12 and 36 inches after prolonged rainy periods. The root zone generally is moderately deep to compact glacial till. The available water capacity is moderate.

Most areas are used as cropland. A few areas are used as pasture or woodland.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Controlling erosion, lowering the seasonal high water table, increasing the rate of water infiltration, minimizing soil compaction, and improving tilth are the major management concerns. Conservation tillage, grassed waterways, and the inclusion of forage crops in the crop rotation reduce the hazard of erosion. The seasonal water table is commonly lowered by subsurface drains, which increase the depth to the root zone. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, tilling within the proper range in moisture content, returning crop residue to the soil, and planting deep-rooted legumes and grasses in rotation with cultivated crops minimize compaction and improve tilth. If adequately drained, the soil is well suited to no-till farming.

This soil is moderately well suited to woodland. Seedling mortality and the windthrow hazard are severe limitations. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard. Planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate.

This soil is moderately well suited to most kinds of building site development. The wetness, frost action, and low strength are severe limitations. Installing storm and foundation drains and coating the exterior basement walls help to reduce water damage. Providing suitable base material can minimize the damage to local roads and streets caused by low strength and frost action. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow or slow permeability. Perimeter drains help to lower the water table.

The land capability classification is IIe. The woodland ordination symbol is 3C. The pasture suitability group is C-1.

CaB—Canfield silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on low knolls and convex ridgetops on end moraines and ground moraines. Most areas range from 5 to 30 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, firm silt loam and loam. It is mottled below a depth of 12 inches. The next part is a fragipan of yellowish brown, mottled, very firm and brittle loam. The lower part is yellowish brown, mottled, firm loam. The underlying material to a depth of about 80 inches is dark yellowish brown, firm loam glacial till. In some areas the fragipan is weak or does not occur. In other areas the soil is well drained.

Included with this soil in mapping are small areas of Bennington, Chili, Condit, and Wadsworth soils. The somewhat poorly drained Bennington and Wadsworth soils are in low areas. The well drained Chili soils have sand and gravel in the underlying material and are on the lower parts of slopes along streams. The poorly drained Condit soils are in depressions along drainageways. Included soils make up about 15 percent of most areas.

Runoff is medium on the Canfield soil. The content of organic matter is moderate. The potential for frost action is high. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Some areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Controlling erosion, minimizing compaction, and increasing the content of organic matter are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, planting cover crops, and tilling within the proper range in moisture content help to control erosion, minimize compaction, and increase the content of organic matter. Grassed waterways help to slow runoff and control erosion. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. Seedling mortality is a moderate limitation. It can be controlled by planting seedlings that have been transplanted once.

This soil is moderately well suited to most kinds of building site development. The wetness and frost action are limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The soil has medium potential for septic tank absorption fields if the size of the absorption area is increased to compensate for the slow permeability. Perimeter drains are needed to lower the seasonal high water table.

The land capability classification is IIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

CaC—Canfield silt loam, 6 to 12 percent slopes. This deep, moderately sloping, moderately well drained soil is on ridgetops and on slopes along drainageways on end moraines and ground moraines. Most areas range from 5 to 40 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, firm silt loam and loam. It is mottled below a depth of 12 inches. The next part is a fragipan of yellowish brown, mottled, very firm and brittle loam. The lower part is yellowish brown, mottled, firm loam. The underlying material to a depth of about 80 inches is dark yellowish brown, firm loam glacial till. In some areas the fragipan is weak or does not occur. In other areas the soil is well drained. In a few areas the surface layer is moderately eroded.

Included with this soil in mapping are small areas of Bennington, Chili, Condit, and Wadsworth soils. The somewhat poorly drained Bennington and Wadsworth soils are in low areas. The well drained Chili soils have sand and gravel in the underlying material. They are on the lower part of slopes along streams. The poorly drained Condit soils are in depressions and along drainageways. Included soils make up as much as 15 percent of most areas.

Runoff is rapid on the Canfield soil. The content of organic matter is moderate. The potential for frost action is high. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Some areas are pastured or wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. Controlling erosion, minimizing compaction, and increasing the rate of water infiltration and the content of organic matter are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, planting cover crops, tilling within the proper range in moisture content, and farming on the contour help to control erosion, minimize compaction, and increase the rate of water infiltration and the content of organic matter. If erosion is controlled and improved management practices or no-till farming is used, row crops can be included in the rotation about half of the time. Grassed waterways help to slow runoff and control erosion. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. Seedling mortality is a moderate limitation. It can be controlled by planting seedlings that have been transplanted once.

This soil is moderately well suited to most kinds of building site development. The wetness, the slope, and frost action are severe limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. Perimeter drains are needed to lower the seasonal high water table. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

CaC2—Canfield silt loam, 6 to 12 percent slopes, eroded. This deep, moderately sloping, moderately well drained soil is on ridgetops and on slopes along drainageways on end moraines and ground moraines. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has a higher content of clay than the original surface layer. Most areas range from 5 to 50 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, firm loam. It is mottled below a depth of 12 inches. The next part is a fragipan of yellowish brown, mottled, very firm and brittle loam. The lower part is yellowish brown, mottled, firm loam. The underlying material to a depth of about 80 inches is dark yellowish brown, firm loam glacial till. In some areas the fragipan is weak or does not occur. In other areas the soil is well drained. In a few areas it is only slightly eroded.

Included with this soil in mapping are small areas of Bennington, Chili, Condit, and Wadsworth soils. The somewhat poorly drained Bennington and Wadsworth and poorly drained Condit soils are in depressions and along drainageways. The well drained Chili soils have sand and gravel in the underlying material. They are on the lower part of slopes along streams. Included soils make up as much as 15 percent of most areas.

Runoff is rapid on the Canfield soil. The content of organic matter is low. The potential for frost action is high. A perched seasonal high water table is between 18 and 36 inches during extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Some areas are pastured, and a few are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. It has resulted in deterioration of tilth and has lowered the content of organic matter in the surface layer. Controlling erosion and increasing the rate of water infiltration and the content of organic matter are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, planting cover crops, and farming on the contour help to control erosion, minimize compaction, and increase the rate of water infiltration and the content of organic matter. If erosion is controlled and improved management practices or a conservation tillage system is used, row crops can be included in the rotation half of the time. Grassed waterways help to slow runoff and control erosion. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. Seedling mortality is a moderate limitation. It can be controlled by planting seedlings that have been transplanted once.

This soil is moderately well suited to most kinds of building site development. The wetness, the slope, and frost action are severe limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. Perimeter drains are needed to lower the seasonal high water table. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

Cb—Carlisle muck. This deep, level, very poorly drained soil is in bogs on end moraines and ground moraines. It is subject to ponding in fall, winter, and spring. The slope is 0 to 2 percent. Most areas range from 2 to 40 acres in size and are circular.

Typically, the upper 5 inches is very dark grayish brown and very dark gray, friable muck. Below that to a depth of about 80 inches are layers of very dark brown, black, and very dark grayish brown, friable muck. In some areas the soil has layers of muck that are less decomposed and have more fiber. In a few areas it has layers of marl. In places 10 to 20 inches of mineral material overlies the muck.

Included with this soil in mapping are small areas of Condit, Milford, and Pewamo soils. These soils are near the edge of areas of the Carlisle soil. They formed in mineral material. Also included are areas of soils that have mineral material at a depth of 30 to 60 inches. Included soils make up 10 to 15 percent of most areas.

Permeability is moderately rapid to moderately slow in the Carlisle soil. The root zone is deep. The available water capacity and the content of organic matter are very high. Deficiencies in trace elements are common. The seasonal high water table is at or above the surface for extended periods. Ponding occurs in fall, winter, and spring and during other extended wet periods. The soil has low strength and high compressibility.

Most areas are undrained and are used for wetland wildlife habitat. A few areas have been mined for humus.

This soil is generally unsuited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture.

This soil is well suited to habitat for wetland wildlife. It is covered by cattails, sedges, and reeds. It is generally unsuited to trees.

This soil is generally unsuited to building site development and has very low potential for septic tank absorption fields. Because of subsidence, septic tank absorption fields will not function properly in the soil. An aerobic system having a subsurface sand filter is needed. A perimeter drain helps to lower the seasonal high water table. An artificial outlet for perimeter drains may be needed where natural outlets are inadequate.

The land capability classification is Vw. The soil has not been assigned a woodland ordination symbol. The pasture suitability group is D-1.

CdB—Centerburg silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on low knolls and the higher parts of end moraines and ground moraines. Most areas range from 5 to 200 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, friable and firm clay loam about 27 inches thick. It is mottled below a depth of about 13 inches. The underlying material to a depth of about 80 inches is yellowish brown, mottled, calcareous, firm loam glacial till. In some areas the soil is well drained. In other areas erosion has removed part of the original surface layer.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington soils are in low spots and at the base of knolls. The well drained Chili soils are on knolls in hummocky areas along streams. Their subsoil and underlying material have more sand and gravel than those in the Centerburg soil. The poorly drained Condit soils are along drainageways and in depressions. Also included are a few areas of soils where the slope is 6 to 12 percent and areas of severely eroded soils on the steeper slopes. Included soils make up less than 15 percent of most areas.

Runoff is medium on the Centerburg soil. The content of organic matter is moderate. The potential for frost action is high. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Permeability is moderately slow. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are used as cropland. Some areas are pastured, and a few are wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Controlling erosion and increasing the rate of water infiltration and the content of organic matter are the major management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year and planting winter cover crops help to control erosion, improve tilth, and increase the rate of water infiltration. Grassed waterways and small grain or forage crops in the crop rotation help to control erosion. Returning crop residue to the soil increases the rate of water infiltration and the content of organic matter. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. Plant competition is a severe limitation. It can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to most kinds of building site development. The wetness, frost action, and the moderate shrink-swell potential in the subsoil are limitations. The soil is better suited to dwellings without basements than to dwellings with basements. The higher parts of knolls and ridges are the best homesites. Installing drains along the foundations and coating the exterior basement walls help to minimize the damage caused by wetness. The increased runoff and erosion that occur during construction can be reduced by maintaining the plant cover wherever possible or by establishing a temporary plant cover. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. Perimeter drains help to lower the seasonal high water table.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture suitability group is A-6.

CdC—Centerburg silt loam, 6 to 12 percent slopes. This deep, moderately sloping, moderately well drained soil is on knolls and ridges on the hummocky parts of end moraines and ground moraines and on side slopes along drainageways. Most areas range from 5 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, friable and firm clay loam about 27 inches thick. It is mottled below a depth of about 13 inches. The underlying material to a depth of about 80 inches is yellowish brown, mottled, calcareous, firm loam glacial till. In some areas the soil is eroded. In a few areas it is well drained.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington soils are in low spots and around the base of knolls. The well drained Chili soils are on hillsides along streams. Their subsoil and underlying material have more sand and gravel than those in the Centerburg soil. The poorly drained Condit soils are in depressions and along drainageways. Also included are severely eroded areas of soils and some areas where the slope is 12 to 18 percent. Included soils make up less than 15 percent of most areas.

Runoff is rapid on the Centerburg soil. The content of organic matter is moderate. The potential for frost action is high. A perched seasonal high water table is between depths of 18 and 36 inches in winter and spring and during other extended wet periods. Permeability is moderately slow. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are used as cropland. Many areas are pastured, and some are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. Maintaining the content of organic matter, controlling erosion, and increasing the rate of water infiltration are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, planting winter cover crops, and using grassed waterways reduce runoff and the hazard of erosion. Contour tillage and stripcropping can be used in some areas. Returning crop residue to the soil or regularly adding other organic material increases the rate of water infiltration and the content of organic matter and improves tilth. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. Plant competition is a severe limitation. It can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to most kinds of building site development. The slope, the moderate shrink-swell potential, and frost action also are limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. The more convex parts of slopes should be selected for homesites. Installing drains along the foundations and coating the exterior basement walls help to minimize the damage caused by wetness. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The increased runoff and erosion that occur during construction can be reduced by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Perimeter drains help to lower the seasonal high water table.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture suitability group is A-6.

CdC2—Centerburg silt loam, 6 to 12 percent slopes, eroded. This deep, moderately sloping, moderately well drained soil is on knolls and ridges on the hummocky parts of end moraines and ground moraines and on side slopes near small streams. Erosion has removed part of the original surface layer. The present surface layer has subsoil material that has a higher content of clay than the original surface layer. Most areas range from 6 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The subsoil is yellowish brown, friable and firm clay loam about 23 inches thick. It is mottled below a depth of about 13 inches. The underlying material to a depth of about 80 inches is yellowish brown, mottled, calcareous, firm loam glacial till. In some areas the soil is well drained. In other areas it is only slightly eroded. In a few areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington soils are in low spots and around the base of knolls. The well drained Chili soils are on hillslopes along streams. Their subsoil and underlying material have more sand and gravel than those in the Centerburg soil. The poorly drained Condit soils are along drainageways and in depressions. Also included are a few areas of soils where the slope is 12 to 18 percent. Included soils make up less than 15 percent of most areas.

Runoff is rapid on the Centerburg soil. The content of organic matter is moderately low. The potential for frost action is high. A perched seasonal high water table is between depths of 18 and 36 inches in winter and spring and during other extended wet periods. Permeability is moderately slow. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are used as cropland. Many areas are pastured, and a few are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion has resulted in deterioration of tilth and has lowered the content of organic matter in the surface layer. Increasing the content of organic matter and the rate of water infiltration, improving tilth, and controlling erosion are the major management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, planting winter cover crops, and using grassed waterways reduce runoff and control erosion. Contour tillage and stripcropping can be used in some areas. Returning crop residue to the soil or regularly adding other organic material increases the rate of water infiltration and the content of organic matter and improves tilth. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. Plant competition is a severe limitation. It can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to most kinds of building site development. The wetness, the slope, the moderate shrink-swell potential, and frost action are limitations. The soil is better suited to dwellings without basements than to dwellings with basements. The more convex parts of slopes should be selected for homesites. Installing drains along the foundations and coating the exterior basement walls help to minimize the damage caused by wetness. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The increased runoff and erosion that occur during construction can be reduced by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Perimeter drains help to lower the seasonal high water table.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture suitability group is A-6.

ChB—Chili loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges and low knolls on stream terraces. Most areas range from 5 to 40 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable and firm loam about 10 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, firm loam. The lower part is yellowish brown, firm gravelly loam and friable very gravelly loam. The underlying material to a depth of about 80 inches is yellowish brown, loose very gravelly loamy sand. In a few areas loam glacial till is below a depth of 50 inches. In other areas the upper part of the subsoil has more silt and less sand. In some places the soil is moderately well drained. In a few places it is eroded.

Included with this soil in mapping are small areas of Amanda, Canfield, Centerburg, Rittman, and Sleeth soils. The well drained Amanda and moderately well drained Canfield, Centerburg, and Rittman soils formed in glacial till and are along upland breaks. The somewhat poorly drained Sleeth soils are in drainageways and depressions. Also included are some areas where the underlying material is at a depth of less than 40 inches and some small areas where the soil is moderately well drained and has more silt and less sand in the subsoil than the Chili soil. Included soils make up less than 15 percent of most areas.

Runoff is medium on the Chili soil. The content of organic matter is moderate. Permeability is moderately rapid. The available water capacity is moderate.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Controlling erosion, conserving moisture, and increasing the content of organic matter are the major management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, and planting cover crops help to control erosion, conserve moisture, and increase the content of organic matter. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, smaller and more frequent applications of lime and fertilizer are needed. Grassed waterways help to slow runoff and control erosion. The soil is well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to most kinds of building site development. Frost action is a moderate limitation. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The soil is a source of sand and gravel. Sloughing and the instability of cutbanks are severe hazards if the soil is excavated. The soil has high potential for septic tank absorption fields. In some areas it readily absorbs but may not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground-water supplies.

The land capability classification is IIe. The woodland ordination symbol is 4A. The pasture suitability group is A-1.

ChC—Chili loam, 6 to 12 percent slopes. This deep, moderately sloping, well drained soil is on side slopes, knolls, and convex ridgetops on stream terraces. Most areas range from 5 to 40 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable loam about 10 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, firm loam. The lower part is yellowish brown, firm gravelly loam and friable very gravelly loam. The underlying material to a depth of about 80 inches is yellowish brown, loose very gravelly loamy sand. In a few areas loam glacial till is below a depth of 50 inches. In other areas the upper part of the subsoil has more silt and less sand. In places the soil is eroded.

Included with this soil in mapping are small areas of Amanda, Canfield, Centerburg, Rittman, and Sleeth soils. The well drained Amanda and moderately well drained Canfield, Centerburg, and Rittman soils formed in glacial till and are on the upper part of slopes and along upland breaks. The somewhat poorly drained Sleeth soils are in drainageways and depressions. Also included are some areas of soils where the underlying material is at a depth of less than 40 inches, a few areas where the slope is 12 to 18 percent, and small areas where the soil is moderately well drained and has more silt and less sand in the subsoil than the Chili soil. Included soils make up less than 20 percent of most areas.

Runoff is rapid on the Chili soil. The content of organic matter is moderate. Permeability is moderately rapid. The available water capacity is moderate.

Most areas are used as cropland. Some areas are pastured, and a few are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Controlling erosion, conserving moisture, and increasing the content of organic matter are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, and planting cover crops help to control erosion, conserve moisture, and increase the content of organic matter. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. Contour farming and grassed waterways help to control runoff and erosion. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, smaller and more frequent applications of lime and fertilizer are needed. The soil is well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to most kinds of building site development. The slope and frost action are moderate limitations. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. Sloughing and the instability of cutbanks are severe hazards if the soil is excavated. The soil has high potential for septic tank absorption fields. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. In some areas the soil readily absorbs but may not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground-water supplies. The soil is a source of sand and gravel.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture suitability group is A-1.

CkF—Colyer Variant silt loam, 25 to 70 percent slopes. This moderately deep, steep and very steep, well drained soil is on valley walls. Most areas range from 10 to 40 acres in size and are long and narrow. Slopes generally are 40 to 70 percent.

Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 24 inches thick. The upper part is yellowish brown, friable loam. The lower part is yellowish brown, firm gravelly clay loam. The underlying material to a depth of 40 inches is variegated very dark brown, black, and dark gray shale that can be dug with a spade. In some areas the surface layer is eroded. In a few areas the depth to the underlying material is more than 40 inches.

Included with this soil in mapping are small areas of Amanda, Gallman, and Shoals soils. The Amanda and Gallman soils are deep over bedrock and are on the less sloping parts of hillslopes and on hillslope shoulders. The somewhat poorly drained Shoals soils are on narrow flood plains. Also included are areas of shale bedrock escarpments. Inclusions make up less than 20 percent of most areas.

Runoff is very rapid on the Colyer Variant soil. The content of organic matter is moderately low. Permeability is moderate. The available water capacity is low. The root zone is moderately deep to highly fractured shale.

Most areas are wooded. A few areas are pastured.

This soil is generally unsuited to cropland because of the slope. It is poorly suited to pasture. The soil is moderately well suited to woodland and as habitat for woodland wildlife. The slope severely limits the use of planting and logging equipment. Erosion is a severe hazard. Establishing logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a plant cover also help to control erosion. The windthrow hazard increases on the upper part of the slopes. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is generally unsuited to most kinds of building site development. The depth to bedrock and the slope are severe limitations. The soil has very low potential for septic tank absorption fields, which will not function properly because of the slope. An aerobic system having a subsurface sand filter is needed. Installing an interceptor drain upslope from the absorption field reduces the amount of surface and subsurface water entering the site.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The pasture suitability group is H-1.

Co—Condit silt loam. This deep, nearly level, poorly drained soil is in depressions and along drainageways on end moraines and ground moraines. It receives runoff from the higher adjacent soils and is subject to occasional ponding. The slope is 0 to 2 percent. Most areas range from 2 to 30 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsoil is dark gray, gray, and grayish brown, mottled, firm clay loam about 64 inches thick. The substratum to a depth of about 82 inches is light olive brown, calcareous, firm silt loam glacial till. In a few areas the subsoil has more clay.

Included with this soil in mapping are small areas of Bennington, Carlisle, Milford, and Pewamo soils. The somewhat poorly drained Bennington soils are on low knolls and slight rises. The very poorly drained Carlisle soils are in bogs. The very poorly drained Milford and Pewamo soils are in depressions. Included soils make up 15 percent of most areas.

Runoff is very slow or ponded on the Condit soil. The content of organic matter is moderate. The potential for frost action is high. The seasonal high water table is 12 inches above the surface to 12 inches below during wet periods. Permeability is slow. The available water capacity is moderate.

Most areas are used as cropland. A few areas are pastured, and some are wooded.

This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Lowering the seasonal high water table, reducing the hazard of ponding, improving tilth, and minimizing compaction are management concerns. Surface and subsurface drains help to lower the seasonal high water table and minimize ponding. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, and tilling within the proper range in moisture content improve tilth and minimize compaction. If adequately drained, the soil is moderately well suited to no-till farming.

Stands of alfalfa are difficult to establish and maintain unless the seasonal high water table is lowered by a drainage system. This soil is better suited to other legumes, such as alsike clover, red clover, or ladino clover. Reed canarygrass and redtop grow in areas that are too wet to support other grasses. In some years mowing is delayed in spring and other wet periods because of the seasonal high water table.

This soil is well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are severe limitations. Logging during the drier parts of the year helps to overcome the equipment limitation. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is generally unsuited to most kinds of building site development. Low strength, the ponding, and frost action are severe limitations. Generally, the adjacent soils are better suited to these uses. The soil has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. A perimeter drain is needed to lower the seasonal high water table. An artificial outlet for perimeter drains may be needed where natural outlets are inadequate.

The land capability classification is IIIw. The woodland ordination symbol is 5W. The pasture suitability group is C-2.

GaB—Gallman silt loam, loamy substratum, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges and low knolls on outwash plains and terraces. Most areas range from 5 to 80 acres in size and are long and narrow or circular.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 67 inches thick. The upper part is yellowish brown, firm silt loam and clay loam. The next part is yellowish brown, firm gravelly clay loam. The lower part is yellowish brown, friable loam and gravelly clay loam. The underlying material to a depth of about 88 inches is brown, calcareous, friable gravelly loam. In some areas glacial till is below a depth of 60 inches. In other areas the soil is moderately well drained. In some places depth to the underlying material is less than 55 inches. In other places the underlying material has more sand and less silt and clay.

Included with this soil in mapping are small areas of Amanda, Centerburg, Glynwood, Millgrove, and Sleeth soils. The well drained Amanda and moderately well drained Centerburg and Glynwood soils are on the upper part of slopes and along upland breaks. The very poorly drained Millgrove soils are in depressions and along drainageways. The somewhat poorly drained Sleeth soils are in depressions. Also included are areas of soils that have shale bedrock below a depth of 60 inches. Included soils make up less than 15 percent of most areas.

Runoff is medium on the Gallman soil. The content of organic matter is moderately low. Permeability is moderately rapid. The available water capacity is high.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Controlling erosion and increasing the content of organic matter are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year reduces the hazard of erosion. Grassed waterways help to control runoff and erosion. Including grasses and legumes in the crop rotation, planting cover crops, and returning crop residue to the soil increase the content of organic matter. The soil is well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to most kinds of building site development. Frost action is a moderate limitation on sites for local roads and streets. Installing a drainage system and providing suitable base material minimize damage to local roads and streets caused by frost action. The soil has high potential for septic tank absorption fields.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture suitability group is A-1.

GaC—Gallman silt loam, loamy substratum, 6 to 12 percent slopes. This deep, moderately sloping, well drained soil is on ridges, side slopes, and low knolls on outwash plains and terraces. Most areas range from 3 to 10 acres in size and are long and narrow.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 67 inches thick. The upper part is yellowish brown, firm silt loam and clay loam. The next part is yellowish brown, firm gravelly clay loam. The lower part is yellowish brown, friable loam and gravelly clay loam. The underlying material to a depth of 88 inches is brown, calcareous, friable gravelly loam. In places glacial till is below a depth of 60 inches. In some areas the soil is eroded. In other areas it is moderately well drained. In some places depth to the underlying material is less than 55 inches. In other places the underlying material has more sand and less silt and clay.

Included with this soil in mapping are small areas of Centerburg, Glynwood, Rittman, and Sleeth soils. The moderately well drained Centerburg, Glynwood, and Rittman soils are along upland breaks. The somewhat poorly drained Sleeth soils are in depressions. Also included are a few areas that have shale bedrock below a depth of 60 inches and a few areas where the slope is 12 to 18 percent. Included soils make up less than 15 percent of most areas.

Runoff is rapid on the Gallman soil. The content of organic matter is moderately low. Permeability is moderately rapid. The available water capacity is high.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Controlling erosion and increasing the content of organic matter are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year reduces the hazard of erosion. Contour farming and grassed waterways help to control runoff and erosion. Including grasses and legumes in the crop rotation, planting cover crops, and returning crop residue to the soil increase the content of organic matter. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to most kinds of building site development. The slope and frost action are moderate limitations. Erosion is a hazard during construction. Maintaining the plant cover as much as possible on the site during construction reduces soil loss. The more convex parts of slopes should be selected for homesites. Buildings should be designed so that they conform to the natural shape of the land. Installing a drainage system and providing suitable base material minimize damage to local roads and streets caused by frost action. The soil has high potential for septic tank absorption fields. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture suitability group is A-1.

GnB2—Glynwood clay loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is on low knolls and uplands on hummocky end moraines and on ground moraines. Most areas range from 5 to 80 acres in size and are irregularly shaped.

Typically, the surface layer is brown, friable clay loam about 8 inches thick. The subsoil is about 14 inches thick. It is yellowish brown and dark yellowish brown, mottled, firm clay. The underlying material to a depth of about 80 inches is dark yellowish brown, calcareous, very firm clay loam glacial till. In some areas the subsoil has less clay. In other areas the soil is well drained.

Included with this soil in mapping are small areas of Blount, Gallman, Pewamo, and Sleeth soils. The somewhat poorly drained Blount and Sleeth soils are on the lower part of slopes and in nearly level areas. The well drained Gallman soils are in some hummocky areas and along streams. The very poorly drained Pewamo soils are along drainageways and in depressions. Also included are severely eroded areas of soils. Included soils make up less than 20 percent of most areas.

Permeability is slow in the Glynwood soil. The available water capacity is moderate. Runoff is medium. The potential for frost action is high. The content of organic matter is moderately low. A perched seasonal high water table is at a depth of 24 to 42 inches in winter and spring and during other extended wet periods. The root zone generally is moderately deep to compact glacial till.

Most areas are used as cropland. Some areas are pastured, and a few are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Controlling erosion, minimizing compaction, and adding plant nutrients are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year reduces compaction and the hazard of erosion and increases the rate of water infiltration. Grassed waterways help to control runoff and erosion. Including close growing crops in the cropping system also helps to control erosion. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. Seedling mortality and the windthrow hazard are severe limitations. Planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is moderately well suited to most kinds of building site development. The wetness, frost action, low strength, and the moderate shrink-swell potential are limitations. The soil is better suited to dwellings without basements than to dwellings with basements because of the wetness. Erosion is a hazard during construction. Stockpiling the surface soil and later spreading it during final grading help to reestablish the plant cover. Installing drains along the foundations and coating the exterior basement walls help to minimize the damage caused by wetness. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and improve soil strength. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. Perimeter drains are needed to lower the seasonal high water table.

The land capability classification is IIIe. The woodland ordination symbol is 4C. The pasture suitability group is A-6.

GnC2—Glynwood clay loam, 6 to 12 percent slopes, eroded. This deep, moderately sloping, moderately well drained soil is along small streams where it receives runoff from adjacent soils and on knolls and convex slopes in the hummocky areas of end moraines. Erosion has removed part of the original surface layer. The present surface layer partly contains subsoil material that has more clay than the original surface layer. Most areas range from 5 to 40 acres in size and are ribbon shaped.

Typically, the surface layer is brown, friable clay loam about 6 inches thick. The subsoil is about 14 inches thick. It is yellowish brown and dark yellowish brown, mottled, firm clay. The underlying material to a depth of about 80 inches is dark yellowish brown, calcareous, very firm clay loam glacial till. In some severely eroded areas the surface layer is silty clay loam, and the subsoil is thinner. In a few areas the subsoil has less clay. In places the soil is well drained.

Included with this soil in mapping are small areas of Blount, Gallman, Pewamo, and Sleeth soils. The somewhat poorly drained Blount soils are on the long slopes and at the base of slopes. The Gallman and Sleeth soils formed in glacial outwash and are on outwash plains and on terraces. The very poorly drained Pewamo soils are along drainageways and in depressions. Included soils make up less than 15 percent of most areas.

Permeability is slow in the Glynwood soil. The available water capacity is moderate. Runoff is rapid. The potential for frost action is high. The content of organic matter is moderately low. A perched seasonal high water table is at a depth of 24 to 42 inches in winter and spring and during extended wet periods. The root zone generally is moderately deep to compact glacial till.

Most areas are used as cropland. Some areas are pastured, and a few are wooded.

This soil is poorly suited to corn, small grain, and soybeans. It is well suited to grasses and legumes for hay or pasture. Natural drainage is generally adequate for crop production except in small areas of the wetter included soils. Controlling erosion, conserving moisture, and improving fertility are the major management concerns. Although the available water capacity is moderate, shallow-rooted plants show moisture stress during extended dry periods because water is lost through runoff. Random subsurface drainage may be needed in the wetter included soils. The higher content of clay in the surface layer makes the soil more difficult to manage. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year and installing grassed waterways help to control erosion. Including small grain and forage crops in the rotation reduces the hazard of erosion. If erosion is controlled and improved management practices or no-till planting is used, cultivated crops can be included in the rotation half of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. Trees selected for planting should be those that can withstand a high content of clay in the subsoil. Seedling mortality and the windthrow hazard are severe limitations. Planting techniques that spread the roots of the seedlings and improve the soil-root contact reduce the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced or isolated reduce the windthrow hazard.

This soil is moderately well suited to most kinds of building site development. The wetness, frost action, low strength, the slope, and the moderate shrink-swell potential are limitations. Building sites should be selected to avoid runoff from the adjacent soils. Maintaining the plant cover as much as possible on the site during construction reduces the hazard of erosion. Placing drains at the base of footings and coating the exterior basement walls help to minimize the damage caused by wetness. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Installing a drainage system and providing suitable base material minimize the damage caused by frost action to local roads and streets and improve soil strength. Buildings should be designed so that they conform to the natural shape of the land. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. Perimeter drains lower the seasonal high water table. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IVe. The woodland ordination symbol is 4C. The pasture suitability group is A-6.

Lo—Lobdell silt loam, occasionally flooded. This deep, nearly level, moderately well drained soil is on flood plains. Brief periods of flooding occasionally occur in winter and spring. They may occur during the growing season. The slope is 0 to 2 percent. Most areas range from 5 to 50 acres in size and are long and narrow.

Typically, the surface layer is dark brown, very friable silt loam about 7 inches thick. The subsurface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 26 inches thick. The upper part is brown, very friable silt loam, and the lower part is dark yellowish brown, mottled, friable silt loam. The underlying material to a depth of about 80 inches is stratified dark yellowish brown and dark gray, mottled, friable loam and very friable sandy loam having thin strata of gravelly loamy coarse sand and loamy sand. In some areas the soil is well drained. In other areas the subsoil has more silt and less sand. In places shale bedrock is below a depth of 60 inches.

Included with this soil in mapping are small areas of Shoals, Sloan, and Tioga soils. The somewhat poorly drained Shoals and very poorly drained Sloan soils are in depressions and former stream channels. The well drained Tioga soils are in the slightly higher positions. Some included areas on the higher parts of the flood plains are only rarely flooded. Included soils make up less than 20 percent of most areas.

Runoff is slow on the Lobdell soil. The content of organic matter is moderate. The potential for frost action is high. The seasonal high water table is between depths of 24 and 42 inches during extended wet periods. Permeability is moderate. The available water capacity is high.

Most areas are used as cropland. Some areas are pastured or wooded.

This soil is well suited to corn and soybeans and to grasses and legumes for hay or pasture. Flooding can damage winter grain and forage crops. Random subsurface drains are needed in areas of the wetter included soils. A tillage method that partly covers crop residue and leaves a rough or ridged surface helps to prevent removal of the crop residue by floodwater. Crusting is a problem after hard rains. Weed control is difficult because the floodwater spreads weed seeds. This soil is moderately well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the occasional flooding and the wetness, this soil is generally unsuited to most kinds of building site development. It has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderate permeability. A perimeter drain is needed to lower the seasonal high water table. The septic tank system should be protected from flooding.

The land capability classification is IIw. The woodland ordination symbol is 5A. The pasture suitability group is A-5.

Mf—Milford silty clay loam. This deep, nearly level, very poorly drained soil is in shallow, closed depressions and along minor waterways on glacial lake plains. It receives runoff from the higher adjacent soils and is subject to occasional ponding. The slope is 0 to 2 percent. Most areas range from 2 to 25 acres in size and are irregular in shape.

Typically, the surface layer is black, firm silty clay loam about 10 inches thick. The subsurface layer is very dark gray, mottled, firm silty clay about 3 inches thick. The subsoil is dark gray, olive gray, and gray, mottled, firm silty clay and silty clay loam about 37 inches thick. The underlying material to a depth of about 80 inches is gray and brown, firm silty clay loam that has thin strata of silt loam. In a few areas the surface layer is thinner. In some areas it is silty clay or has dark grayish brown silt loam overwash. In a few places the underlying material is glacial till. In other places the subsoil has less clay.

Included with this soil in mapping are small areas of Blount, Bennington, Carlisle, Condit, and Sloan soils. The somewhat poorly drained Blount and Bennington soils are on low knolls and ridges. The Carlisle soils have a surface layer of muck and are in the center of depressions. The poorly drained Condit soils are along drainageways and in small depressions. The Sloan soils have more sand and gravel than the Milford soil and are along drainageways. Included soils make up 10 to 15 percent of most areas.

Runoff is very slow or ponded on the Milford soil. The content of organic matter is high. The potential for frost action also is high. Permeability is moderately slow. The seasonal high water table is 6 inches above the surface to 24 inches below after prolonged rainy periods. The available water capacity is high. The shrink-swell potential is moderate.

Most areas are drained and are used as cropland. Draining some areas is difficult because suitable outlets are not available. A few undrained areas are used as pasture. Many small undrained areas are idle.

If drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Reducing the hazard of ponding, minimizing compaction, and improving tilth are the major management concerns. The surface layer hardens after it dries and may inhibit seedling emergence. Surface and subsurface drains help to lower the seasonal high water table and minimize ponding. Applying a conservation tillage system, returning crop residue to the soil, and tilling within the proper range in moisture content improve tilth and minimize compaction. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in the fall. A tillage method that leaves a rough or ridged surface and partly covers crop residue increases the rate of water infiltration and hastens drying. If adequately drained, the soil is moderately well suited to no-till farming. Deep-rooted crops, such as alfalfa, make the soil more porous and thus facilitate the movement of water to subsurface drains.

Stands of alfalfa are difficult to establish and maintain unless the seasonal high water table is lowered by a drainage system. This soil is better suited to other legumes, such as alsike clover or ladino clover. Reed canarygrass and redtop grow in areas that are too wet to support other grasses. In some years mowing is delayed in spring and other wet periods because of the seasonal high water table.

This soil is generally unsuited to most kinds of building site development. The ponding, low strength, and frost action are severe limitations. Generally, the adjacent soils are better suited to these uses. The soil has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. Two 1,000-gallon septic tanks are needed to minimize clogging in the system. Perimeter drains and french drains lower the seasonal high water table. An artificial outlet for the drains may be needed where natural outlets are inadequate.

The land capability classification is IIw. The soil has not been assigned a woodland ordination symbol. The pasture suitability group is C-1.

Mg—Millgrove silt loam. This deep, very poorly drained, nearly level soil is on outwash plains and low terraces. In the lower areas in depressions, it receives runoff from the adjacent higher soils and is subject to ponding. The slope is 0 to 2 percent. Most areas range from 10 to 40 acres in size and are irregularly shaped.

Typically, the surface layer is black, friable silt loam about 9 inches thick. The subsoil is very dark gray and gray, mottled, friable and firm loam and clay loam about 41 inches thick. The underlying material to a depth of about 80 inches is yellowish brown and brown, friable gravelly loam and gravelly sandy loam and dark grayish brown, very friable gravelly loamy sand. In some areas along upland breaks, the underlying material has glacial till below a depth of 55 inches. In other areas the subsoil has more clay and silt and less sand and gravel. In places the surface layer is silty clay loam. In a few places along streams, the soil is subject to rare flooding.

Included with this soil in mapping are small areas of the very poorly drained Milford and somewhat poorly drained Shoals and Sleeth soils. The Milford soils are in depressions. The Shoals soils are in the higher areas. Included soils make up as much as 10 percent of most areas.

Permeability is moderate in the Millgrove soil. The available water capacity is moderate. However, plants seldom show moisture stress. Runoff is very slow or ponded. The potential for frost action is high. The content of organic matter also is high. The seasonal water table is 12 inches above the surface to 12 inches below in winter and spring and during other extended wet periods.

Most areas are drained and are used as cropland. A few areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Reducing the hazard of ponding, lowering the seasonal high water table, improving tilth, and minimizing compaction are management concerns. Surface and subsurface drains are very effective in minimizing ponding and lowering the seasonal high water table. A tillage method that leaves a rough or ridged surface and partly covers crop residue hastens drying. Minimizing tillage and planting cover crops are good management practices, especially if this soil is used for continuous row crops. Tilling within the proper range in moisture content minimizes compaction. Including grasses and legumes in the cropping system improves tilth. If adequately drained, this soil is well suited to a conservation tillage system, such as no-till farming.

Stands of alfalfa are difficult to establish and maintain on this soil unless the seasonal high water table is lowered by a drainage system. This soil is better suited to other legumes, such as alsike clover, red clover, or ladino clover. Reed canarygrass and redtop grow in areas that are too wet to support other grasses. In some years mowing is delayed during spring and other wet periods because of the seasonal high water table.

The soil is well suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are severe limitations. Logging during the drier parts of the year or when the ground is frozen helps to overcome the equipment limitation. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is poorly suited to most kinds of building site development. The ponding and frost action are severe limitations. The soil is better suited to dwellings without basements than to dwellings with basements. Surface drains and subsurface drains improve drainage. Installing drains along the foundations and coating exterior basement walls minimize the damage caused by wetness. Building sites should be landscaped for good surface drainage away from the foundation. The ponding and sloughing of cutbanks limit excavations in winter and spring. The instability of cutbanks and sloughing are severe hazards if the soil is excavated. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The soil has low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderate permeability. A perimeter drain helps to lower the seasonal high water table. An artificial outlet for perimeter drains may be needed where natural outlets are inadequate. A french drain is needed to remove excess surface water from the site.

The land capability classification is IIw. The woodland ordination symbol is 5W. The pasture suitability group is C-1.

MoC—Morley silt loam, 6 to 12 percent slopes. This deep, well drained, moderately sloping soil is on side slopes and on ground moraines and end moraines. Most areas are along streams and drainageways. A few areas are on knolls. Most areas range from 5 to 20 acres in size and are long and narrow or round.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, firm clay loam about 31 inches thick. The underlying material to a depth of about 80 inches is yellowish brown, calcareous, firm clay loam glacial till. In a few narrow strips near the base of slopes and in less sloping areas, the soil is moderately well drained. In some areas the subsoil has less clay. In other areas the soil is eroded.

Included with this soil in mapping are small areas of Blount, Gallman, and Pewamo soils. The somewhat poorly drained Blount soils are on the lower part of some slopes. The Gallman soils are at the base of slopes along streams. Their subsoil and underlying material have more sand and gravel than those in the Morley soil. The very poorly drained Pewamo soils are along waterways and in depressions. Also included are a few areas of soils that are severely eroded and have gullies. The surface layer of these soils is mostly subsoil material and has poor tilth. Also included are a few springs and seeps. Included soils make up 15 percent of most areas.

Runoff is rapid on the Morley soil. The content of organic matter is moderate. Permeability is moderately slow or slow. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are used as cropland. Some areas are pastured, and a few are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. Controlling erosion, increasing the content of organic matter and the rate of water infiltration, and improving tilth are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year helps to control erosion and increases the content of organic matter and the rate of water infiltration. No-till farming, farming on the contour, planting cover crops, returning crop residue to the soil, and including small grain and forage crops in the rotation help to control sheet and rill erosion. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. Grassed waterways help to control runoff and erosion. The soil is well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to most kinds of building site development. The shrink-swell potential, the slope, and frost action are moderate limitations. Low strength is a severe limitation for roads and streets. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. Buildings should be designed so that they conform to the natural shape of the land. Installing a drainage system and providing suitable base material to local roads and streets minimize damage caused by frost action and low strength. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow or moderately slow permeability. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines and septic tank absorption fields on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture suitability group is A-1.

MoC2—Morley silt loam, 6 to 12 percent slopes, eroded. This deep, well drained, moderately sloping soil is on slopes and isolated knolls on ground moraines and end moraines. In many areas it is on side slopes along streams. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has more clay than the original surface layer. Most areas range from 6 to 20 acres in size and are long and narrow or round.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is yellowish brown, firm clay loam about 24 inches thick. The underlying material to a depth of about 80 inches is yellowish brown, firm clay loam glacial till. In a few narrow strips near the base of the slopes the soil is moderately well drained. In some areas the subsoil has less clay. In a few areas along streams, the subsoil and the underlying material have more sand and gravel.

Included with this soil in mapping are small areas of Blount and Pewamo soils. The somewhat poorly drained Blount soils are on the lower part of some slopes. The very poorly drained Pewamo soils are along waterways and in depressions. Also included are a few areas of soils that are severely eroded and have gullies. The surface layer in these areas is mostly subsoil material and has poor tilth. Also included are a few springs and seeps. Included soils make up less than 15 percent of most areas.

Runoff is rapid on the Morley soil. The surface layer crusts after rains. The content of organic matter is moderately low. The root zone generally is moderately deep or deep to compact glacial till. The available water capacity is moderate. Permeability is moderately slow or slow.

Most areas are used as cropland. Some areas are pastured, and a few are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Controlling erosion, increasing the content of organic matter and the rate of water infiltration, and improving fertility are the major management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year helps to control erosion and increases the content of organic matter and the rate of water infiltration. No-till farming, farming on the contour, returning crop residue to the soil, and including small grain and forage crops in the rotation reduce sheet and rill erosion. If erosion is controlled and improved management practices or no-till planting is used, cultivated crops can be included in the rotation half of the time. Grassed waterways help to control runoff and erosion. The soil is well suited to no-till farming.

This soil is well suited to woodland; the included severely eroded spots, however, are difficult to revegetate.

This soil is well suited to building site development. The shrink-swell potential, the slope, and frost action are moderate limitations. Low strength is a severe limitation for roads and streets. Building sites should be carefully selected to avoid runoff from the adjacent soils. Providing suitable base material and installing a good drainage system minimize the damage to local roads and streets caused by frost action and low strength. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Buildings should be designed so that they conform to the natural shape of the land. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow or slow permeability. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. The hazard of erosion can be controlled during construction by maintaining the plant cover on the site as much as possible. Many areas are good sites for ponds.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture suitability group is A-1.

MoD2—Morley silt loam, 12 to 18 percent slopes, eroded. This deep, well drained, strongly sloping soil is on ground moraines and end moraines. It commonly is on side slopes of dissected valleys. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that is high in content of clay. Most areas range from 5 to 20 acres in size and are long and narrow.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is yellowish brown, firm clay loam about 24 inches thick. The underlying material to a depth of about 80 inches is yellowish brown, calcareous, firm clay loam glacial till. In a few areas near the base of slopes and along drainageways, the soil is moderately well drained. In most of the wooded areas the soil is only slightly eroded. In some areas the subsoil has layers of loam or silt loam that are more permeable than the typical subsoil, and the underlying material has loam, silt loam, sandy loam, and gravelly loam.

Included with this soil in mapping are small areas of Blount and Pewamo soils. The somewhat poorly drained Blount soils are at the base of slopes, in seeps, and in concave areas on hillsides. The very poorly drained Pewamo soils are along small natural drainageways. Also included are some small areas on knolls and on the steeper parts of hillsides where the soils are severely eroded and have a surface layer of silty clay loam. In a few places small areas of steeper soils are included. Also included are a few springs and seeps. Included soils make up less than 15 percent of most areas.

Permeability is moderately slow or slow in the Morley soil. The available water capacity is moderate. Runoff is very rapid. The root zone generally is moderately deep to compact glacial till. The content of organic matter is moderately low.

Most areas are used as pasture. A few areas are used as cropland, and some are used as woodland.

This soil is poorly suited to corn and small grain and moderately well suited to grasses and legumes for hay or pasture. Controlling erosion, reducing runoff, and increasing the rate of water infiltration are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year and including winter cover crops, small grain, and forage crops in the rotation help to control erosion and increase the rate of water infiltration. If erosion is controlled and improved management practices or no-till planting is used, cultivated crops can be included in the rotation one-fourth of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. The hazard of erosion and the equipment limitation are moderate. Establishing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion.

This soil is poorly suited to most kinds of building site development. The slope, the shrink-swell potential, low strength, and frost action are limitations. Extensive land shaping is generally necessary. Runoff channels should be protected against erosion by grass or a stone riprap lining. Providing suitable base material and installing a drainage system minimize the damage to local roads and streets caused by frost action and low strength. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Buildings should be designed so that they conform to the natural shape of the land. Subsurface drains are needed in areas of the wetter included soils to intercept lateral movement of water. The soil has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IVe. The woodland ordination symbol is 4R. The pasture suitability group is A-1.

OcB—Ockley silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on low knolls and ridges on terraces. Most areas range from 5 to 40 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is strong brown and brown, firm and friable gravelly clay loam and gravelly coarse sandy loam. The underlying material to a depth of about 80 inches is yellowish brown, loose gravelly loamy coarse sand. In some areas the subsoil is not as deep. In other areas glacial till is in the underlying material below a depth of 60 inches. In some places the upper part of the subsoil has more silt. In other places the soil is eroded. In a few areas the subsoil is thicker and the underlying material has more silt and clay.

Included with this soil in mapping are small areas of Amanda, Centerburg, Rittman, and Sleeth soils. The Amanda and the moderately well drained Centerburg and Rittman soils formed in glacial till and are on upland slope breaks. The somewhat poorly drained Sleeth soils are in drainageways and depressions. Included soils make up less than 15 percent of most areas.

Runoff is medium on the Ockley soil. The content of organic matter is moderate. Permeability is moderate in the subsoil and very rapid in the underlying material. The available water capacity is moderate.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Controlling erosion, conserving moisture, and increasing the content of organic matter are the major management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, and planting cover crops help to control erosion, conserve moisture, and increase the content of organic matter. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, smaller and more frequent applications of lime and fertilizer are needed. Grassed waterways help to control runoff and erosion. The soil is well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to most kinds of building site development. The shrink-swell potential, frost action, and low strength are moderate limitations. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Installing a drainage system and providing suitable base material can minimize the damage to local roads and streets caused by low strength and frost action. The soil has high potential for septic tank absorption fields. In some areas it readily absorbs but may not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground-water supplies. The soil is a source of sand and gravel. Sloughing and the instability of cutbanks are severe hazards if the soil is excavated.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture suitability group is A-1.

OcC—Ockley silt loam, 6 to 12 percent slopes. This deep, moderately sloping, well drained soil is on side slopes and knolls on terraces. Most areas range from 5 to 40 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is strong brown and brown, firm and friable gravelly clay loam and gravelly coarse sandy loam. The underlying material to a depth of 80 inches is yellowish brown, loose gravelly loamy coarse sand. In some areas the subsoil is not as deep. In other areas glacial till is in the underlying material. In a few places the upper part of the subsoil contains more silt. In other places the subsoil is thicker and the underlying material has more silt and clay. In some areas the soil is eroded.

Included with this soil in mapping are small areas of Amanda, Centerburg, Rittman, and Sleeth soils. The Amanda and the moderately well drained Centerburg and Rittman soils formed in glacial till and are on upland slope breaks. The somewhat poorly drained Sleeth soils are in drainageways and depressions. Also included are areas of soils where the slope is 12 to 18 percent. Included soils make up less than 15 percent of most areas.

Permeability is moderate in the subsoil and very rapid in the underlying material of the Ockley soil. The available water capacity is moderate. Runoff is rapid. The content of organic matter is moderately low. The root zone is deep.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Controlling erosion, conserving moisture, and increasing the content of organic matter are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, and planting cover crops help to control erosion, conserve moisture, and increase the content of organic matter. Contour farming and grassed waterways help to control runoff and erosion. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, smaller and more frequent applications of lime and fertilizer are needed. The soil is well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to most kinds of building site development. The shrink-swell potential, the slope, frost action, and low strength are moderate limitations. Foundation walls should be reinforced or should be backfilled with material that has a lower shrink-swell potential. Installing a drainage system and providing suitable base material can minimize the damage to local roads and streets caused by low strength and frost action. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. Sloughing and the instability of cutbanks are severe hazards if the soil is excavated. The soil has high potential for septic tank absorption fields. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. In some areas the soil readily absorbs but may not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground-water supplies. The soil is a source of sand and gravel.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture suitability group is A-1.

Pm—Pewamo silty clay loam. This deep, nearly level, very poorly drained soil is in low areas, closed depressions, and along intermittent drainageways on ground moraines and end moraines. It receives runoff from the adjacent higher soils and is subject to ponding. The slope is 0 to 2 percent. Most areas range from 2 to 320 acres in size and are irregular in shape.

Typically, the surface layer is black and very dark gray, firm silty clay loam about 15 inches thick. The subsoil is dark gray and gray, mottled, firm silty clay loam about 51 inches thick. The underlying material to a depth of about 80 inches is dark yellowish brown, mottled, firm clay loam. In some areas the surface layer is thinner or lighter in color and has less organic matter. In a few small areas along drainageways, the slope is 3 or 4 percent. In a few places the subsoil has more sand and less clay.

Included with this soil in mapping are small areas of Blount, Bennington, Carlisle, Condit, and Sloan soils. The somewhat poorly drained Blount and Bennington soils are on slight rises. The Carlisle soils formed in organic material and are in the center of the larger depressions. The poorly drained Condit soils do not have a deep, dark surface layer and are in depressions. The Sloan soils are along drainageways. Included soils make up less than 15 percent of most areas.

Permeability is moderately slow in the Pewamo soil. The available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface. The content of organic matter is high. Tilth is generally good, although in some areas the soil becomes cloddy if plowed when wet. The potential for frost action is high.

Most areas are drained and are used as cropland. Some undrained areas are used as pasture. A few undrained areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. It responds well to practices that improve drainage and control compaction. Surface and subsurface drainage are used to remove excess surface water and lower the seasonal water table. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in the fall. Tilling within the proper range in moisture content and returning crop residue to the soil minimizes compaction and improves tilth. If adequately drained, the soil is moderately well suited to no-till farming.

Stands of alfalfa are difficult to establish and maintain unless the seasonal high water table is lowered by a drainage system. This soil is better suited to other legumes, such as alsike clover or ladino clover. Reed canarygrass and redtop grow in areas that are too wet to support other grasses. In some years mowing is delayed in spring or other wet periods because of a seasonal high water table.

This soil is well suited to woodland. Most of the woodland is second-growth, and swamp forest species are dominant. The equipment limitation, seedling mortality, and the windthrow hazard are severe limitations. Trees that can withstand wetness should be selected for planting. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is poorly suited to building site development. The ponding, frost action, and low strength are severe limitations. Because of the seasonal high water table, the soil is better suited to dwellings without basements than to dwellings with basements. Landscaping of building sites so that surface water drains away from the foundation and foundation drains help to minimize the damage caused by wetness and by shrinking and swelling. Coating the exterior basement walls also help to minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The soil has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. Two 1,000-gallon septic tanks are needed to minimize clogging in the system. A french drain is needed to remove excess surface water from the site. An artificial outlet for the drain may be needed where natural outlets are inadequate.

The land capability classification is IIw. The woodland ordination symbol is 5W. The pasture suitability group is C-1.

Ps—Pits, gravel. This map unit generally consists of open excavations from which gravel and sand have been removed. In some areas, however, the sand and gravel are currently being removed. Gravel pits are typically in hummocky areas and on stream terraces where they are associated with Chili, Gallman, and Ockley soils. Slopes are very irregular because of spoil piles, overburden, and unmined banks. Many areas have high walls on one or more sides. Small ponds are on the bottom of some of the pits. Loam glacial till is at the base of many of the pits.

Gravel pits vary considerably in size and depth. Most are 2 to 50 acres in size. Pits that are smaller than 2 acres are identified by a spot symbol on the soil map. Many of the smaller pits have not been recently used. Most areas are barren; however, the pits are being slowly revegetated by natural plant succession of weeds, grasses, shrubs, and drought-tolerant tree species.

The stripped soil material making up the spoil banks varies in thickness and composition within a short distance. It has poor physical properties and is commonly droughty, gravelly and sandy, and poorly suited to plants. It is subject to erosion and is a potential source of siltation.

Most abandoned gravel pits are used as habitat for wildlife or as pasture. In a few areas the abandoned pits are suited to recreational uses. Some pits have stands of second-growth timber. Pits are poorly suited to cropland because of the irregular slope, shallow root zone, and low fertility. These areas are suited to habitat for wildlife and to some recreational uses. Onsite investigation is needed to determine the suitability of pits as sites for buildings and sanitary facilities.

Establishing plant cover on abandoned sites reduces the hazard of erosion and siltation. Grasses and trees that can withstand droughtiness and the somewhat unfavorable soil properties should be selected for seeding and planting.

This unit has not been assigned a land capability classification, a woodland ordination symbol, or a pasture suitability group.

RsB—Rittman silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on the higher parts of end moraines and ground moraines. Most areas range from 5 to 200 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, mottled, firm and very firm clay loam. The next part is a fragipan of yellowish brown and dark yellowish brown, very firm and brittle clay loam and loam. The lower part is dark yellowish brown, mottled, firm clay loam. The underlying material to a depth of about 80 inches is dark yellowish brown, calcareous, very firm clay loam glacial till. In some areas the fragipan is weak or does not occur. In other areas the soil is well drained. In a few areas the surface layer is eroded.

Included with this soil in mapping are small areas of Bennington, Chili, Condit, and Wadsworth soils. The somewhat poorly drained Bennington and Wadsworth soils are in low areas. The well drained Chili soils have sand and gravel in the underlying material. They are along the larger streams. The poorly drained Condit soils are in depressions and along drainageways. Included soils make up as much as 20 percent of some areas.

Runoff is medium on the Rittman soil. The content of organic matter is moderate. The potential for frost action is high. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Some areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture.

Controlling erosion, minimizing compaction, and increasing the content of organic matter are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, planting cover crops, and tilling within the proper range in moisture content help to control erosion, minimize compaction, and increase the content of organic matter. Grassed waterways help to control runoff and erosion. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. The windthrow hazard is moderate. It can be reduced by harvesting procedures that do not leave the remaining trees widely spaced.

This soil is moderately well suited to most kinds of building site development. The wetness and frost action are limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. Perimeter drains help to lower the seasonal high water table.

The land capability classification is IIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

RsC—Rittman silt loam, 6 to 12 percent slopes. This deep, moderately sloping, moderately well drained soil is on ridgetops and along drainageways on end moraines and ground moraines. Most areas range from 2 to 40 acres in size and are irregular in shape.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, mottled, firm and very firm clay loam. The next part is a fragipan of yellowish brown and dark yellowish brown, very firm and brittle clay loam and loam. The lower part is dark yellowish brown, mottled, firm clay loam. The underlying material to a depth of about 80 inches is dark yellowish brown, calcareous, very firm clay loam glacial till. In some areas the fragipan is weak or does not occur. In a few areas the surface layer is moderately eroded. In other areas the soil is well drained.

Included with this soil in mapping are small areas of Bennington, Chili, Condit, and Wadsworth soils. The somewhat poorly drained Bennington and Wadsworth soils are in low areas. The well drained Chili soils have sand and gravel in the underlying material. They are along the larger streams. The poorly drained Condit soils are in depressions and along drainageways. Included soils make up less than 15 percent of most areas.

Runoff is rapid on the Rittman soil. The content of organic matter is moderate. The potential for frost action is high. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Some areas are pastured or wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. Controlling erosion, minimizing compaction, and increasing the rate of water infiltration and the content of organic matter are the main management concerns. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, planting cover crops, and farming on the contour help to control erosion, minimize compaction, and increase the rate of water infiltration and the content of organic matter. Grassed waterways help to control runoff and erosion. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. The windthrow hazard is moderate. It can be reduced by harvesting procedures that do not leave the remaining trees widely spaced.

This soil is moderately well suited to most kinds of building site development. The wetness, the slope, and frost action are severe limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. Perimeter drains help to lower the seasonal high water table. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

RsC2—Rittman silt loam, 6 to 12 percent slopes, eroded. This deep, moderately sloping, moderately well drained soil is on side slopes and convex ridgetops on end moraines and ground moraines. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has a higher content of clay than the original surface layer. Most areas range from 2 to 25 acres in size and are long and narrow.

Typically, the surface layer is brown and yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, mottled, firm and very firm clay loam. The next part is a fragipan of yellowish brown and dark yellowish brown, very firm and brittle clay loam and loam. The lower part is dark yellowish brown, mottled, firm clay loam. The underlying material to a depth of about 80 inches is dark yellowish brown, calcareous, very firm clay loam glacial till. In some areas the fragipan is very weak or does not occur. In a few areas the surface layer is only slightly eroded. In places the soil is well drained.

Included with this soil in mapping are small areas of Bennington, Chili, Condit, and Wadsworth soils. The somewhat poorly drained Bennington and Wadsworth soils are in low areas. The well drained Chili soils have sand and gravel in the underlying material. They are along the larger streams. The poorly drained Condit soils are in depressions and along drainageways. Included soils make up as much as 15 percent of some areas.

Runoff is rapid on the Rittman soil. The content of organic matter is moderately low. The potential for frost action is high. A perched seasonal high water table is between depths of 18 and 36 inches during wet periods. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Some areas are pastured or wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. It has resulted in deterioration of tilth and has lowered the content of organic matter in the surface layer. Controlling erosion, improving tilth, and increasing the rate of water infiltration and the content of organic matter are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, planting cover crops, farming on the contour, returning crop residue to the soil, and including grasses and legumes in the rotation help to control erosion, increase the rate of water infiltration and the content of organic matter, and improve tilth. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. Grassed waterways help to control runoff and erosion. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. The windthrow hazard is moderate. It can be reduced by harvesting procedures that do not leave the remaining trees widely spaced.

This soil is moderately well suited to most kinds of building site development. The wetness, the slope, and frost action are severe limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating the exterior basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the slow permeability. Perimeter drains help to lower the seasonal high water table. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

Sh—Shoals silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. It is in low areas near upland slope breaks or terraces on flood plains along the major streams. Along the smaller streams it is the dominant soil on the flood plains and is subject to flooding following intense local thunderstorms. Brief periods of flooding occasionally occur in fall, winter, and spring. They may occur during the growing season. The slope is 0 to 2 percent. Most areas range from 5 to 80 acres in size and are long and narrow.

Typically, the surface layer is dark brown and brown, friable silt loam about 12 inches thick. The underlying material to a depth of about 80 inches is multicolored, friable and loose silt loam, loam, clay loam, sandy loam, and silty clay loam. In some small areas the surface layer is darker colored. In a few areas in depressions and along former stream channels, the soil is poorly drained and the subsoil has more clay. On many of the smaller flood plains, clay loam or loam till is at a depth of 40 to 60 inches. In a few areas the soil is subject to rare flooding. In some areas the subsoil has a lower reaction. In other areas it has less sand and more silt. In places the upper 40 inches of the soil contains about 5 percent gravel, by volume.

Included with this soil in mapping are small areas of Condit, Lobdell, and Pewamo soils. The poorly drained Condit and very poorly drained Pewamo soils are near the head of streams on small flood plains. The moderately well drained Lobdell soils are near stream channels and on slightly elevated parts of the flood plains. Included soils make up about 15 percent of most areas.

Runoff is slow on the Shoals soil. The content of organic matter is moderate. The potential for frost action is high. The seasonal high water table is between depths of 6 and 18 inches after prolonged rainy periods. Permeability is moderate. The available water capacity is high.

Most areas are used as cropland. Generally, areas in the narrower valleys are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. In some years the hazard of flooding and the wetness delay planting and limit the choice of crops. The soil is suited to row crops that can be planted when flooding is not a hazard. The level of flooding can be reduced by keeping channels free of logs and debris. Surface and subsurface drains are effective in removing ponded water after flooding and lowering the seasonal water table. However, in some areas on the narrow flood plains the soil is difficult to drain. In some areas diversions are needed on the lower part of upland slope breaks and terraces. A tillage method that partly covers crop residue and leaves a rough or ridged surface layer helps to prevent the removal of crop residue by floodwater, hastens drying, and increases the rate of water infiltration. In adequately drained areas the soil is moderately well suited to no-till farming. Weed control is difficult on this soil because the floodwater carries weed seeds.

This soil is well suited to woodland. The equipment limitation and the seedling mortality rate are moderate. Logging during the drier parts of the year or when the ground is frozen helps to overcome the equipment limitation. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

This soil is generally unsuited to most kinds of building site development. It is suited to recreational uses during the drier part of the year. The soil has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderate permeability. Perimeter drains lower the seasonal high water table. The septic tank system should be protected from flooding.

The land capability classification is IIw. The woodland ordination symbol is 5A. The pasture suitability group is C-3.

SkA—Sleeth silt loam, loamy substratum, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is in low areas on outwash plains and terraces. Most areas are irregularly shaped and commonly range from 2 to 30 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 10 inches thick. The subsoil is about 50 inches thick. The upper part is brown, mottled, friable silt loam. The next part is grayish brown, mottled, firm loam. The lower part is brown, mottled, friable clay loam. The underlying material to a depth of about 80 inches is dark grayish brown and dark gray, very friable sandy loam and gravelly clay loam and yellowish brown, very friable gravelly loam. In some areas the surface layer is darker in color. In other areas the subsoil has less sand. In places glacial till is below a depth of 48 inches. In a few areas the slope is 3 to 6 percent.

Included with this soil in mapping are small areas of Bennington, Blount, Chili, Gallman, and Millgrove soils. Bennington and Blount soils are in slightly higher positions on the landscape than the Sleeth soil. Their subsoil has more clay than that of the Sleeth soil. The well drained Chili and Gallman soils are on the more sloping hillslopes and summits. The very poorly drained Millgrove soils are in depressions and along drainageways. Also included are small areas where the soil is moderately well drained. Included soils make up less than 15 percent of most areas.

Runoff is slow on the Sleeth soil. The content of organic matter is moderate. The frost action is high. The seasonal high water table is at a depth of 12 to 36

Figure 6.—Poor tilth and sheet erosion in an area of Sleeth silt loam, loamy substratum, 0 to 3 percent slopes. Chili loam, 6 to 12 percent slopes, is in the background.

inches during extended wet periods. Permeability is moderate. The available water capacity is high.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Lowering the seasonal high water table and minimizing compaction are management concerns. Subsurface drains are an effective way to lower the seasonal high water table. Applying a conservation tillage system, such as no-till farming, returning crop residue to the soil, and tilling within the proper range in moisture content are effective ways to minimize compaction and improve tilth (fig. 6). If adequately drained, the soil is well suited to no-till farming.

Stands of alfalfa are difficult to establish and maintain unless the seasonal high water table is lowered by a drainage system. This soil is better suited to other legumes, such as alsike clover or ladino clover.

This soil is well suited to woodland. Tree species selected for planting should be those that can withstand wetness.

This soil is poorly suited to most kinds of building site development. The wetness, low strength, and frost action are severe limitations. This soil is better suited to dwellings without basements than to dwellings with basements. The instability of cutbanks and sloughing are severe hazards if the soil is excavated. Installing drains along the foundations and coating the exterior basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderate permeability. A perimeter drain helps to lower the seasonal high water table. An artificial outlet for perimeter drains may be needed where natural outlets are inadequate.

The land capability classification is IIw. The woodland ordination symbol is 5A. The pasture suitability group is C-1.

So—Sloan silty clay loam, sandy substratum, occasionally flooded. This deep, nearly level, very poorly drained soil is in depressions on flood plains. Brief periods of flooding occasionally occur in winter and spring. They may occur during the growing season. The slope is 0 to 2 percent. Most areas range from 5 to 60 acres in size and are long and narrow.

Typically, the surface layer is very dark gray, firm silty clay loam about 12 inches thick. The subsoil is about 36 inches thick. The upper part is dark gray and brown, mottled, firm silty clay loam and clay loam. The lower part is yellowish brown and gray, mottled, friable loam. The underlying material to a depth of about 80 inches is grayish brown, mottled, friable loam and very dark gray, mottled, loose gravelly loamy sand. In some areas the surface layer is silt loam. In other areas it is lighter in color. In a few areas in old channels, the subsoil has more clay. In places the underlying material has more gravel.

Included with this soil in mapping are small areas of Milford, Pewamo, and Shoals soils. The Milford and Pewamo soils are near the head of streams on small flood plains. The somewhat poorly drained Shoals soils are in slightly higher positions on the landscape than the Sloan soil. Included soils make up 10 to 20 percent of most areas.

Runoff is very slow on the Sloan soil. The seasonal high water table is near the surface during prolonged rainy periods. The content of organic matter is high. Tilth is good. The potential for frost action is high. Permeability is moderate or moderately slow. The available water capacity is high.

Most areas are used as cropland. A few areas are pastured or wooded.

If drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. The flooding and the wetness may delay planting and limit the choice of crops. The flooding often damages winter grain crops. The soils should be tilled at the optimum moisture content because the soil becomes cloddy and compacted if worked when wet. If suitable outlets are available, surface and subsurface drains are effective in removing ponded water and lowering the seasonal high water table. Applying a conservation tillage system, returning crop residue to the soil, and planting cover crops help to maintain tilth and protect the surface in areas that are subject to scouring by floodwater. Tilling and planting should be delayed in the spring until flooding is no longer a hazard. Because the soil is wet and is slow to warm up in the spring, the soil is poorly suited to no-till farming.

This soil is well suited to native hardwoods. The equipment limitation is severe. The seedling mortality rate and the windthrow hazard are moderate. Logging during the drier parts of the year or when the ground is frozen helps to overcome the equipment limitation. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

Because of the hazard of flooding and the wetness, this soil is generally unsuited to most kinds of building site development. It has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow or slow permeability. A perimeter drain helps to lower the seasonal high water table. The septic tank system should be protected from flooding.

The land capability classification is IIIw. The woodland ordination symbol is 5W. The pasture suitability group is C-3.

Tg—Tioga loam, occasionally flooded. This deep, nearly level, well drained soil is on wide flood plains. Brief periods of flooding occasionally occur in winter and spring. They may occur during the growing season. The slope is 0 to 2 percent. Most areas range from 15 to 120 acres in size and are long and narrow.

Typically, the surface layer is brown, friable loam about 12 inches thick. The subsoil is yellowish brown, very friable fine sandy loam and loam about 22 inches thick. The underlying material to a depth of about 80 inches is dark yellowish brown, gray, dark gray, and yellowish brown, very friable, friable, and loose sandy loam, loamy sand, loam, and very gravelly loamy sand. In some areas the surface layer is fine sandy loam or silt loam. In a few areas the subsoil has more clay.

Included with this soil in mapping are small areas of Lobdell and Shoals soils. The moderately well drained

Lobdell soils are slightly lower on the landscape than the Tioga soil and are along the base of slopes. The somewhat poorly drained Shoals soils are in depressions and old stream channels. Included soils make up as much as 15 percent of most areas.

Runoff is slow on the Tioga soil. The content of organic matter is moderate. The seasonal high water table is between depths of 36 and 72 inches after prolonged rainy periods. Permeability is moderate or moderately rapid. The available water capacity is moderate.

Most areas are used as cropland. Many areas are pastured, and some are wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. The flooding can damage winter grain and forage crops. A tillage method that partly covers crop residue and leaves a rough or ridged surface helps to prevent removal of the crop residue by floodwater. Weed control is difficult because the floodwater spreads weed seeds. Spring tillage and planting should be delayed until the flooding is no longer a hazard. The soil is moderately well suited to no-till farming.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is generally unsuited to most kinds of building site development because of the hazard of flooding. It has very low potential for septic tank absorption fields. A perimeter drain helps to lower the seasonal high water table. The septic tank system should be protected from flooding.

The land capability classification is IIw. The woodland ordination symbol is 4A. The pasture suitability group is A-5.

Ud—Udorthents, loamy. These deep, nearly level soils are in borrow areas. They are surface mined for roadfill material. Typically, the remaining soil material is similar to the underlying material of the adjacent soils. The slope is dominantly 0 to 2 percent. Most areas range from 5 to 20 acres in size and are rectangular or triangular.

Typically, these soils are calcareous loam and gravelly loam glacial till. In places the surface layer has been covered by 2 to 3 inches of limestone gravel.

Included with these soils in mapping are small areas of relatively undisturbed soils, small piles of gravelly and loamy material, a few small areas that are covered with asphalt, and an area used as a sanitary landfill. In some areas along the edge of the map unit, the slopes are 2 to 12 percent. In other areas they are short and steep. Inclusions make up about 20 percent of most areas.

Runoff is slow on the Udorthents. The content of organic matter is very low. Permeability is generally slow; however, it varies. The available water capacity is very low.

In most areas these soils support some weeds. A few small trees are in some areas. The soils are poorly suited to plants. Native or adapted species that can withstand mildly alkaline or moderately alkaline reaction and low fertility should be selected for planting. Mulching seedlings helps to retain moisture and increase growth rates. Blanketing the soils with topsoil helps to establish the plant cover more rapidly.

The suitability of these soils for building site development varies. Onsite investigation is needed to determine the limitations affecting any proposed use.

These soils have not been assigned a land capability classification, a woodland suitability symbol, or a pasture suitability group.

WaA—Wadsworth silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is in low areas and on flats on the higher parts of end moraines and ground moraines. Most areas are irregularly shaped and range from 5 to 80 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 yellowish brown, mottled, firm silty clay loam. The next part is yellowish brown, mottled, very firm and brittle clay loam. The lower part is yellowish brown, mottled, very firm clay loam. A fragipan is between depths of 29 and 40 inches. The underlying material to a depth of about 80 inches is yellowish brown and brown, calcareous, very firm clay loam glacial till. In some areas the fragipan is weak or does not occur. In a few areas the subsoil has more sand.

Included with this soil in mapping are small areas of Bennington, Condit, and Rittman soils. The somewhat poorly drained Bennington and poorly drained Condit soils have more sand in the subsoil than that in the Wadsworth soil. They do not have a fragipan. The Bennington soils are in positions on the landscape similar to those of the Wadsworth soil. The Condit soils are in depressions and along drainageways. The moderately well drained Rittman soils are on low knolls and ridgetops. Included soils make up less than 20 percent of most areas.

Runoff is slow on the Wadsworth soil. The content of organic matter is moderate. A perched seasonal high water table is at a depth of 12 to 24 inches during extended wet periods. Permeability is moderately slow or moderate above the fragipan and very slow or slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Lowering the seasonal high water table, reducing crusting, increasing the rate of water infiltration and the content of organic matter, and minimizing compaction are the major management concerns. Subsurface drainage systems are an effective way to lower the seasonal high water table. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, and tilling within the proper range in moisture content are effective ways to minimize compaction and crusting and increase the rate of water infiltration and the content of organic matter. If adequately drained, the soil is well suited to no-till farming.

Stands of alfalfa are difficult to establish and maintain unless the seasonal high water table is lowered by a drainage system. This soil is better suited to other legumes, such as alsike clover, red clover, or ladino clover. In some years mowing is delayed during wet periods because of the seasonal high water table.

This soil is well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are moderate limitations. Logging during the drier parts of the year helps to overcome the equipment limitation. Selecting species for planting that can withstand seasonal wetness reduces the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is moderately well suited to most kinds of building site development. The wetness and frost action are severe limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The soil has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the very slow or slow permeability. Perimeter drains are needed to lower the seasonal high water table. An artificial outlet for perimeter drains may be needed where natural outlets are inadequate.

The land capability classification is IIIw. The woodland ordination symbol is 5D. The pasture suitability group is C-2.

WaB—Wadsworth silt loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on low knolls and long concave slopes on end moraines and ground moraines. Most areas are irregularly shaped and range from 5 to 40 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 yellowish brown, mottled, firm silty clay loam. The next part is yellowish brown, mottled, very firm and brittle clay loam. The lower part is yellowish brown, mottled, very firm clay loam. A fragipan is between depths of 29 and 40 inches. The underlying material to a depth of about 80 inches is yellowish brown and brown, calcareous, very firm clay loam glacial till. In some areas the fragipan is weak or does not occur. In a few areas the subsoil has more sand.

Included with this soil in mapping are small areas of Bennington, Condit, and Rittman soils. The somewhat poorly drained Bennington and poorly drained Condit soils have more sand in the subsoil than that in the Wadsworth soil. They do not have a fragipan. The Bennington soils are in positions on the landscape similar to those of the Wadsworth soil. The Condit soils are in depressions and along drainageways. The moderately well drained Rittman soils are on low knolls and ridgetops. Included soils make up less than 20 percent of most areas.

Runoff is medium on the Wadsworth soil. The content of organic matter is moderate. A perched seasonal high water table is at a depth of 12 to 24 inches during extended wet periods. Permeability is moderately slow or moderate above the fragipan and very slow or slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep or deep to compact glacial till.

Most areas are used as cropland. A few areas are pastured or wooded.

This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Lowering the seasonal high water table, reducing crusting, minimizing compaction, and controlling erosion are the major management concerns. Subsurface drainage systems are an effective way to lower the seasonal high water table. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, and tilling within the proper range in moisture content are effective ways to help to control erosion and minimize compaction and crusting. Grassed waterways help to control runoff and erosion. If adequately drained, the soil is well suited to no-till farming.

Stands of alfalfa are difficult to establish and maintain unless the seasonal high water table is lowered by a drainage system. This soil is better suited to other legumes, such as alsike clover, red clover, or ladino clover. In some years mowing is delayed during wet periods because of the seasonal high water table.

This soil is well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are moderate limitations. Logging during the drier parts of the year helps to overcome the equipment limitation. Selecting species for planting that can withstand seasonal wetness reduces the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is moderately well suited to most kinds of building site development. The wetness and frost action are severe limitations. Because of the wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Installing drains along the foundations and coating basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action. The soil has low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the very slow or slow permeability. Perimeter drains are needed to lower the seasonal high water table.

The land capability classification is IIIe. The woodland ordination symbol is 5D. The pasture suitability group is C-2.

WsB—Wooster silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on the higher parts of end moraines and ground moraines. Most areas range from 2 to 15 acres in size and are irregular in shape.

Typically, the surface layer is brown, very friable silt loam about 10 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown and dark yellowish brown, friable silt loam and loam and firm gravelly loam. The next part is a fragipan of yellowish brown and brown, very firm and brittle loam and clay loam. The lower part is brown, firm loam. The underlying material to a depth of about 80 inches is brown, firm gravelly loam glacial till. In some areas the fragipan is weak or does not occur. In a few areas the surface layer is eroded. In other areas gray mottles are in the upper part of the subsoil above the fragipan.

Included with this soil in mapping are small areas of Condit and Wadsworth soils. The poorly drained Condit and somewhat poorly drained Wadsworth soils are in depressions and along drainageways. Included soils make up less than 15 percent of most areas.

Runoff is medium on the Wooster soil. The content of organic matter is moderate. A perched seasonal high water table is at a depth of 30 to 48 inches during wet periods. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Some areas are pastured or wooded.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Controlling erosion, minimizing compaction, and increasing the content of organic matter are the main management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, planting cover crops, and tilling within the proper range in moisture content help to control erosion, minimize compaction, and increase the content of organic matter. Grassed waterways help to control runoff and erosion. Random subsurface drains are needed in the wetter included soils. The soil is well suited to no-till farming.

This soil is well suited to woodland. The windthrow hazard is moderate. It can be reduced by harvesting procedures that do not leave the remaining trees widely spaced or isolated.

This soil is well suited to most kinds of building site development. The wetness, low strength, and frost action are moderate limitations. Installing drains along the foundations and coating the exterior basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. Perimeter drains help to lower the seasonal high water table.

The land capability classification is IIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

WsC—Wooster silt loam, 6 to 12 percent slopes. This deep, moderately sloping, well drained soil is along drainageways and occasionally on convex ridgetops on end moraines and ground moraines. Most areas range from 3 to 20 acres in size and are long and narrow.

Typically, the surface layer is brown, very friable silt loam about 10 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown and dark yellowish brown, friable silt loam and loam and firm gravelly loam. The next part is a fragipan of yellowish brown and brown, very firm and brittle loam and clay loam. The lower part is brown, firm loam. The underlying material to a depth of about 80 inches is brown, firm gravelly loam glacial till. In some areas gray mottles are in the upper part of the subsoil above the fragipan. In other areas the fragipan is weak or does not occur. In places the surface layer is eroded.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington and poorly drained Condit soils do not have a fragipan. The Bennington soils are in low areas. The Condit soils are in depressions and along drainageways. The Chili soils have sand and gravel in the underlying material and are along the larger streams. Also included, along drainageways, are some areas where the soil is underlain by sandstone bedrock. Included soils make up less than 15 percent of most areas.

Runoff is rapid on the Wooster soil. The content of organic matter is moderate. A perched seasonal high water table is at a depth of 30 to 48 inches during wet periods. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Many areas are pastured, and a few are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. Controlling erosion, minimizing compaction, and increasing the rate of water infiltration and the content of organic matter are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, planting cover crops, farming on the contour, returning crop residue to the soil, tilling within the proper range in moisture content, and including grasses and legumes in the rotation help to control erosion, minimize compaction, increase the rate of water infiltration and the content of organic matter, and improve tilth. Grassed waterways help to control runoff and erosion. Random subsurface drains are needed on the wetter included soils. If erosion is controlled and improved management practices or no-till farming is used, row crops can be included in the rotation about half of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. The windthrow hazard is moderate. It can be reduced by harvesting procedures that do not leave the remaining trees widely spaced.

This soil is moderately well suited to most kinds of building site development. The slope, the wetness, low strength, and frost action are moderate limitations. Installing drains along the foundations and coating the exterior basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible or by establishing a temporary plant cover. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. Perimeter drains help to lower the seasonal high water table. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

WsC2—Wooster silt loam, 6 to 12 percent slopes, eroded. This deep, moderately sloping, well drained soil is along drainageways and on convex ridgetops on end moraines and ground moraines. Erosion has removed part of the original surface layer. Most areas range from 2 to 25 acres in size and are long and narrow.

Typically, the surface layer is brown, very friable silt loam about 9 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown and dark yellowish brown, friable silt loam and loam and firm gravelly loam; the next part is a fragipan of yellowish brown and brown, very firm and brittle loam and clay loam; and the lower part is brown, firm loam. The underlying material to a depth of about 80 inches is brown, firm gravelly loam glacial till. In some areas gray mottles are in the upper part of the subsoil above the fragipan. In other areas the fragipan is weak or does not occur. In places the surface layer is only slightly eroded.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington and poorly drained Condit soils do not have a fragipan. The Bennington soils are in low areas in depressions and along drainageways. The Chili soils have sand and gravel in the underlying material and are along the larger streams. Also included, along drainageways, are some areas where the soil is underlain by sandstone bedrock. Included soils make up less than 15 percent of most areas.

Runoff is rapid on the Wooster soil. The content of organic matter is moderately low. A perched seasonal high water table is at a depth of 30 to 48 inches during wet periods. Permeability is moderate above the

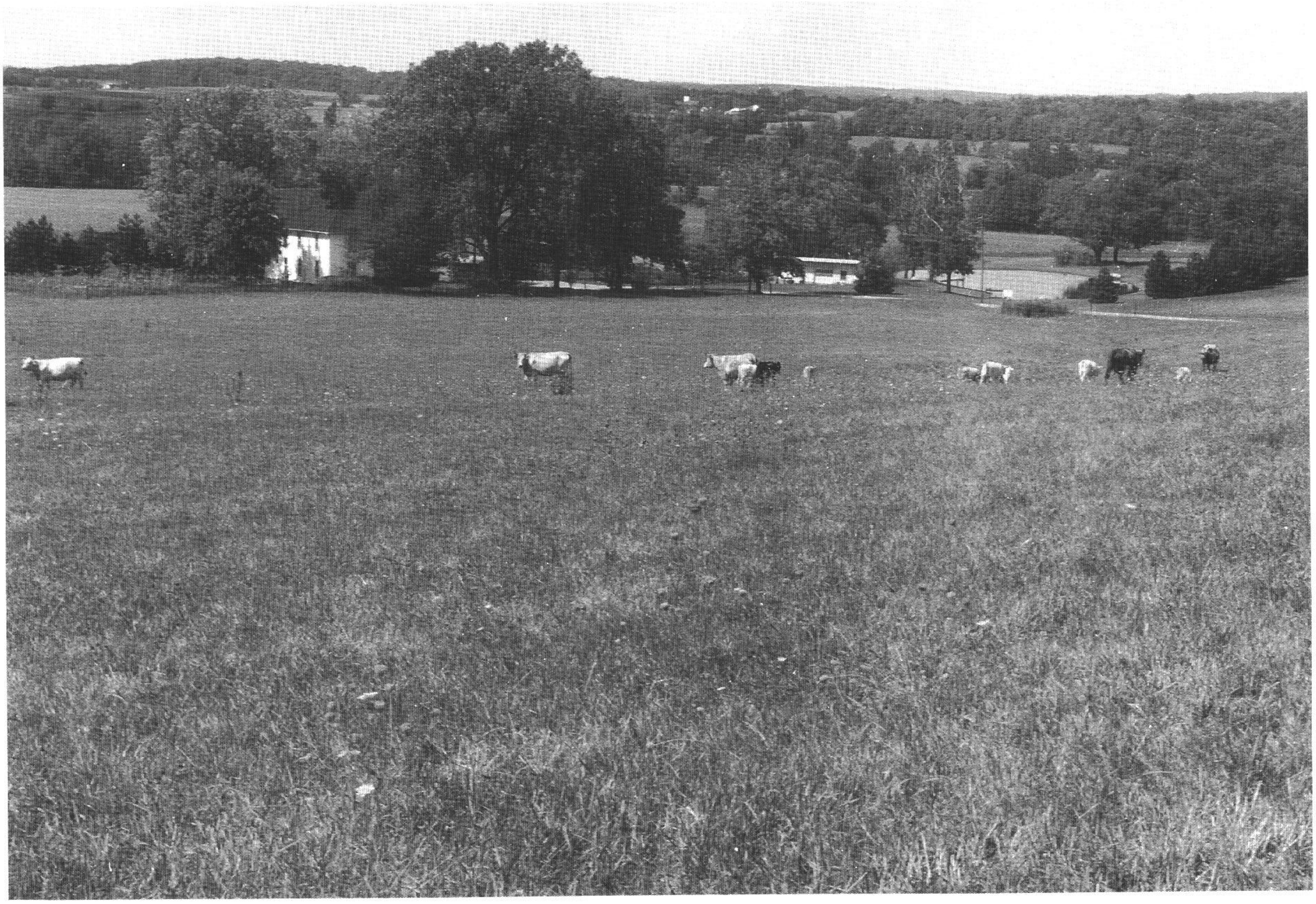

Figure 7.—Wooster silt loam, 6 to 12 percent slopes, eroded, is well suited to pasture. The buildings are on Canfield silt loam, 2 to 6 percent slopes.

fragipan and moderately slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas are used as cropland. Many areas are pastured, and some are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. It is well suited to grasses and legumes for hay or pasture (fig. 7). Erosion is a severe hazard in cultivated areas. It has resulted in deterioration of tilth and has lowered the content of organic matter in the surface layer. Controlling erosion, increasing the rate of water infiltration and the content of organic matter, and minimizing compaction are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, planting cover crops, including grasses and legumes in the crop rotation, and returning crop residue to the soil help to control erosion and increase the rate of water infiltration and the content of organic matter. Tilling within the proper range in moisture content minimizes compaction. Contour farming and grassed waterways help to control runoff and erosion. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about half of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. The windthrow hazard is moderate. It can be reduced by harvesting procedures that do not leave the remaining trees widely spaced.

This soil is moderately well suited to most kinds of building site development. The slope, the wetness, low strength, and frost action are moderate limitations.

Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible. Installing drains along the foundations and coating the exterior basement walls minimize the damage caused by wetness. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by low strength and frost action. The soil has medium potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the restricted permeability. Perimeter drains help to lower the seasonal high water table. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 5D. The pasture suitability group is F-3.

WsD2—Wooster silt loam, 12 to 18 percent slopes, eroded. This deep, strongly sloping, well drained soil is on hillslopes and on side slopes along drainageways on end moraines and ground moraines. Erosion has removed part of the original surface layer. Most areas of this soil range from 5 to 40 acres in size and are long and narrow.

Typically, the surface layer is dark yellowish brown, very friable silt loam about 6 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown and dark yellowish brown, friable silt loam and loam and firm gravelly loam. The next part is a fragipan of yellowish brown and brown, very firm and brittle loam and clay loam. The lower part is brown, firm loam. The underlying material to a depth of about 80 inches is brown, firm gravelly loam glacial till. In some areas the fragipan is weak or does not occur. In a few areas gray mottles are in the upper part of the subsoil above the fragipan.

Included with this soil in mapping are small areas of Bennington, Chili, and Condit soils. The somewhat poorly drained Bennington and poorly drained Condit soils do not have a fragipan. The Bennington soils are in low areas. The Condit soils are in depressions and along drainageways. The Chili soils have more sand and gravel in the underlying material than that in the Wooster soil. They are along the larger streams. Also included, along drainageways, are some areas where the soil is underlain by sandstone bedrock. Included soils make up less than 15 percent of most areas.

Runoff is very rapid on the Wooster soil. The content of organic matter is moderately low. A perched seasonal high water table is at a depth of 30 to 48 inches during wet periods. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Some areas are used as cropland. Many areas are pastured or wooded.

This soil is poorly suited to corn, soybeans, and small grain. It is moderately well suited to grasses and legumes for hay or pasture. Erosion is a severe hazard in cultivated areas. It has resulted in deterioration of tilth and has lowered the content of organic matter in the surface layer. Controlling erosion, minimizing compaction, and increasing the rate of water infiltration and the content of organic matter are management concerns. Applying a conservation tillage system, such as no-till farming, that leaves crop residue on the surface most of the year, returning crop residue to the soil, tilling within the proper range in moisture content, farming on the contour or stripcropping, and planting winter cover crops and including small grain and forage crops in the rotation help to control erosion, minimize compaction, and increase the rate of water infiltration and the content of organic matter. If erosion is controlled and improved management practices or no-till planting is used, row crops can be included in the rotation about one-fourth of the time. The soil is well suited to no-till farming.

This soil is well suited to woodland. The hazard of erosion, the equipment limitation, and the windthrow hazard are moderate. Establishing logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a plant cover also help to control erosion. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is poorly suited to most kinds of building site development. The slope is a severe limitation, and the wetness, low strength, and frost action are moderate limitations. Buildings should be designed so that they conform to the natural shape of the land. The increased runoff and erosion during construction can be controlled by maintaining the plant cover wherever possible. Installing drains along the foundations and coating the exterior basement walls help to minimize the damage caused by wetness. Installing a drainage system and providing suitable base material can minimize the damage to local roads and streets caused by low strength and frost action. The soil has very low potential for septic tank absorption fields. Increasing the size of the absorption field helps to compensate for the moderately slow permeability. The cost of installing the septic tank system is increased because of the slope. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Perimeter drains help to lower the seasonal high water table. Installing an interceptor drain upslope from the absorption field reduces the amount of surface and subsurface water entering the site.

The land capability classification is IVe. The woodland ordination symbol is 5R. The pasture suitability group is F-3.

WsE2—Wooster silt loam, 18 to 25 percent slopes, eroded. This deep, moderately steep, well drained soil is on hillslopes and side slopes along drainageways on end moraines and ground moraines. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas of this soil range from 5 to 30 acres in size and are long and narrow.

Typically, the surface layer is dark yellowish brown, very friable silt loam about 5 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown and dark yellowish brown, friable silt loam and loam and firm gravelly loam. The next part is a fragipan of yellowish brown and brown, very firm and brittle loam and clay loam. The lower part is brown, firm loam. The underlying material to a depth of about 80 inches is brown, firm gravelly loam glacial till. In some areas the fragipan is weak or does not occur. In a few areas gray mottles are in the upper part of the subsoil above the fragipan.

Included with this soil in mapping are small areas of Bennington and Shoals soils. The included soils are somewhat poorly drained and do not have a fragipan. The Bennington soils are in depressions and along drainageways. The Shoals soils are on flood plains along small streams. Also included, along drainageways, are some areas where the soil is underlain by sandstone bedrock. Included soils make up less than 15 percent of most areas.

Runoff is very rapid on the Wooster soil. The content of organic matter is moderately low. A perched seasonal high water table is at a depth of 30 to 48 inches during wet periods. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. The root zone generally is moderately deep. It is restricted by the fragipan.

Most areas of this soil are wooded. Some areas are pastured.

This soil is generally unsuited to corn, soybeans, and small grain. The moderately steep slope and the hazard of erosion are the main management concerns. The soil is poorly suited to pasture.

This soil is well suited to woodland. The hazard of erosion, the equipment limitation, and the windthrow hazard are moderate. Establishing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars, a plant cover, or other erosion-control measures also help to control erosion. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard.

This soil is generally unsuited to most kinds of building site development. The slope is a severe limitation. The soil has very low potential for septic tank absorption fields, which will not function properly because of the slope. An aerobic system having a subsurface sand filter is needed. Installing an interceptor drain upslope from the system helps to prevent surface and subsurface water from entering the site.

The land capability class is VIe. The woodland ordination symbol is 5R. The pasture suitability group is F-3.

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service or the Morrow Soil and Water Conservation District.

About 207,000 acres in the survey area, or more than 80 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the western and central parts, mainly in associations 1, 2, and 3, which are described under the heading "General Soil Map Units."

A recent trend in land use in some parts of the county has been the loss of some prime farmland to urban development. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible and less productive than prime farmland and cannot be easily cultivated.

The map units in Morrow County that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify as prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help to prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

James Overmoyer, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

At the end of each map unit description, the soil has been assigned to a pasture suitability group. These groups are based primarily on the suitability of the soil for certain pasture species, management needs, and potential productivity. Detailed interpretations for each pasture suitability group in the county are provided in the "Technical Guide," which is available in the local office of the Soil Conservation Service.

The paragraphs that follow describe the management needed on the cropland in Morrow County. The management concerns are soil drainage, erosion, fertility, tilth, and soil compaction.

Crops

In 1979, more than 160,000 acres, or 62 percent of the county, was used as cropland *(22)*. The major crops grown in the county are soybeans, corn, wheat, oats, and hay.

The potential of the soils in Morrow County for increased crop production is good. About 42,000 acres of potentially good cropland is currently being used as pasture or woodland *(22)*. However, the cost of converting this land to cropland should be considered. Erosion-control practices may be needed. A drainage system also may be needed, but installation of the system may not be possible because of inadequate natural outlets.

Changes in land use in Morrow County since 1967 have been significant. While the acreage of cropland has increased slightly, the acreage of urban land has more than doubled. In 1967, 11,000 acres was in urban or built-up land *(13)*. In 1979, more than 24,000 acres was in urban land *(22)*. As the acreage in urban land and cropland has increased, the acreage in woodland and pasture has decreased.

Soil drainage is the main management concern in the county. Almost half of the cropland needs a systematic drainage system *(22)*. Subsurface drains help to lower the seasonal high water table in many of the soils of the county. A seasonal high water table may delay planting and harvesting in some years. Surface drains help to remove excess water and ponded water and reduce the amount of water entering the soil.

Some very poorly drained and poorly drained soils, such as Condit, Milford, and Pewamo soils, have a seasonal high water table above or near the surface. In some places natural drainage outlets are not available because of the position of the soils on the landscape. If a subsurface drainage system is not provided, these poorly drained and very poorly drained soils are generally too wet to produce commonly grown crops.

The somewhat poorly drained Bennington and Blount soils have a perched water table in the upper part of the subsoil during winter and spring. A subsurface drainage system is needed for most crops.

The moderately well drained Centerburg, Glynwood, Lobdell, and Rittman soils commonly include small areas of wet soils in depressions along drainageways and hillside seeps. Subsurface and surface drains help to remove excess water in these areas.

The design of subsurface and surface drainage systems varies with the kind of soil and the availability of outlets. The very poorly drained and poorly drained soils require both subsurface and surface drains. Drains should be more closely spaced in slowly permeable and moderately slowly permeable soils than in the more permeable soils.

Erosion is a management concern. It is a hazard where the slope is more than 2 percent. Erosion-control practices are needed in 44 percent of the county *(22)*.

Erosion of the surface layer reduces productivity, increases the cost of production, and pollutes streams. Where the surface layer is lost and part of the subsoil is incorporated into the plow layer, productivity is reduced because tilth, the available water capacity, and rooting depth decrease. Most of the organic matter and plant nutrients in the soil are in the surface layer. When erosion removes the surface layer, the plant nutrients and organic matter are removed along with the soil particles. Increased amounts of fertilizer are needed to replace these lost nutrients. Where tilth is reduced, more energy is required for tillage. Erosion degrades water quality by increasing the amount of sediment in streams. Also, the amount of plant nutrients, herbicides, and insecticides in the streams increases. Controlling erosion can minimize the pollution of streams by sediment and improve water quality.

Erosion-control practices provide a protective surface cover, help to control runoff, and increase the rate of water infiltration. No-till farming or another system of conservation tillage that leaves crop residue on the surface most of the year, a crop rotation that includes grasses and legumes, contour farming, contour stripcropping, and terraces help to control erosion. The better drained soils and soils that are artificially drained are suited to no-till farming. A conservation tillage system and a crop rotation that includes grasses and legumes are effective on most soils. Contour farming, contour stripcropping, and terraces are the most practical measures on long, smooth slopes.

Grassed waterways can protect many areas where surface runoff is concentrated into a narrow channel or where surface runoff crosses the steeper slopes. They are natural or constructed channels protected by a cover of grass. They help to control erosion by holding the surface soil in place. Natural drainageways are the best locations for grassed waterways. They require a minimum of shaping to produce a good channel. The waterway should be wide and shallow so that it can be crossed by farm machinery.

The Bennington, Blount, and Glynwood soils that have slopes of 2 to 6 percent have a highly erodible surface layer. They require careful management to maintain losses by erosion within limits that do not reduce productivity or increase the cost of production.

The Amanda, Centerburg, Glynwood, Ockley, Rittman, and Wooster soils that have slopes of 6 to 12 percent have a severe hazard of erosion if row crops are grown more than once every 2 years using conventional methods. No-till farming or another system of conservation tillage that leaves crop residue on the surface most of the year is effective in controlling erosion on these soils.

Fertility is naturally low in many of the soils in the uplands that have a light colored surface layer. These soils have a moderately low content of organic matter and are naturally acid. Pewamo, Milford, and other soils in depressions and along drainageways have a dark surface layer and a high content of organic matter. They are less acid and more naturally fertile than the soils in the uplands. The soils on flood plains, such as Lobdell, Shoals, and Sloan soils, are naturally higher in plant nutrients than most of the soils in the uplands. They have a moderate or high content of organic matter.

Applications of lime may be needed to decrease the acidity of the surface layer to a level where most plant nutrients are readily available to most plants. On all soils, additions of lime and fertilizer should be based on the results of soil tests. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous. They can be worked easily, provide good seed contact, and allow for quick seedling emergence and strong root growth. Maintaining tilth is a management concern on many of the soils in Morrow County.

Many of the soils in the county have a surface layer that is light in color and low or moderately low in content of organic matter. Generally, the structure of such soils is weak or moderate. During periods of intense rainfall, a crust forms on the surface. When dry, the crust is hard and becomes nearly impervious to water. It reduces the rate of water infiltration and increases the runoff rate. Regularly adding crop residue, manure, and other organic materials to the soil maintains or improves the soil structure and minimizes crusting. No-till farming or another system of conservation tillage also minimizes crusting.

Fall plowing is generally not a good practice on the light colored soils in the county because such soils settle during winter and spring. If plowed in the fall, many of these soils are nearly as hard and dense at planting time as they were before they were plowed. Sloping soils are subject to erosion if they are plowed in the fall.

The Pewamo and Milford soils that have a dark surface layer have more clay in the surface layer than most of the lighter colored soils. Poor tilth is a problem because these soils tend to stay wet until late in the spring. If these soils are tilled when wet, they tend to be very cloddy when dry. Fall plowing generally results in good tilth in the spring.

Soil compaction occurs if the soils are worked when they are wet or are subject to heavy traffic or heavy loads. It limits root growth, reduces the rate of air and water movement, and creates plowpans. It can be prevented by tilling the soils at the proper moisture content, applying a system of conservation tillage, and planting deep-rooted legumes and grasses.

Including hay in the crop rotation helps to control erosion, increases the content of organic matter, and improves internal drainage and tilth. Most of the soils in the county are suited to grasses and legumes for hay. The strongly sloping to very steep soils limit the operation of farm machinery. On the somewhat poorly drained to very poorly drained soils, stands of alfalfa are difficult to establish and maintain if the seasonal high water table is not lowered by an artificial drainage system. Many of the soils in the county have a high potential for frost action, which may damage legumes. Including grasses in the seeding mixture helps to protect the legumes from frost heaving. The subsoil of most of the soils in the county is very strongly acid or strongly acid. When these soils are used for the production of legumes for hay, applications of lime are needed every 2 years to maintain high quality. Cutting hay on a schedule helps to produce high-quality forage.

Pasture

The acreage of pasture in Morrow County has been decreasing for several years. In 1979, the county had 23,981 acres of pasture, compared to 38,404 acres in 1967 *(22)*. Most of the pasture is on the moderately sloping to moderately steep terrain and is naturally seeded to Kentucky bluegrass. Orchardgrass has been seeded in many pastures and provides superior yields. Tall fescue can be grown and harvested into cylindrical bales for winter feeding. It can be successfully grown but is not widely used.

The soils used as pasture typically have low pH and a low content of phosphorus and potassium. Many unproductive pastures can be made productive with the addition of lime and fertilizer. Applying nitrogen fertilizer can greatly increase the production of grasses. Lime and fertilizer should be applied according to soil test recommendations. Control of weeds and brush by regular mowing and applications of recommended herbicides can help to maintain or increase forage production. Protection from overgrazing and pasture rotation help to maintain a healthy, vigorous stand for maximum forage production. Limited grazing during winter and wet periods minimizes soil compaction.

Most of the soils in the county are well suited to forage species. Typically, the moderately sloping to moderately steep soils, such as Amanda, Centerburg, Glynwood, and Rittman soils, are eroded and are naturally less fertile than the less sloping soils. The amount of available moisture is lower than that on most other soils because of rapid runoff. No-till seeding during pasture renovation helps to control erosion.

Production is good on the gently sloping soils; however, erosion can be a problem if overgrazing is permitted. To keep livestock from grazing bluegrass closer than 1 inch high or orchardgrass closer than 2 inches high, the number of livestock should be reduced or a system of rotation grazing should be applied. Grazing when the soils are wet causes soil compaction, which reduces productivity.

The soils on terraces and flood plains, such as

Ockley, Shoals, and Tioga soils, are well suited to pasture. They are high in natural fertility and have a moderate or high available water capacity. Many of these soils are limited for use as cropland because of flooding and the small, irregularly shaped fields; however, these factors are less restrictive in areas used as pasture.

The level or slightly depressional soils, such as Pewamo, Condit, and Milford soils, can be productive if a surface drainage system is installed to prevent ponding. Soil compaction is a severe hazard. It limits production if grazing is permitted on wet soils. Stands of alfalfa are difficult to establish and maintain if the seasonal high water table is not lowered by artificial drainage. These soils are better suited to other legumes, such as alsike clover, red clover, and ladino clover.

Conservation Tillage

In Morrow County the use of conservation tillage as a management measure in crop and forage production is increasing. Conservation tillage reduces the hazard of erosion and helps to maintain the productivity of the soil. It does not invert the soil and leaves a protective amount of crop residue on the surface throughout the year. A variety of conservation tillage systems are being applied in the county, including chisel plowing, offset disking, ridge tillage, and no-till farming.

Conservation tillage reduces the hazard of erosion by maintaining year-round ground cover. Soils erode when the impact of raindrops dislodges soil particles and rapid runoff carries the particles away. Raindrops also cause a crust to form on the surface. Ground cover, however, protects the surface, increases the rate of water infiltration into the soil, and slows the rate of runoff. The amount of ground cover remaining after tillage varies with the type of tillage system. The sloping soils, such as Amanda, Centerburg, Glynwood, Rittman, and Wooster soils, have a moderate or severe hazard of erosion but can be protected by adequate ground cover without a change in the crop rotation. Conservation tillage increases the amount of water available to plants. It is preferable to conventional tillage on Glynwood, Rittman, and Wooster soils, which have a limited available water capacity. The crop residue left on the surface increases the rate of water infiltration, slows the rate of runoff, and minimizes evaporation.

Drainage is a management concern where no-till farming is used on the nearly level to gently sloping Bennington, Blount, Condit, Pewamo, and Sleeth soils. Surface ditches and subsurface drains lower the seasonal high water table. Without adequate drainage, yields may be lower than they would be with other tillage systems. Properly managed cover crops help to remove excess water from the soil. Ridge planting can minimize the wetness in extremely flat fields.

Applications of fertilizer can be effective in most areas where a system of conservation tillage is applied *(11)*. Because fertilizer applied on the surface is not incorporated into the plow layer as it is in conventional tillage, the timing and method of fertilizer application may need to be adjusted.

Weed control is an important consideration in all forms of tillage. Herbicide programs should be designed to control the weeds in individual fields *(11)*.

Insects and diseases generally are not a deterrent to conservation tillage systems. Applying integrated pest management procedures to continually monitor for potential problems is recommended for all types of tillage. Insects can be controlled chemically, but applications of insecticide are limited to chemicals that do not require incorporation into the soil. Crop rotations and the selection of resistant varieties help to control diseases in most situations *(11)*.

Conservation tillage is an economically competitive way to protect soil resources. On the appropriate soils, it is a significant alternative to conventional tillage for farmers in Morrow County.

Yields Per Acre

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

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(20)*. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Pasture Suitability Groups

The pasture suitability group symbol for each soil is listed at the end of each map unit description and in the section "Interpretive Groups," which follows the tables in the back of this survey. Soils assigned the same suitability group symbol require the same general management and have about the same potential productivity. The pasture suitability groups are organized by soil characteristics and limitations.

The soils in group A have few limitations for the management and growth of climatically adapted plants. The soils in pasture suitability group A-1 are deep and are well drained or moderately well drained. Their surface layer is loam, fine sandy loam, or silt loam. Available water capacity is moderate or high. The average slope ranges from 0 to 18 percent. The soils in group A-2 are deep and are well drained or moderately well drained. Their surface layer is clay loam, fine sandy loam, loam, or silt loam. Available water capacity is moderate. The average slope ranges from 18 to 25 percent. The soils in group A-5 are deep and are well drained or moderately well drained. They are on flood plains and are frequently flooded or occasionally flooded. Their surface layer is loam or silt loam. Available water capacity ranges from low to very high. The average slope is 0 to 3 percent. The soils in group A-6 are deep and are well drained or moderately well drained. Their surface layer is silt loam or clay loam. Available water capacity is moderate. The average slope ranges from 2 to 12 percent.

The soils in group C generally are wet because of the high water table or because they are saturated during the growing season. The soils in pasture suitability group C-1 are deep and somewhat poorly drained. Their surface layer is silt loam. Available water capacity ranges from low to high. These soils respond well to subsurface drainage systems. The slope is 0 to 4 percent. The soils in group C-2 are deep and are somewhat poorly drained or poorly drained. Their surface layer is silt loam. Available water capacity is moderate or high. The effectiveness of subsurface drainage systems generally is limited by the permeability of the subsoil or by the landscape position of the soil. The slope is 0 to 4 percent. The soils in group C-3 are deep and are somewhat poorly drained or poorly drained. They are on flood plains and are frequently flooded or occasionally flooded. Their surface layer is silt loam. Available water capacity ranges from moderate to very high. The effectiveness of subsurface drainage systems is limited by the landscape position of the soil.

The soils in group D formed in organic material. The soils in pasture suitability group D-1 are deep and very poorly drained. Available water capacity is very high. The slope is 0 to 2 percent.

The soils in group F have a root zone that is only 20 to 40 inches thick. The soils in group F-3 are deep and moderately well drained. They have a fragipan at a depth of 20 to 40 inches. Their surface texture is silt loam. Available water capacity is moderate or low in the root zone. The slope ranges from 0 to 15 percent. The subsoil of the soils in group F-5 has a high content of clay, which restricts rooting depth. These soils are deep and are moderately well drained or well drained. Their surface layer is silty clay loam. Available water capacity is moderate. The slope ranges from 3 to 25 percent.

The soils in group H are not suited to pasture. The soils in group H-1 are on slopes of more than 40 percent.

Woodland Management and Productivity

Most of Morrow County was covered with beech forests at the time of the earliest land surveys *(10)*. Sugar maple, red oak, and white ash were associated species. A significant amount of oak was in Westfield Township *(16)*. Elm-ash swamp forests occupied the flat, somewhat poorly drained to very poorly drained areas in the western half of the county *(10)*.

The acreage of forest in the county has continually decreased as land has been cleared for agriculture. Small, scattered woodlots made up 30,072 acres, or about 12 percent of the county, in 1979 *(22)*. The wooded areas generally support mixed hardwoods. Mixed mesophytic stands of beech, maple, oak, yellow poplar, black walnut, and black cherry are on morainal hills. The elm-ash-red maple cover type is dominant along streams and in depressions. Oak-hickory stands are common on uplands at the interface of ground moraines and end moraines.

Generally, the soils in the county are well suited to woodland. On the very poorly drained Millgrove, Pewamo, and Sloan soils, the composition of stands is limited to trees that are tolerant of wetness. Carlisle and Milford soils are generally unsuited to woodland because the water table is at or above the surface for extended periods.

Firewood, lumber, and fence posts are produced from local woodlots. These woodlots also provide protection from the wind, wildlife habitat, and recreational opportunities. Because many of the woodlots are unmanaged, the potential for increasing yields is high. Removing diseased and less desirable trees and controlling grapevines help to establish vigorous stands of merchantable species. Trees planted for reforestation and for windbreaks should be tolerant of any limitation on the soils on the site.

More than 25,000 acres of woodland needs conservation treatment *(22)*. Wooded areas should not be grazed because grazing destroys the layer of organic litter, damages tree roots, increases the seedling mortality rate, and compacts the soil.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

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

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed also are subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

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

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service, the Cooperative Extension Service, or the Ohio Department of Natural Resources, Division of Forestry, or from a commercial nursery.

Recreation

Morrow County has a variety of recreational opportunities. The Mt. Gilead State Park has facilities for camping, picnicking, hiking, and fishing. The 172-acre State park is at the edge of the Allegheny Plateau. A double dam where Sam's Creek flows through the park creates a 30-acre area of water. About one-third of the Clear Fork Reservoir is in the northeastern corner of the county. Facilities for boating, camping, and fishing are provided at the reservoir. The Delaware Reservoir Wildlife Area, along Whetstone Creek in the southwestern part of the county, is open for hunting and fishing in season. The county also has several private campgrounds, municipal parks and playgrounds, a golf course, and a country club.

Generally, the soils in the county are moderately well suited to recreational development. However, several of the soils are moderately or severely limited because of wetness. This limitation can be overcome by installing surface and subsurface drains and by grading.

The slope is a limitation for certain types of recreational development. Steep slopes can preclude the use of an area for playgrounds and golf courses, but the design of campgrounds, picnic areas, and paths and trails can often accommodate this limitation.

Erosion is a severe hazard for paths and trails and intensively used areas on Amanda, Bennington, Centerburg, Glynwood, and Ockley soils. It can be controlled by establishing vegetation in critically eroded areas and by establishing trails on the contour on steep slopes.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor *(1)*. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are corn, soybeans, wheat, oats, and barley.

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

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

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwoods and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, maple, hawthorn, dogwood, hickory, blackberry, and black walnut. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn olive, and crabapple.

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

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, duckweed, reed canarygrass, willow, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and shallow ponds.

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

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

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

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

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, the shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

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

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer;

stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, the shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. The depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), the shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the presence of toxic substances affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

In the detailed soil map unit descriptions in this survey, each map unit has been rated according to its potential for septic tank absorption fields. Soil potential ratings are classes that indicate the relative quality of a soil for a particular use compared with that of other soils in a given area. Because comparisons in this survey are made only among soils in Morrow County, ratings of a given soil in another county may differ.

The ratings for this county are based on a system that includes consideration of performance levels, the difficulty or relative cost of corrective measures that can improve soil performance, and any adverse social, economic, or environmental effects of soil limitations that cannot be overcome.

The ratings do not constitute recommendations for soil use. They are to assist individuals, planning commissions, and others in making wise land use decisions. Treatment measures are intended as a guide to planning and are not to be applied at a specific location without onsite investigation for design and installation.

The soil potential ratings are defined as follows:

High potential.—Performance is at or above the level of local standards; the cost of overcoming soil limitations is judged locally to be favorable in relation to the expected performance; and soil limitations after corrective measures are installed do not detract appreciably from environmental quality or economic returns.

Medium potential.—Performance is somewhat below local standards; the cost of overcoming soil limitations is high; or soil limitations after corrective measures are installed detract from environmental quality or economic returns.

Low potential.—Performance is significantly below local standards; the cost of overcoming soil limitations is very high; or soil limitations after corrective measures are installed detract appreciably from environmental quality or economic returns.

Very low potential.—Performance is much below local standards; soil limitations are so severe that the cost of overcoming them is economically infeasible; or soil limitations after corrective measures are installed seriously detract from environmental quality or economic returns.

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

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

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and the shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability in the aquifer, and quality of the water as inferred from the salinity of the soil. The depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

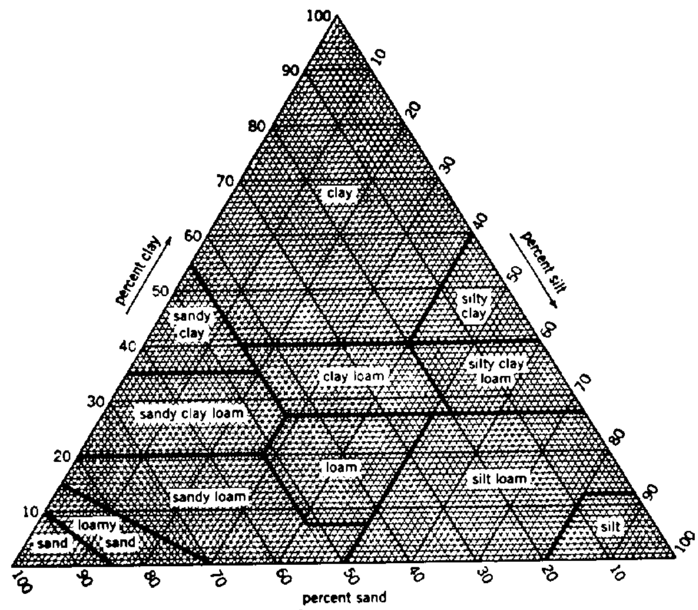

Figure 8.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 8). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(3)* and the system adopted by the American Association of State Highway and Transportation Officials *(2)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated content of clay in each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

The shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

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

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

Several of the soils in Morrow County were sampled and laboratory data were determined by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained from most of the samples include particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

The data were used in classifying and correlating the soils and in evaluating their behavior under various land uses. Among these data, two profiles were selected as representative for their respective series and are described in this survey. These series and their laboratory identification numbers are Blount (MW15) and Centerburg (MW17).

In addition to the data from Morrow County, laboratory data also are available from nearby counties in central Ohio that have many of the same soils. These data and the data from Morrow County are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the State Office of the Soil Conservation Service, Columbus, Ohio.

Engineering Index Test Data

Several of the soils in Morrow County were analyzed for engineering properties by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section. Two of the series described in this publication were tested. These series and their laboratory identification numbers are Blount (MW15) and Centerburg (MW17).

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(21)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is 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 development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ochraqualfs (*Ochr*, meaning light colored surface layer, plus *aqualf*, the suborder of Alfisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aeric* identifies the subgroup that is drier than the typical great group. An example is Aeric Ochraqualfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, illitic, mesic Aeric Ochraqualfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(18)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(21)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Amanda Series

The Amanda series consists of deep, well drained soils on ground moraines and end moraines. These soils formed in glacial till. Permeability is moderately slow. The slope ranges from 2 to 25 percent.

Amanda soils are commonly adjacent to Bennington, Centerburg, and Condit soils and are similar to Centerburg and Morley soils. The somewhat poorly drained Bennington and poorly drained Condit soils have low-chroma mottles below the surface layer. They are in depressions and along drainageways. The moderately well drained Centerburg soils have low-chroma mottles in the upper part of the subsoil. They are on knolls and ridges. Morley soils have more clay in the subsoil than the Amanda soils.

Typical pedon of Amanda silt loam, 6 to 12 percent slopes, eroded, about 1.75 miles northeast of Sparta, in South Bloomfield Township; 1,782 feet north and about 600 feet west of the southeast corner of sec. 9, T. 6 N., R. 15 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to moderate fine and medium granular; friable; common fine and few medium roots; common fine vesicular and few fine tubular pores; about 5 percent gravel; medium acid; abrupt smooth boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/6) silt loam; few fine faint yellowish brown (10YR 5/8) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few fine and medium tubular and common fine vesicular pores; very few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 10 percent gravel; medium acid; clear smooth boundary.

Bt1—12 to 18 inches; yellowish brown (10YR 5/6) loam; few medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine and medium tubular and many fine vesicular pores; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few coarse fragments; strongly acid; clear smooth boundary.

Bt2—18 to 21 inches; strong brown (7.5YR 5/6) clay loam; moderate fine subangular blocky structure; firm; few fine roots; few fine vesicular and tubular pores; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common medium distinct black (N 2/0) stains of iron and manganese oxide; about 10 percent gravel; strongly acid; clear smooth boundary.

Bt3—21 to 29 inches; yellowish brown (10YR 5/6) clay loam; few fine faint brown (10YR 5/3) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular and tubular pores; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent gravel; strongly acid; clear smooth boundary.

Bt4—29 to 34 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct brown (10YR 5/3) and few fine faint yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; common distinct brown (10YR 5/3) and few distinct yellowish brown (10YR 5/4) clay films on faces of peds; few fine distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent gravel; slightly acid; gradual smooth boundary.

BC—34 to 38 inches; yellowish brown (10YR 5/4) loam; few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine vesicular pores; very few faint brown (10YR 5/3) and dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent gravel; neutral; clear smooth boundary.

C—38 to 80 inches; yellowish brown (10YR 5/4) loam; few fine faint yellowish brown (10YR 5/6) mottles; massive; very firm; common faint brown (10YR 5/3) coatings on faces of peds; reddish yellow (7.5YR 6/8) weathered sandstone fragments; about 10 percent gravel; light gray (10YR 7/2) lime splotches; strong effervescence; moderately alkaline.

The thickness of the solum generally ranges from 40 to 60 inches. In eroded areas, however, it ranges from 32 to 50 inches. The content of coarse fragments ranges from 2 to 15 percent, by volume, throughout the solum.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, loam, or silty clay loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is loam or silt loam.

Bennington Series

The Bennington series consists of deep, somewhat poorly drained soils on slight rises, knolls, and the slightly dissected parts of ground moraines and end moraines. These soils formed in glacial till. In some areas they have a thin mantle of silty sediments. Permeability is slow. The slope ranges from 0 to 6 percent.

The Bennington soils in this county have less clay in the subsoil than is definitive for the series. This difference, however, does not alter the use or behavior of the soils.

Bennington soils are commonly adjacent to Amanda, Centerburg, and Condit soils and are similar to Blount soils. The moderately well drained Centerburg and well drained Amanda soils are on knolls and side slopes. The poorly drained Condit soils are in depressions and along drainageways. Blount soils have more clay in the subsoil than the Bennington soils.

Typical pedon of Bennington silt loam, 0 to 2 percent slopes, about 3 miles southeast of Sparta, in South Bloomfield Township; 924 feet south and 1,452 feet west of the northeast corner of sec. 20, T. 6 N., R. 15 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) dry; common medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; few coarse fragments; medium acid; abrupt smooth boundary.

Bt1—9 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct yellowish brown (10YR 5/8) and few medium prominent gray (10YR 6/1) mottles; moderate medium subangular blocky structure; friable; few fine and medium roots; common fine vesicular and few medium tubular pores; common distinct gray (10YR 5/1) clay films on faces of peds; many distinct light brownish gray (2.5Y 6/2) silt coatings on faces of peds; few coarse fragments; strongly acid; clear smooth boundary.

Bt2—16 to 25 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct yellowish brown (10YR 5/8) and few medium prominent gray (10YR 6/1) mottles; weak medium and coarse subangular blocky structure; firm; few fine roots; few fine and medium tubular and few fine vesicular pores; many distinct gray (10YR 5/1) clay films on faces of peds; common medium distinct black (N 2/0) stains of iron and manganese oxide; few coarse fragments; medium acid; clear smooth boundary.

Bt3—25 to 37 inches; yellowish brown (10YR 5/6) loam; common fine distinct yellowish brown (10YR 5/8) and few fine prominent gray (10YR 6/1) mottles; weak medium and coarse subangular blocky structure; firm; few fine roots; few fine and medium tubular and few fine vesicular pores; many distinct gray (10YR 6/1) clay films on faces of peds; common medium distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent coarse fragments; slightly acid; gradual smooth boundary.

BC—37 to 49 inches; yellowish brown (10YR 5/4) loam; few fine distinct gray (10YR 6/1) and few fine faint brown (10YR 4/3) mottles; weak medium and coarse subangular blocky structure; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds; about 5 percent coarse fragments; neutral; gradual wavy boundary.

C—49 to 80 inches; yellowish brown (10YR 5/4) loam; common medium faint dark yellowish brown (10YR 4/4) mottles; massive; firm; about 5 percent coarse fragments; strong effervescence; mildly alkaline.

The solum ranges from 28 to 50 inches in thickness. The content of coarse fragments ranges from 0 to 5 percent in the Ap horizon and in the upper part of the Bt horizon and from 2 to 15 percent in the lower part of the Bt horizon and in the C horizon.

The Bt horizon has chroma of 2 to 6. It commonly is clay loam or silty clay loam, but some pedons have subhorizons of loam. The C horizon has value of 4 or 5 and chroma of 2 to 4.

Blount Series

The Blount series consists of deep, somewhat poorly drained soils on ground moraines and end moraines. These soils formed in glacial till. Permeability is moderately slow or slow. The slope is 0 to 6 percent.

The Blount soils are commonly adjacent to Glynwood, Milford, Morley, and Pewamo soils and are similar to Bennington soils. Bennington soils have less clay in the subsoil than the Blount soils. The moderately well drained Glynwood and well drained Morley soils dominantly do not have low-chroma colors in the upper part of the subsoil. They are on knolls and side slopes. The very poorly drained Milford and Pewamo soils are in drainageways and shallow depressions. They have a mollic epipedon.

Typical pedon of Blount silt loam, 0 to 2 percent slopes, about 4.8 miles northwest of Cardington, in Cardington Township; 1,880 feet south and 1,800 feet east of the northwest corner of sec. 6, T. 6 S., R. 17 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; many fine and medium roots; few medium tubular and few fine vesicular pores; few coarse fragments; slightly acid; abrupt smooth boundary.

Bt—10 to 15 inches; yellowish brown (10YR 5/4) silty clay; common medium faint grayish brown (10YR 5/2) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; medium roots; few fine vesicular pores; few faint grayish brown (10YR 5/2) clay films on faces of peds; few faint light brownish gray (10YR 6/2) silt coatings on faces of peds; few coarse fragments; very strongly acid; clear smooth boundary.

Btg1—15 to 23 inches; dark grayish brown (10YR 4/2) silty clay; common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; very few faint dark brown (10YR 3/3) clay films on horizontal faces of peds; very few distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) clay films on horizontal and vertical faces of peds; few coarse fragments; medium acid; clear smooth boundary.

Btg2—23 to 36 inches; dark grayish brown (10YR 4/2) clay; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; common faint dark brown (10YR 3/3) clay films on horizontal faces of peds; common faint grayish brown (10YR 5/2) clay films on horizontal and vertical faces of peds; common black (10YR 2/1) concretions of iron and manganese oxide; about 5 percent coarse fragments; mildly alkaline; clear wavy boundary.

C—36 to 80 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct grayish brown (10YR 5/2) and few fine distinct strong brown (7.5YR 5/8) mottles; massive; firm; common medium distinct light gray (10YR 7/1) lime coatings; about 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 45 inches, and the depth to carbonates ranges from 20 to 40 inches. The content of coarse fragments is 0 to 10 percent, by volume, throughout the solum.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 to 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay, clay loam, silty clay loam, or clay. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

Canfield Series

The Canfield series consists of deep, moderately well drained soils on ground moraines and end moraines. These soils formed in glacial till. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. The slope ranges from 2 to 12 percent.

Canfield soils are commonly adjacent to Bennington and Wooster soils and are similar to Rittman and Wooster soils. The somewhat poorly drained Bennington soils do not have a fragipan and have more gray colors in the subsoil than the Canfield soils. They are in broad, nearly level areas and in depressions. Rittman soils have more clay in the subsoil than the Canfield soils. The well drained Wooster soils do not have low-chroma mottles above the fragipan.

Typical pedon of Canfield silt loam, 2 to 6 percent slopes, about 2.8 miles southeast of Johnsville, in Perry Township; 924 feet south and 24 feet west of the northeast corner of sec. 21, T. 19 N., R. 19 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; few medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure parting to moderate medium granular; friable; common very fine roots; few very fine tubular pores; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; strongly acid; clear wavy boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/4) silt loam; common faint brown (10YR 4/3) silt coatings on faces of peds; moderate medium subangular blocky structure; firm; few fine roots; few fine tubular pores; common distinct dark grayish brown (10YR 4/2) tonguing of Ap material; few coarse fragments; strongly acid; clear smooth boundary.

Bt1—12 to 20 inches; yellowish brown (10YR 5/4) loam; common fine distinct yellowish brown (10YR 5/6) and common medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine and medium tubular pores; common faint brown (10YR 4/3) clay films on faces of peds; common faint brown (10YR 5/3) silt coatings on faces of peds; few coarse fragments; strongly acid; clear smooth boundary.

Bt2—20 to 26 inches; yellowish brown (10YR 5/4) loam; common medium distinct yellowish brown (10YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; slightly brittle; few fine roots; few fine and medium tubular pores; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; common distinct dark grayish brown (10YR 4/2) clay flows and common distinct gray (10YR 5/1) clay films along vertical faces of prisms; few coarse fragments; strongly acid; clear smooth boundary.

Btx—26 to 34 inches; yellowish brown (10YR 5/4) loam; common medium faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure; very firm; brittle; very few fine roots; few fine and medium tubular pores; common distinct grayish brown (10YR 5/2) clay films along vertical faces of prisms; black (N 2/0) stains of iron and manganese oxide; few coarse fragments; very strongly acid; clear wavy boundary.

BC—34 to 46 inches; yellowish brown (10YR 5/4) loam; common medium distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; common fine and few medium tubular pores; common distinct gray (10YR 6/1) and common faint brown (10YR 4/3) clay films on faces of peds; common faint pale brown (10YR 6/3) sand grains on faces of peds; black (N 2/0) stains of iron and manganese oxide; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

C1—46 to 58 inches; dark yellowish brown (10YR 4/4) loam; few fine faint yellowish brown (10YR 5/4) and few fine distinct brown (7.5YR 5/4) mottles; massive; firm; very few fine tubular pores; few fine brown (10YR 4/3) clay films; black (N 2/0) concretions of iron and manganese oxide; about 10 percent coarse fragments; mildly alkaline; clear smooth boundary.

C2—58 to 80 inches; dark yellowish brown (10YR 4/4) loam; common fine faint yellowish brown (10YR 5/4) and common fine distinct brown (7.5YR 5/4) mottles; massive; firm; white (10YR 8/1) lime splotches; about 5 percent coarse fragments; slight effervescence; mildly alkaline.

The solum ranges from 40 to 68 inches in thickness. Depth to the top of the fragipan ranges from 15 to 30 inches. The content of coarse fragments ranges from 2 to 15 percent, by volume, in the solum.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt and Btx horizons have hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The Bt horizon is loam, silt loam, clay loam, silty clay loam, or the gravelly analogs of those textures. The Btx horizon is loam, silt loam, sandy loam, or the gravelly analogs of those textures. The C horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. It is loam, silt loam, or sandy loam.

Carlisle Series

The Carlisle series consists of deep, very poorly drained soils in bogs on end moraines and ground moraines. These soils formed in organic material from grasses, sedges, reeds, and woody fragments. Permeability is moderately slow to moderately rapid. The slope is 0 to 2 percent.

Carlisle soils are commonly adjacent to Condit, Milford, and Pewamo soils. The adjacent soils formed in mineral material. They are in depressions on the edge of bogs.

Typical pedon of Carlisle muck, about 3.4 miles southeast of Mt. Gilead, in Franklin Township; 2,100 feet north and 990 feet west of the southeast corner of sec. 8, T. 17 N., R. 20 W.

Oa1—0 to 2 inches; sapric material, very dark grayish brown (10YR 3/2) broken face and rubbed; about 75 percent fiber, about 5 percent rubbed; about 15 percent mineral material; weak fine granular structure; friable; many fine and medium roots; strongly acid; abrupt smooth boundary.

Oa2—2 to 5 inches; sapric material, very dark gray (10YR 3/1) broken face and rubbed; about 30 percent fiber, less than 5 percent rubbed; about 15 percent mineral material; weak fine and medium granular structure; friable; many fine and medium roots; few yellowish red (5YR 5/6) woody fibers; medium acid; clear smooth boundary.

Oa3—5 to 10 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 10 percent fiber, less than 5 percent rubbed; weak fine and medium granular structure; friable; many fine and medium roots; about 5 percent yellowish red (5YR 5/8) woody fragments 1 to 4 inches in diameter; few dark reddish brown (2.5YR 3/4) woody fibers; medium acid; gradual smooth boundary.

Oa4—10 to 18 inches; sapric material, very dark brown (10YR 2/2) broken face and rubbed; about 40 percent fiber, 10 percent rubbed; massive; friable; common fine and medium roots; 5 to 10 percent yellowish red (5YR 5/8) woody fragments 1 to 4 inches in diameter; few dark reddish brown (2.5YR 3/4) woody fibers; medium acid; gradual smooth boundary.

Oa5—18 to 23 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 40 percent fiber, 10 percent rubbed; massive; friable; common fine and medium roots; about 5 percent yellowish red (5YR 5/8) woody fragments 1 to 4 inches in diameter; few yellowish red (5YR 4/6) woody fibers; medium acid; gradual smooth boundary.

Oa6—23 to 33 inches; sapric material, very dark grayish brown (10YR 3/2) broken face and rubbed; about 30 percent fiber, less than 5 percent rubbed; massive; friable; common yellowish brown (10YR 5/4) and dark reddish brown (5YR 3/4) woody fibers; slightly acid; gradual smooth boundary.

Oa7—33 to 53 inches; sapric material, very dark brown (10YR 2/2) broken face and rubbed; about 25 percent fiber, less than 5 percent rubbed; massive; friable; few yellowish brown (10YR 5/4) woody fibers; slightly acid; gradual smooth boundary.

Oa8—53 to 66 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 30 percent fiber, less than 5 percent rubbed; massive; friable; few dark yellowish brown (10YR 4/4) woody fibers; slightly acid; gradual smooth boundary.

Oa9—66 to 80 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 40 percent fiber, less than 5 percent rubbed; massive; friable; few dark yellowish brown (10YR 4/4) woody fibers; slightly acid.

The organic material is commonly more than 60 inches thick. The content of woody fragments is 0 to 30 percent, by volume, throughout the profile.

The surface tier has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. In some areas it has a thin, light colored layer of overwash. The subsurface tier has hue of 10YR, value of 2 or 3, and chroma of 0 to 3. The content of fiber is 0 to 15 percent rubbed. The bottom tier has colors similar to those of the subsurface tier.

Centerburg Series

The Centerburg series consists of deep, moderately well drained soils on ground moraines and end moraines. These soils formed in glacial till. Permeability is moderately slow. The slope ranges from 2 to 12 percent.

Centerburg soils are commonly adjacent to Amanda, Bennington, and Condit soils and are similar to Amanda and Glynwood soils. The well drained Amanda soils do not have low-chroma mottles in the upper part of the subsoil. They are on ridgetops, knolls, and hillsides. The somewhat poorly drained Bennington and poorly drained Condit soils have low-chroma mottles directly below the surface layer and are in depressions and along drainageways. Glynwood soils have a thinner subsoil than the Centerburg soil and more clay in the subsoil.

Typical pedon of Centerburg silt loam, 2 to 6 percent slopes, about 1.8 miles northeast of Sparta, in South Bloomfield Township; 1,750 feet south and 162 feet east of the northwest corner of sec. 2, T. 6 N., R. 15 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) dry; about 5 percent yellowish brown (10YR 5/6) inclusions of Bt material; weak medium subangular blocky structure parting to moderate medium granular; friable; few coarse and common fine and medium roots; common fine and medium vesicular pores; few coarse fragments; neutral; abrupt smooth boundary.

Bt1—8 to 13 inches; yellowish brown (10YR 5/6) clay loam; few medium distinct yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; friable; common fine and medium roots; few fine vesicular and few fine and medium tubular pores; common distinct brown (10YR 4/3) clay films on faces of peds; common distinct brown (10YR 5/3) silt films on faces of peds; few coarse fragments; strongly acid; clear smooth boundary.

Bt2—13 to 20 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) and few fine faint strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine and medium tubular and few fine vesicular pores; common distinct brown (10YR 5/3) clay films on faces of peds; few distinct pale brown (10YR 6/3) silt films on faces of peds; common fine distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—20 to 27 inches; yellowish brown (10YR 5/6) clay loam; common fine faint strong brown (7.5YR 5/8) and common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; few fine vesicular and few fine tubular pores; common distinct light brownish gray (10YR 6/2) and common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common medium distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent coarse fragments; medium acid; gradual smooth boundary.

BC—27 to 35 inches; yellowish brown (10YR 5/4) clay loam; few medium distinct yellowish red (5YR 4/6) and common fine distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; firm; few fine roots; few fine and medium vesicular and few fine tubular pores; few distinct dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine distinct black (N 2/0) stains of iron and manganese oxide; about 10 percent coarse fragments; neutral; gradual smooth boundary.

C—35 to 80 inches; yellowish brown (10YR 5/4) loam; common fine faint strong brown (7.5YR 5/8) and common medium distinct grayish brown (10YR 5/2) mottles; white (10YR 8/1) lime streaks; massive; firm; few fine vesicular pores; common distinct brown (10YR 4/3) and grayish brown (10YR 5/2) clay films on faces of peds; about 15 percent coarse fragments; strong effervescence; mildly alkaline.

The solum ranges from 30 to 54 inches in thickness. The content of coarse fragments ranges from 0 to 10 percent in the Ap horizon and the upper part of the Bt horizon and from 3 to 15 percent in the lower part of the Bt horizon and the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Low-chroma mottles are within the upper 10 inches. This horizon is mainly clay loam and loam but is silty clay loam or silt loam in the upper part in some pedons. The BC horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6. It is clay loam or loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

Chili Series

The Chili series consists of deep, well drained soils on stream terraces. These soils formed in outwash sediments. Permeability is moderately rapid. The slope ranges from 2 to 12 percent.

Chili soils are commonly adjacent to Sleeth soils and are similar to Gallman and Ockley soils. The somewhat poorly drained Sleeth soils have low-chroma mottles in the upper part of the subsoil. They are in depressions and along drainageways. Gallman soils have more silt and clay in the underlying material than the Chili soils. Ockley soils have more clay in the subsoil than the Chili soils.

Typical pedon of Chili loam, 2 to 6 percent slopes, about 1.5 miles east of Blooming Grove, in Troy Township; 1,100 feet east and 880 feet south of the northwest corner of sec. 7, T. 20 N., R. 19 W.

Ap1—0 to 6 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; friable; common fine and medium roots; few fine vesicular and tubular pores; few coarse fragments; strongly acid; clear smooth boundary.

Ap2—6 to 10 inches; brown (10YR 4/3) loam, very pale brown (10YR 7/3) dry; common medium distinct strong brown (7.5YR 5/6) mottles; cloddy; firm; few fine roots; few fine tubular and vesicular pores; few coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—10 to 16 inches; yellowish brown (10YR 5/4) loam; weak medium and coarse subangular blocky structure; firm; few fine roots; common fine and medium tubular and few fine vesicular pores; few fine dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine black (N 2/0) stains of iron and manganese oxide; few coarse fragments; very strongly acid; clear smooth boundary.

Bt2—16 to 21 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular and tubular pores; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few very fine black (N 2/0) stains of iron and manganese oxide; about 5 percent gravel; strongly acid; clear smooth boundary.

Bt3—21 to 32 inches; yellowish brown (10YR 5/4) gravelly loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular and few coarse tubular pores; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine black (N 2/0) stains of iron and manganese oxide; about 20 percent gravel; very strongly acid; gradual smooth boundary.

Bt4—32 to 42 inches; yellowish brown (10YR 5/4) gravelly loam; weak medium and coarse subangular blocky structure; firm; few fine roots; few medium tubular pores; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 25 percent gravel; very strongly acid; gradual smooth boundary.

Bt5—42 to 52 inches; yellowish brown (10YR 5/4) very gravelly loam; few fine distinct yellowish red (5YR 5/6) mottles; weak medium and coarse subangular blocky structure; friable; few fine roots; few medium tubular pores; few faint dark yellowish brown (10YR 4/4) clay bridges between sand grains and pebbles; about 40 percent gravel; very strongly acid; gradual wavy boundary.

C—52 to 80 inches; yellowish brown (10YR 5/4) very gravelly loamy sand; single grained; loose; few very fine roots; about 50 percent gravel; strongly acid.

The solum ranges from 40 to 80 inches in thickness. The content of coarse fragments is 0 to 30 percent in the surface layer and the upper part of the subsoil, 15 to 50 percent in the lower part of the subsoil, and 25 to 60 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is silt loam, loam, or gravelly loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam, silty clay loam, or loam in the upper part and clay loam, loam, gravelly clay loam, gravelly loam, or very gravelly loam in the lower part. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is the very gravelly or gravelly analogs of loamy coarse sand or loamy sand.

Colyer Variant

The Colyer Variant consists of moderately deep, well drained soils on valley walls on dissected till plains. These soils formed in glacial till or outwash and in residuum of the underlying shale bedrock. Permeability is moderate. The slope ranges from 25 to 70 percent.

Colyer Variant soils are commonly adjacent to Amanda, Gallman, Glynwood, and Morley soils. The well drained Amanda, Gallman, and Morley and moderately well drained Glynwood soils do not have shale in the underlying material.

Typical pedon of Colyer Variant silt loam, 25 to 70 percent slopes, about 1 mile southwest of West Liberty, in Peru Township; 1,050 feet northeast of the intersection of County Road 24 and County Road 15, along County Road 24, then 900 feet east:

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam; strong fine and medium granular structure; friable; few coarse and common fine and medium roots; few fine tubular and vesicular pores; about 5 percent gravel; mildly alkaline; clear smooth boundary.

E—4 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few coarse and common fine and medium roots; few fine tubular and vesicular pores; about 5 percent gravel; mildly alkaline; clear smooth boundary.

BE—9 to 14 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; few coarse and common fine and medium roots; many fine vesicular and few medium tubular pores; dark grayish brown (10YR 4/2) krotovinas; tonguing of dark yellowish brown (10YR 4/4) material; about 10 percent gravel; neutral; clear smooth boundary.

Bt1—14 to 20 inches; yellowish brown (10YR 5/6) gravelly clay loam; few fine distinct reddish yellow (7.5YR 6/8) mottles; weak medium subangular blocky structure; firm; few coarse, medium, and fine roots; common fine vesicular and few fine and medium tubular pores; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 15 percent gravel; neutral; clear smooth boundary.

Bt2—20 to 33 inches; yellowish brown (10YR 5/6) gravelly clay loam; few fine faint strong brown (7.5YR 5/6) mottles; strong fine and medium subangular blocky structure; firm; few fine and medium roots; common fine vesicular and few fine tubular pores; many faint yellowish brown (10YR 5/4) clay films on faces of peds; about 30 percent coarse fragments; slightly acid; clear smooth boundary.

2Cr—33 to 40 inches; variegated very dark brown (10YR 2/2), black (10YR 2/1), and dark gray (10YR 4/1) highly fractured shale; cuts with spade.

The solum ranges from 20 to 40 inches in thickness. The content of coarse fragments is 0 to 10 percent in the surface layer and 5 to 35 percent in the Bt horizon.

The A horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, clay loam, silty clay loam, or the gravelly or shaly analogs of those textures.

Condit Series

The Condit series consists of deep, poorly drained soils on end moraines and ground moraines. These soils formed in glacial till. Permeability is slow. The slope is 0 to 2 percent.

The Condit soils in this county have less clay in the upper part of the subsoil and a thicker solum than is definitive for the series. These differences, however, do not alter the use or behavior of the soils.

Condit soils are commonly adjacent to Amanda, Bennington, Centerburg, and Pewamo soils. The well drained Amanda and moderately well drained Centerburg soils dominantly do not have low-chroma colors in the subsoil. They are on ridges and side slopes. The somewhat poorly drained Bennington soils dominantly do not have low-chroma colors throughout the upper part of the subsoil. They are on low knolls and in depressions. The very poorly drained Pewamo soils have a mollic epipedon and are in landscape positions similar to those of the Condit soil.

Typical pedon of Condit silt loam, about 1.68 miles east of Sparta, in South Bloomfield Township; 90 feet south and 2,260 feet west of the northeast corner of sec. 12, T. 6 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure parting to moderate fine granular; friable; few medium and coarse roots; few very fine vesicular pores; few coarse fragments; neutral; clear smooth boundary.

Btg1—8 to 16 inches; dark gray (10YR 4/1) clay loam; few fine distinct yellowish brown (10YR 5/8 and 5/4) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; few fine tubular and few very fine vesicular pores; few distinct very dark gray (10YR 3/1) clay films on faces of peds; few coarse fragments; slightly acid; clear smooth boundary.

Btg2—16 to 30 inches; gray (10YR 5/1) clay loam; common medium faint yellowish brown (10YR 5/6) mottles; moderate coarse and medium subangular blocky structure; firm; few fine and very fine roots; few fine tubular and few very fine vesicular pores; common distinct dark gray (10YR 4/1) clay films on faces of peds; about 5 percent coarse fragments; slightly acid; clear smooth boundary.

Btg3—30 to 42 inches; gray (10YR 5/1) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine tubular pores; common faint gray (10YR 5/1) and grayish brown (2.5YR 5/2) clay films on faces of peds; about 5 percent coarse fragments; neutral; gradual smooth boundary.

Btg4—42 to 60 inches; grayish brown (10YR 5/2) clay loam; common medium distinct strong brown (7.5YR 5/8) and common medium faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; few very fine vesicular pores; common faint gray (10YR 5/1) clay films on vertical faces of peds; about 10 percent coarse fragments; neutral; gradual smooth boundary.

Btg5—60 to 72 inches; grayish brown (10YR 5/2) clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; common distinct gray (10YR 5/1) clay films on vertical faces of peds; about 10 percent coarse fragments; neutral; clear smooth boundary.

Cg—72 to 82 inches; light olive brown (2.5Y 5/4) silt loam; common fine faint yellowish brown (10YR 5/4) and common medium distinct gray (N 6/0) mottles; massive; firm; about 5 percent coarse fragments; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 72 inches. The content of coarse fragments ranges from 0 to 5 percent in the Ap horizon and from 2 to 15 percent in the Bt and C horizons.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 6. It is silty clay loam, clay loam, or silty clay. High-chroma mottles are common. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 8. It is silty clay loam, clay loam, or silt loam.

Gallman Series

The Gallman series consists of deep, well drained soils on outwash plains and terraces. These soils formed in poorly sorted outwash sediments. Permeability is moderately rapid. The slope ranges from 2 to 12 percent.

Gallman soils are commonly adjacent to Millgrove and Sleeth soils and are similar to Chili and Ockley soils. Chili soils are more acid in the lower part of the subsoil than the Gallman soils and have more sand and gravel in the underlying material. The very poorly drained Millgrove soils have a mollic epipedon. They are in depressions and along drainageways. Ockley soils have a thinner solum than that of the Gallman soils and do not have shale fragments in the underlying material. Sleeth soils are somewhat poorly drained and have low-chroma mottles below the surface layer. They are in low areas.

Typical pedon of Gallman silt loam, loamy substratum, 2 to 6 percent slopes, about 2.2 miles south of Edison, in Gilead Township; 1,056 feet north and 205 feet east of the southwest corner of sec. 10, T. 13 N., R. 21 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; many distinct dark brown (10YR 3/3) organic coatings on faces of peds; moderate fine and medium granular structure; friable; common fine and medium and few coarse roots; few coarse and medium tubular and common fine tubular and vesicular pores; few coarse fragments; neutral; clear smooth boundary.

Bt1—10 to 18 inches; yellowish brown (10YR 5/4) silt loam; common distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; moderate fine and medium subangular blocky structure; firm; common fine and few medium roots; common fine and medium tubular and few fine vesicular pores; many faint brown (10YR 4/3) clay films on faces of peds; few coarse fragments; medium acid; clear smooth boundary.

Bt2—18 to 26 inches; yellowish brown (10YR 5/4) clay loam; few distinct dark grayish brown (10YR 4/2) organic coatings in root channels; common fine faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine and few medium roots; few fine vesicular and tubular pores; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; gradual smooth boundary.

Bt3—26 to 33 inches; yellowish brown (10YR 5/4) clay loam; common fine faint strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; firm; few fine and medium roots; few very fine and fine vesicular and few fine tubular pores; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common coarse and very coarse rounded or platelike yellowish red (5YR 5/6) and light brownish gray (10YR 6/2) soft shale fragments; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bt4—33 to 44 inches; yellowish brown (10YR 5/4) gravelly clay loam; weak medium and coarse subangular blocky structure; firm; few fine roots; few fine vesicular and tubular pores; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds and on coarse fragments; common coarse and very coarse rounded or platelike dark brown (7.5YR 4/4) soft shale fragments; few coarse yellowish brown (10YR 5/6) weathered sandstone fragments; few fine black (N 2/0) stains of iron and manganese oxide; about 20 percent coarse fragments; strongly acid; gradual smooth boundary.

Bt5—44 to 52 inches; yellowish brown (10YR 5/4) gravelly clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; firm; few fine roots; few fine vesicular and common fine tubular pores; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds and on coarse fragments; common coarse and very coarse reddish brown (5YR 4/3) rounded or platelike soft shale fragments; few fine black (N 2/0) stains of iron and manganese oxide; about 20 percent coarse fragments; medium acid; clear smooth boundary.

Bt6—52 to 58 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; friable; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few coarse and very coarse rounded or platelike yellowish red (5YR 5/6) soft shale fragments; about 10 percent coarse fragments; medium acid; clear wavy boundary.

Bt7—58 to 68 inches; yellowish brown (10YR 5/4) gravelly clay loam; weak medium subangular blocky structure; friable; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds and on coarse fragments; common coarse and very coarse rounded or platelike yellowish red (5YR 5/6) soft shale fragments; few coarse brown (7.5YR 5/4) weathered sandstone fragments; about 20 percent coarse fragments; neutral; gradual smooth boundary.

BC—68 to 77 inches; yellowish brown (10YR 5/4) gravelly clay loam; weak medium subangular blocky structure; friable; few fine roots; few fine dark yellowish brown (10YR 4/4) clay films on faces of peds and on coarse fragments; common coarse and very coarse rounded or platelike pale brown (10YR 6/3) soft shale fragments; about 20 percent coarse fragments; neutral; very slight effervescence; clear wavy boundary.

C—77 to 88 inches; brown (10YR 5/3) gravelly loam; massive; friable; common coarse light gray (10YR 7/2) lime splotches; about 30 percent coarse fragments; moderately alkaline; strong effervescence.

The solum ranges from 55 to 85 inches in thickness. The content of coarse fragments is 0 to 10 percent in the Ap horizon, 2 to 30 percent in the Bt horizon, and 5 to 40 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, clay loam, silt loam, sandy loam, or the gravelly analogs of those textures. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam, loam, sandy loam, or the gravelly analogs of those textures.

Glynwood Series

The Glynwood series consists of deep, moderately well drained soils on end moraines and ground moraines. These soils formed in glacial till. Permeability is slow. The slope ranges from 2 to 12 percent.

Glynwood soils are commonly adjacent to Blount, Morley, and Pewamo soils and are similar to Centerburg and Morley soils. The somewhat poorly drained Blount soils have low-chroma mottles below the surface layer. They are on low rises and flats in the uplands. The very poorly drained Pewamo soils have a mollic epipedon. They are in depressions and along drainageways. The Centerburg soils have less clay in the subsoil than the Glynwood soils. The well drained Morley soils do not have low-chroma mottles in the upper part of the subsoil. They are in landscape positions similar to those of the Glynwood soils.

Typical pedon of Glynwood clay loam, 2 to 6 percent slopes, eroded, about 2.5 miles northwest of Cardington, in Cardington Township; 1,180 feet north and 2,460 feet west of the southeast corner of sec. 17, T. 6 S., R. 17 E.

Ap—0 to 8 inches; brown (10YR 4/3) clay loam, very pale brown (10YR 7/3) dry; about 5 percent pockets of yellowish brown (10YR 5/6) Bt material; weak medium subangular blocky structure parting to moderate fine and medium granular; friable; few medium and common fine roots; few common tubular and very fine vesicular pores; few coarse fragments; very strongly acid; clear smooth boundary.

Bt1—8 to 13 inches; yellowish brown (10YR 5/4) clay; few fine faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; few fine tubular and few very fine vesicular pores; many distinct brown (10YR 5/3) clay films on horizontal and vertical faces of peds; few coarse fragments; very strongly acid; clear smooth boundary.

Bt2—13 to 19 inches; dark yellowish brown (10YR 4/4) clay; common fine distinct dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine tubular pores; many distinct brown (10YR 4/3) clay films on horizontal and vertical faces of peds; common medium distinct black (10YR 2/1) concretions of iron and manganese oxide; about 5 percent gravel; slightly acid; gradual smooth boundary.

BC—19 to 22 inches; dark yellowish brown (10YR 4/4) clay; common medium distinct dark grayish brown

(10YR 4/2) mottles; weak medium subangular blocky structure; firm; few fine roots; few fine tubular and few very fine vesicular pores; common faint brown (10YR 4/3) clay films on vertical and horizontal faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

C1—22 to 34 inches; dark yellowish brown (10YR 4/4) clay loam; massive; very firm; few fine roots; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common medium distinct light gray (10YR 7/1) lime coatings; about 10 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—34 to 80 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; very firm; about 10 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 40 inches. The content of coarse fragments ranges from 0 to 5 percent in the Ap horizon, from 0 to 10 percent in the Bt horizon, and from 1 to 15 percent in the BC and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is clay loam or silt loam. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay, clay, or clay loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6.

Lobdell Series

The Lobdell series consists of deep, moderately well drained soils on flood plains. These soils formed in recent alluvium. Permeability is moderate. The slope is 0 to 2 percent.

Lobdell soils are commonly adjacent to Shoals, Sloan, and Tioga soils. The somewhat poorly drained Shoals and very poorly drained Sloan soils dominantly have low-chroma colors below the surface. They are in low areas and in old stream channels. The well drained Tioga soils have less clay in the subsoil than the Lobdell soils. They are in the higher areas of the flood plains.

Typical pedon of Lobdell silt loam, occasionally flooded, about 2.2 miles southeast of Chesterville, in Chester Township; 900 feet east of the intersection of County Road 179 and Township Road 180, along County Road 179, then 820 feet north:

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to moderate fine granular; very friable; moderate fine and medium roots; few fine tubular pores; neutral; clear smooth boundary.

A—7 to 12 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; few distinct dark grayish brown (10YR 4/2) organic coatings; weak medium subangular blocky structure; friable; few fine roots; few coarse tubular and common fine and very fine vesicular pores; neutral; gradual smooth boundary.

Bw1—12 to 23 inches; brown (10YR 4/3) silt loam; few distinct dark brown (10YR 3/3) organic coatings; weak medium subangular blocky structure parting to moderate fine and medium granular; very friable; few fine roots; few coarse and common fine and medium tubular and many fine vesicular pores; neutral; clear smooth boundary.

Bw2—23 to 38 inches; dark yellowish brown (10YR 4/4) silt loam; common medium faint dark brown (7.5YR 4/2) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few coarse and common fine and medium tubular and many fine vesicular pores; neutral; gradual smooth boundary.

C1—38 to 55 inches; dark yellowish brown (10YR 4/4) stratified loam and sandy loam; common medium faint dark grayish brown (10YR 4/2) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; neutral; gradual smooth boundary.

C2—55 to 80 inches; dark gray (10YR 4/1) sandy loam; thin strata of loamy coarse sand and gravelly loamy coarse sand; common medium distinct very dark gray (N 3/0) mottles; massive and single grained; very friable and loose; about 10 percent gravel; neutral.

The thickness of the solum ranges from 24 to 50 inches. The content of gravel ranges from 0 to 5 percent in the Ap horizon and from 0 to 15 percent in the B and C horizons.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly silt loam, but in some pedons it is loam. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It commonly is loam or silt loam, but some pedons have subhorizons of sandy loam or silty clay loam. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 6. It commonly is stratified sandy loam to silt loam, but some pedons have thin strata of loamy sand or gravelly loamy coarse sand.

Milford Series

The Milford series consists of deep, very poorly drained soils on glacial lake plains. These soils formed in lacustrine sediments. Permeability is moderately slow. The slope is 0 to 2 percent.

Milford soils are commonly adjacent to Blount, Glynwood, and Pewamo soils and are similar to Pewamo soils. The somewhat poorly drained Blount soils formed in glacial till and are on low knolls and broad flats in the uplands. The moderately well drained Glynwood soils formed in glacial till and are on hillslopes. Pewamo soils formed in glacial till and have a higher content of coarse fragments in the solum than the Milford soils. They are in depressions.

Typical pedon of Milford silty clay loam, about 2.5 miles southwest of Cardington, in Westfield Township; 1,452 feet west of the intersection of County Road 25 and County Road 165, along County Road 25, then 1,452 feet south:

Ap1—0 to 4 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very coarse subangular blocky clods; firm; common fine and few medium roots; few fine vesicular and few fine and medium tubular pores; slightly acid; clear smooth boundary.

Ap2—4 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; strong medium subangular blocky structure; firm; common fine and medium roots; few fine vesicular and few fine and medium tubular pores; neutral; clear smooth boundary.

AB—10 to 13 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; common medium faint yellowish brown (10YR 5/4) and common medium distinct yellowish brown (10YR 5/6) mottles; strong medium angular blocky structure; firm; few fine roots; few fine vesicular and tubular pores; common faint black (10YR 2/1) organic coatings on faces of peds; neutral; clear smooth boundary.

Bg1—13 to 20 inches; dark gray (10YR 4/1) silty clay; common medium faint yellowish brown (10YR 5/4) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; common fine roots; many fine vesicular and few fine and medium tubular pores; few distinct black (10YR 2/1) krotovinas; mildly alkaline; clear smooth boundary.

Bg2—20 to 25 inches; olive gray (5YR 5/2) silty clay; many fine prominent yellowish brown (10YR 5/8) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; firm; few fine and medium roots; few fine and medium tubular and common fine vesicular pores; few distinct black (10YR 2/1) krotovinas; common distinct dark gray (10YR 4/1) coatings in root channels; common distinct black (N 2/0) concretions of iron and manganese oxide; mildly alkaline; clear smooth boundary.

Bg3—25 to 39 inches; gray (5YR 5/1) silty clay; many medium distinct yellowish brown (10YR 5/6) and common medium faint light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few fine roots; common fine and medium tubular and many fine vesicular pores; few distinct very dark gray (10YR 3/1) krotovinas; common distinct gray (10YR 4/1) coatings in root channels; few distinct black (N 2/0) stains of iron and manganese oxide; mildly alkaline; clear smooth boundary.

BCg—39 to 50 inches; gray (5Y 5/1) silty clay loam; common medium distinct light olive brown (2.5Y 5/4) and common medium distinct yellowish brown (10YR 5/6) mottles; weak fine and medium subangular blocky structure; firm; few fine roots; few fine and medium tubular and few very fine vesicular pores; few distinct very dark gray (10YR 3/1) krotovinas; strong effervescence; mildly alkaline; gradual smooth boundary.

Cg1—50 to 63 inches; gray (5Y 5/1) silty clay loam; many coarse faint yellowish brown (10YR 5/4) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; very few fine tubular pores; strong effervescence; mildly alkaline; gradual smooth boundary.

Cg2—63 to 80 inches; brown (10YR 5/3) silty clay loam; thin strata of silt loam; few faint yellowish brown (10YR 5/4) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; very few fine tubular pores; remains of shells; strong effervescence; moderately alkaline.

The solum ranges from 36 to 60 inches in thickness.

The Ap or A horizon is commonly silty clay loam, but some pedons are silty clay or silt loam. The Bg horizon below the mollic epipedon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 0 to 2. It is silty clay loam or silty clay. The C horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 3. It is stratified lacustrine or water-sorted sediments. It is commonly silty clay loam stratified with loam and silt loam. Some pedons have thin strata of sandy loam.

Millgrove Series

The Millgrove series consists of deep, very poorly drained soils on outwash plains and terraces. These soils formed in loamy water-sorted material and in stratified sandy, gravelly, and loamy deposits. Permeability is moderate. The slope is 0 to 2 percent.

Millgrove soils are commonly adjacent to Gallman and Sleeth soils. The well drained Gallman soils do not have low-chroma colors in the upper part of the subsoil. They are on low knolls, side slopes, and hummocky ridges. The somewhat poorly drained Sleeth soils have fewer low-chroma colors in the subsoil than the Millgrove soils. They are in the higher landscape positions.

Typical pedon of Millgrove silt loam, about 3.5 miles northwest of Denmark, in Canaan Township; 1,920 feet east and 1,188 feet north of the southwest corner of sec. 5, T. 5 S., R. 17 E.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak medium granular; friable; few medium tubular pores; few coarse fragments; slightly acid; abrupt smooth boundary.

BA—9 to 12 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; common medium faint yellowish brown (10YR 5/4) and common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few fine vesicular and tubular pores; few coarse fragments; slightly acid; clear smooth boundary.

Btg1—12 to 17 inches; gray (10YR 5/1) clay loam; common medium faint yellowish brown (10YR 5/4) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine vesicular and few medium vesicular and tubular pores; few distinct dark gray (10YR 4/1) clay films on faces of peds; few distinct very dark gray (10YR 3/1) organic coatings on vertical faces of peds; few coarse fragments; slightly acid; clear smooth boundary.

Btg2—17 to 21 inches; gray (10YR 5/1) clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine vesicular and tubular pores; many distinct dark gray (10YR 4/1) clay films on faces of peds; few distinct very dark gray (10YR 3/1) organic coatings on vertical faces of peds; about 5 percent gravel; neutral; clear smooth boundary.

Btg3—21 to 30 inches; gray (10YR 5/1) clay loam; common medium faint yellowish brown (10YR 5/4) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; few fine vesicular and tubular pores; many distinct dark gray (10YR 4/1) clay films on faces of peds; few distinct very dark gray (10YR 3/1) organic coatings on faces of peds; about 5 percent gravel; neutral; clear smooth boundary.

Btg4—30 to 41 inches; gray (10YR 5/1) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine vesicular and tubular and few medium pores; common distinct dark gray (10YR 4/1) clay films on faces of peds; about 5 percent gravel; mildly alkaline; clear smooth boundary.

BCg—41 to 50 inches; gray (10YR 5/1) loam; common fine distinct yellowish brown (10YR 5/4) and common medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; firm; few fine vesicular and tubular pores; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; about 10 percent gravel; mildly alkaline; gradual smooth boundary.

C1—50 to 59 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; common fine strong brown (7.5YR 5/8) weathered sandstone fragments; about 15 percent gravel; slight effervescence; mildly alkaline; clear smooth boundary.

C2—59 to 74 inches; brown (10YR 4/3) gravelly sandy loam; massive; friable; common medium strong brown (7.5YR 5/8) weathered sandstone fragments; about 30 percent gravel; slight effervescence; mildly alkaline; clear smooth boundary.

C3—74 to 80 inches; dark grayish brown (10YR 4/2) gravelly loamy sand; massive; very friable; about 30 percent gravel; slight effervescence; mildly alkaline.

The solum ranges from 28 to 55 inches in thickness. The content of coarse fragments is 2 to 15 percent, by volume, in the upper part of the solum and 10 to 50 percent, by volume, in the lower part of the solum and in the underlying material.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It commonly is silt loam, but some pedons are silty clay loam. The Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is clay loam or loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4. It is loam, sandy loam, loamy sand, or the gravelly analogs of those textures.

Morley Series

The Morley series consists of deep, well drained soils on end moraines and ground moraines. These soils formed in glacial till. Permeability is moderately slow or slow. The slope ranges from 6 to 18 percent.

Morley soils are commonly adjacent to Blount, Glynwood, and Pewamo soils and are similar to Amanda and Glynwood soils. The somewhat poorly drained Blount and very poorly drained Pewamo soils are in low areas and depressions and along drainageways. They have low-chroma colors below the surface layer. Glynwood soils are moderately well drained and have low-chroma mottles in the upper part of the subsoil. They are on less sloping parts of side slopes and knolls. Amanda soils have less clay in the subsoil than the Morley soils.

Typical pedon of Morley silt loam, 6 to 12 percent slopes, about 0.5 mile northeast of Westfield, in Westfield Township; 280 feet south of the intersection of County Road 159 and County Road 156, then 1,060 feet west:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine and medium subangular blocky structure; friable; common fine and few medium roots; common medium tubular and few fine vesicular pores; neutral; abrupt smooth boundary.

Bt1—8 to 12 inches; yellowish brown (10YR 5/6) clay loam; many distinct brown (10YR 4/3) organic coatings on faces of peds; weak medium subangular blocky structure; firm; few fine roots; common fine tubular pores; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few coarse fragments; slightly acid; clear smooth boundary.

Bt2—12 to 15 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine tubular and vesicular pores; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine faint pinkish gray (7.5YR 7/2) stains of iron and manganese oxide; about 5 percent gravel; slightly acid; clear smooth boundary.

Bt3—15 to 21 inches; yellowish brown (10YR 5/6) clay loam; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few fine roots; common fine tubular and few fine vesicular pores; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent gravel; neutral; clear smooth boundary.

Bt4—21 to 28 inches; yellowish brown (10YR 5/4) clay loam; weak medium subangular blocky structure; firm; few fine roots; common fine tubular pores; many distinct dark yellowish brown (10YR 4/4) and few distinct brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; neutral; gradual wavy boundary.

BC—28 to 39 inches; yellowish brown (10YR 5/4) clay loam; weak fine and medium subangular blocky structure; firm; few fine roots; many medium distinct brown (10YR 4/3) clay films; common fine distinct very pale brown (10YR 7/3) lime splotches; few medium reddish yellow (7.5YR 6/8) weathered sandstone fragments; about 8 percent gravel; slight effervescence; mildly alkaline; gradual smooth boundary.

C—39 to 80 inches; yellowish brown (10YR 5/4) clay loam; few fine faint yellowish brown (10YR 5/6) mottles; massive; firm; common medium distinct light gray (10YR 7/2) lime streaks; about 10 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 20 to 42 inches in thickness. The content of coarse fragments ranges from 0 to 15 percent, by volume, throughout the solum.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam. The C horizon has hue of 10YR, value of 5, and chroma of 2 to 4. It is clay loam or silty clay loam.

Ockley Series

The Ockley series consists of deep, well drained soils on terraces and outwash plains. These soils formed in loess, loamy outwash, and stratified sand and gravelly sand. Permeability is moderate in the subsoil and very rapid in the underlying material. The slope ranges from 2 to 12 percent.

Ockley soils are commonly adjacent to Sleeth soils and are similar to Chili and Gallman soils. Chili soils have less clay in the subsoil than the Ockley soils and are more acid in the lower part of the subsoil. Gallman soils have a thicker subsoil than that of the Ockley soils and more shale in the underlying material. The somewhat poorly drained Sleeth soils have low-chroma mottles below the surface layer. They are in low areas and at the base of slopes.

Typical pedon of Ockley silt loam, 2 to 6 percent slopes, about 2 miles southeast of Chesterville, in Chester Township; about 2,185 feet south of the intersection of State Route 95 and Township Road 180, along Township Road 180, then 465 feet east:

Ap1—0 to 6 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure parting to moderate fine and medium granular; friable; common fine and medium roots; few fine vesicular and few fine tubular pores; medium acid; clear smooth boundary.

Ap2—6 to 9 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; common fine and few medium roots; common fine and few medium tubular and few fine vesicular pores; medium acid; clear smooth boundary.

Bt1—9 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine and few medium roots; few fine and medium tubular and few fine vesicular pores; common distinct brown (10YR 4/3) and dark brown (10YR 3/3) clay films on faces of peds; few coarse fragments; strongly acid; abrupt smooth boundary.

2Bt2—23 to 30 inches; strong brown (7.5YR 5/6) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; few very fine vesicular pores; common prominent reddish brown (5YR 4/3) clay films on faces of peds; about 20 percent gravel; medium acid; clear smooth boundary.

2Bt3—30 to 36 inches; brown (7.5YR 5/4) gravelly clay loam; few fine distinct reddish brown (5YR 4/4) mottles; weak medium subangular blocky structure; friable; few medium vesicular pores; common distinct brown (10YR 4/3) and common prominent dark brown (7.5YR 4/2) clay films on faces of peds; about 20 percent gravel; medium acid; clear wavy boundary.

2BC—36 to 47 inches; brown (7.5YR 4/4) gravelly coarse sandy loam; weak medium subangular blocky structure; friable; common fine vesicular pores; few distinct dark grayish brown (10YR 4/2) clay films on horizontal and vertical faces of peds; about 25 percent gravel; neutral; abrupt wavy boundary.

2C—47 to 80 inches; yellowish brown (10YR 5/4) gravelly loamy coarse sand; single grained; loose; about 30 percent gravel; common medium reddish yellow (7.5YR 6/8) weathered sandstone fragments; strata of gravelly coarse sandy loam; few medium distinct very dark gray (10YR 3/1) organic masses; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 72 inches. The content of gravel ranges from 0 to 10 percent in the Ap and Bt horizons and from 10 to 45 percent in the 2Bt horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silt loam. The upper part of the 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, sandy loam, or the gravelly analogs of those textures. The lower part of the 2Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is clay loam, sandy clay loam, coarse sandy loam, or the gravelly analogs of those textures. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

Pewamo Series

The Pewamo series consists of deep, very poorly drained soils on ground moraines and end moraines. These soils formed in glacial till. Permeability is moderately slow. The slope is 0 to 2 percent.

Pewamo soils are commonly adjacent to Blount and Glynwood soils and are similar to Milford soils. The somewhat poorly drained Blount soils do not have a dark surface layer and are on low knolls and toe slopes. The moderately well drained Glynwood soils are on knolls and side slopes. They do not have a dominantly gray subsoil. The Milford soils formed in lacustrine deposits and have few or no pebbles in the solum.

Typical pedon of Pewamo silty clay loam, about 2.1 miles southwest of Cardington, in Westfield Township; 3,036 feet west of the intersection of Township Road 151 and County Road 165, then about 190 feet south:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; firm; few fine roots; few coarse fragments; slightly acid; clear wavy boundary.

A—8 to 15 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (2.5Y 5/2) dry; common medium faint yellowish brown (10YR 5/6) and common fine distinct brown (7.5YR 4/4) mottles; moderate medium angular blocky structure; firm; few fine roots; few coarse fragments; neutral; clear wavy boundary.

Btg1—15 to 22 inches; dark gray (10YR 4/1) silty clay loam; common medium faint yellowish brown (10YR 5/4) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint brown (10YR 4/3) and very dark gray (10YR 3/1) clay films on horizontal and vertical faces of peds; few coarse fragments; neutral; gradual smooth boundary.

Btg2—22 to 32 inches; gray (10YR 5/1) silty clay loam; common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; common faint gray (10YR 5/1 and 5Y 5/1) clay films on horizontal and vertical faces of peds; few coarse fragments; neutral; gradual smooth boundary.

Btg3—32 to 49 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) and few fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; few faint very dark gray (10YR 3/1) and gray (5Y 5/1) clay films on vertical faces of peds; about 5 percent coarse fragments; mildly alkaline; gradual wavy boundary.

BCg—49 to 66 inches; gray (5Y 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) and few fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; few faint gray (10YR 5/1) clay films on vertical faces of peds; about 5 percent coarse fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

C—66 to 80 inches; dark yellowish brown (10YR 4/4) clay loam; many medium distinct gray (5Y 5/1) mottles; massive; firm; about 10 percent coarse fragments; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 46 to 70 inches. The content of coarse fragments is 0 to 10 percent, by volume, throughout the solum.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam or silt loam. The Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 or 2. It is clay loam, clay, silty clay loam, or silty clay. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4.

Rittman Series

The Rittman series consists of deep, moderately well drained soils on end moraines and ground moraines. These soils formed in glacial till. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. The slope ranges from 2 to 12 percent.

Rittman soils are commonly adjacent to Bennington and Wooster soils and are similar to Canfield and Wooster soils. The somewhat poorly drained Bennington soils have more low-chroma colors in the subsoil than the Rittman soils. They are in depressions and broad, nearly level areas. The Canfield soils have less clay in the subsoil than the Rittman soils. The well drained Wooster soils do not have low-chroma mottles above the fragipan and are in positions similar to those of the Rittman soils.

Typical pedon of Rittman silt loam, 2 to 6 percent slopes, about 5.2 miles northeast of Chesterville, in Franklin Township; about 219 feet south and 30 feet west of the northeast corner of sec. 5, T. 18 N., R. 19 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; few medium distinct yellow (10YR 7/6) mottles; weak medium subangular blocky structure parting to moderate medium granular; friable; few coarse and common fine roots; few fine and medium tubular pores; few coarse fragments; neutral; abrupt smooth boundary.

Bt1—7 to 16 inches; yellowish brown (10YR 5/6) clay loam; few medium faint strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few coarse and medium and common fine roots; few fine tubular pores; common distinct dark yellowish brown (10YR 4/4) clay films on horizontal and vertical faces of peds; common distinct light gray (10YR 7/2) silt coatings on faces of peds; few distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent gravel; slightly acid; clear smooth boundary.

Bt2—16 to 21 inches; yellowish brown (10YR 5/6) clay loam; few medium distinct strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to moderate very thick platy and moderate medium subangular blocky; very firm, slightly brittle; few fine roots; few fine vesicular pores; common distinct dark yellowish brown (10YR 4/4) clay films on horizontal and vertical faces of peds; few distinct dark grayish brown (10YR 4/2) clay films on vertical faces of peds; few distinct light gray (10YR 7/2) silt coatings on faces of peds; few distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent gravel; strongly acid; clear smooth boundary.

Btx1—21 to 27 inches; yellowish brown (10YR 5/4) loam; weak very coarse and coarse prismatic structure parting to moderate very thick platy and moderate medium subangular blocky; very firm, about 70 percent brittle; few fine roots on prism faces; few fine vesicular pores; few distinct dark gray (10YR 4/1) clay films on vertical faces of peds and few distinct dark grayish brown (10YR 4/2) clay films on horizontal and vertical faces of peds; few distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent gravel; strongly acid; clear smooth boundary.

Btx2—27 to 33 inches; dark yellowish brown (10YR 4/4) clay loam; common medium faint yellowish brown (10YR 5/4) and common fine distinct white (10YR 8/1) and grayish brown (10YR 5/2) mottles; weak very coarse and coarse prismatic structure parting to moderate medium subangular blocky; very firm, brittle; few medium and many fine vesicular pores; common distinct dark grayish brown (10YR 4/2) and dark brown (10YR 3/3) clay films on horizontal and vertical faces of peds; about 5 percent gravel; slightly acid; clear smooth boundary.

BC—33 to 40 inches; dark yellowish brown (10YR 4/4) clay loam; common medium faint yellowish brown (10YR 5/4) and common fine distinct white (10YR 8/1) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; about 5 percent gravel; slightly acid; clear wavy boundary.

C—40 to 80 inches; dark yellowish brown (10YR 4/4) clay loam; massive; very firm; common medium distinct white (10YR 8/1) lime splotches; about 5 percent gravel; strong effervescence; mildly alkaline.

The solum ranges from 34 to 60 inches in thickness. Depth to the fragipan ranges from 18 to 30 inches. The content of coarse fragments ranges from 0 to 10 percent, by volume, in the Ap and Bt horizons and from 2 to 15 percent in the Btx and C horizons.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6. It is clay loam or silty clay loam. The Btx and BC horizons have hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, loam, or silt loam.

Shoals Series

The Shoals series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in recent alluvium. Permeability is moderate. The slope is 0 to 2 percent.

Shoals soils are commonly adjacent to Lobdell, Sloan, and Tioga soils and are similar to the Sloan soils. The moderately well drained Lobdell and well drained Tioga soils do not have low-chroma mottles below the surface layer. They are on the higher parts of the flood plain. The very poorly drained Sloan soils have a mollic epipedon. They are in low areas and in old stream channels.

Typical pedon of Shoals silt loam, occasionally flooded, about 1.7 miles east of Denmark, in Cannan Township; 704 feet north and 1,981 feet west of the southeast corner of sec. 22, T. 5 S., R. 17 E.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine and medium roots; mildly alkaline; abrupt smooth boundary.

A—7 to 12 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; few fine and medium roots; few fine and medium tubular and few fine vesicular pores; many distinct dark grayish brown (10YR 4/2) organic coatings; mildly alkaline; abrupt smooth boundary.

C—12 to 16 inches; brown (10YR 4/3) loam; few fine distinct strong brown (7.5YR 5/6) mottles; common medium faint reddish brown (5YR 4/4) stains of iron and manganese oxide; weak medium subangular blocky structure; friable; common fine and few medium tubular and common fine vesicular pores; many distinct dark grayish brown (10YR 4/2) organic coatings; mildly alkaline; clear wavy boundary.

Cg1—16 to 21 inches; dark grayish brown (10YR 4/2) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; common medium faint reddish brown (5YR 4/4) stains of iron and manganese oxide; weak medium subangular blocky structure; friable; common fine and few medium tubular and common fine vesicular pores; mildly alkaline; clear wavy boundary.

Cg2—21 to 26 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; common fine faint reddish brown (5YR 4/4) stains of iron and manganese oxide; moderate medium subangular blocky structure; friable; few fine roots; few fine tubular and vesicular pores; mildly alkaline; clear wavy boundary.

Cg3—26 to 32 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; common medium faint yellowish red (5YR 5/6) stains of iron and manganese oxide; moderate medium subangular blocky structure; firm; few fine and medium tubular and few fine vesicular pores; mildly alkaline; clear wavy boundary.

Cg4—32 to 36 inches; dark gray (10YR 4/1) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; common fine distinct yellowish red (5YR 5/8) stains of iron and manganese oxide; weak medium subangular blocky structure; friable; few fine tubular and vesicular pores; mildly alkaline; clear wavy boundary.

Cg5—36 to 47 inches; dark grayish brown (10YR 4/2) loam; common medium distinct strong brown (7.5YR 5/6) and common fine faint brown (10YR 5/3) mottles; common fine distinct yellowish red (5YR 5/8) stains of iron and manganese oxide; weak coarse subangular blocky structure; friable; few fine tubular and vesicular pores; dark grayish brown (10YR 4/2) clay flow; mildly alkaline; abrupt smooth boundary.

Cg6—47 to 50 inches; grayish brown (10YR 5/2) loam; common medium faint yellowish brown (10YR 5/6) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; few fine tubular and vesicular pores; mildly alkaline; abrupt smooth boundary.

Cg7—50 to 63 inches; grayish brown (10YR 5/2) sandy loam; common fine distinct yellowish brown (10YR 5/4) and common medium distinct strong brown (7.5YR 5/8) mottles; single grained; loose; few coarse fragments; mildly alkaline; abrupt wavy boundary.

Cg8—63 to 75 inches; dark gray (10YR 4/1) loam and gray (10YR 5/1) sandy loam; massive; friable; about 10 percent decayed roots; few coarse fragments; mildly alkaline; abrupt wavy boundary.

Cg9—75 to 80 inches; dark gray (10YR 4/1) loam;

massive; friable; about 10 percent gravel; mildly alkaline; slight effervescence.

The content of coarse fragments ranges from 5 to 15 percent, by volume, below a depth of 40 inches.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4. It is loam, silt loam, silty clay loam, sandy loam, and clay loam.

Sleeth Series

The Sleeth series consists of deep, somewhat poorly drained soils on outwash plains and terraces. These soils formed in outwash sediments. Permeability is moderate. The slope is 0 to 3 percent.

Sleeth soils are commonly adjacent to Chili, Gallman, Millgrove, and Ockley soils. The well drained Chili, Gallman, and Ockley soils do not have low-chroma mottles in the upper part of the subsoil and are in slightly higher landscape positions than those of the Sleeth soils. The very poorly drained Millgrove soils are dominantly gray below the surface layer and are in depressions and along drainageways.

Typical pedon of Sleeth silt loam, loamy substratum, 0 to 3 percent slopes, about 0.3 mile southeast of Climax, in Canaan Township; 825 feet south and 990 feet west of the northeast corner of sec. 10, T. 5 S., R. 17 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak coarse subangular blocky structure parting to moderate fine and medium granular; very friable; common fine and medium roots; common fine and medium vesicular and tubular pores; few coarse fragments; strongly acid; abrupt smooth boundary.

Bt—10 to 18 inches; brown (10YR 5/3) silt loam; common medium distinct yellowish brown (10YR 5/6) and few fine faint light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common fine and medium roots; common fine and medium tubular and vesicular pores; few faint grayish brown (10YR 5/2) clay films on faces of peds; few distinct light gray (10YR 7/2) silt coatings on faces of peds; few coarse fragments; strongly acid; gradual smooth boundary.

2Btg1—18 to 25 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/6) and few fine distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine and few medium roots; few fine tubular and common fine vesicular pores; few faint brown (10YR 5/3) clay films on faces of peds; few distinct light gray (10YR 7/2) silt coatings on faces of peds; few coarse fragments; strongly acid; clear smooth boundary.

2Btg2—25 to 40 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/6) and few fine distinct gray (10YR 6/1) mottles; weak coarse subangular blocky structure; firm; common fine roots; few fine tubular and common fine vesicular pores; few faint brown (10YR 5/3) clay films on faces of peds; common distinct light brownish gray (10YR 6/2) sand grain coatings on faces of peds; about 5 percent gravel; medium acid; clear smooth boundary.

2Btg3—40 to 46 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine tubular and common fine vesicular pores; few faint brown (10YR 5/3) clay films on faces of peds; about 10 percent gravel; slightly acid; clear smooth boundary.

2Btg4—46 to 60 inches; brown (10YR 4/3) clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; weak coarse and medium subangular blocky structure; friable; few fine vesicular pores; common distinct grayish brown (10YR 5/2) and few distinct brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; slightly acid; abrupt smooth boundary.

2C1—60 to 73 inches; dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) sandy loam; few medium prominent strong brown (7.5YR 5/6) mottles; massive; very friable; few fine vesicular pores; common distinct dark gray (10YR 4/1) and few distinct grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent gravel; mildly alkaline; clear smooth boundary.

2C2—73 to 77 inches; dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) gravelly clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; massive; very friable; about 15 percent gravel; slight effervescence; mildly alkaline; clear smooth boundary.

2C3—77 to 80 inches; yellowish brown (10YR 5/6) gravelly loam; massive; very friable; about 15 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 40 to 75 inches in thickness. The content of coarse fragments is 0 to 10 percent in the surface layer and the upper part of the subsoil and 5 to 30 percent in the lower part of the subsoil.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 to 3. It is silt loam or loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is silt loam, silty clay loam, clay loam, or loam. The 2Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is clay loam, loam, or gravelly clay loam. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 6. It is stratified gravelly loamy coarse sand to clay loam.

Sloan Series

The Sloan series consists of deep, very poorly drained soils on flood plains. These soils formed in recent alluvium. Permeability is moderately slow or moderate. The slope is 0 to 2 percent.

Sloan soils are commonly adjacent to Lobdell, Shoals, and Tioga soils and are similar to Shoals soils. The moderately well drained Lobdell, the somewhat poorly drained Shoals, and the well drained Tioga soils do not have a mollic epipedon. Shoals soils are in slightly higher landscape positions than those of the Sloan soils. Lobdell and Tioga soils are on the higher parts of the flood plain.

Typical pedon of Sloan silty clay loam, sandy substratum, occasionally flooded, about 2.6 miles west of Fulton, in Lincoln Township; 1,056 feet west of the intersection of County Road 25 and County Road 168, then 423 feet north:

Ap—0 to 12 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; few fine distinct reddish brown (5YR 4/4) mottles; weak coarse subangular blocky structure parting to moderate medium subangular blocky; firm; common fine and medium roots; few fine vesicular pores; very dark grayish brown (10YR 3/2) organic coatings; neutral; clear smooth boundary.

Bg—12 to 18 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; few fine vesicular and tubular pores; neutral; gradual smooth boundary.

Bw—18 to 25 inches; brown (10YR 5/3) silty clay loam; common medium faint gray (10YR 5/1) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; few medium tubular and few fine vesicular pores; common distinct dark gray (10YR 4/1) coatings on faces of peds; black (N 2/0) concretions of iron and manganese oxide; neutral; clear smooth boundary.

Bg′—25 to 29 inches; dark gray (10YR 4/1) clay loam; common medium distinct yellowish brown (10YR 5/6), common fine faint strong brown (7.5YR 5/6), and common medium faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; black (N 2/0) concretions of iron and manganese oxide; few coarse fragments; neutral; clear smooth boundary.

Bw′—29 to 40 inches; yellowish brown (10YR 5/6) loam; common fine distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; few fine roots; few medium tubular and few fine vesicular pores; common distinct gray (10YR 5/1) coatings on faces of peds; black (N 2/0) stains of iron and manganese oxide; few coarse fragments; neutral; clear smooth boundary.

Bg″—40 to 48 inches; gray (10YR 5/1) loam; common medium distinct yellowish brown (10YR 5/6) and common fine distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine tubular and vesicular pores; few distinct dark grayish brown (10YR 4/2) coatings on faces of peds; few coarse fragments; neutral; clear smooth boundary.

Cg1—48 to 64 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/6) and common fine distinct strong brown (7.5YR 5/8) mottles; massive; friable; few fine roots; few fine tubular and vesicular pores; few coarse fragments; neutral; abrupt smooth boundary.

Cg2—64 to 80 inches; very dark gray (10YR 3/1) gravelly loamy sand; few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; about 35 percent gravel; strong effervescence; mildly alkaline.

The solum ranges from 24 to 55 inches in thickness. The content of coarse fragments ranges from 0 to 5 percent, by volume, in the solum.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam or silt loam. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 6. It is silty clay loam, clay loam, loam, or silt loam. The C horizon has hue of 10YR, value of 3 to 5, and chroma of 1 to 3. It is dominantly loam, sandy loam, clay loam, silty clay loam, or the gravelly analogs of those textures. Below a depth of 40 inches it is also loamy sand or gravelly loamy sand.

Tioga Series

The Tioga series consists of deep, well drained soils on flood plains. These soils formed in recent alluvium. Permeability is moderate or moderately rapid. The slope is 0 to 2 percent.

Tioga soils are commonly adjacent to Lobdell, Shoals, and Sloan soils. The moderately well drained Lobdell, the somewhat poorly drained Shoals, and the very poorly drained Sloan soils have more clay in the subsoil than the Tioga soils. They are in the lower areas on the flood plain.

Typical pedon of Tioga loam, occasionally flooded, about 2 miles east of Johnsville, in Perry Township; 330 feet north and 150 feet west of the southeast corner of sec. 4, T. 19 N., R. 19 W.

Ap—0 to 12 inches; brown (10YR 4/3) loam, brown (10YR 5/3) dry; few fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure parting to moderate fine and medium granular; friable; common fine and few medium roots; few fine vesicular and common medium and fine tubular pores; common faint very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few coarse fragments; neutral; clear smooth boundary.

Bw1—12 to 22 inches; yellowish brown (10YR 5/4) fine sandy loam; weak coarse subangular blocky structure; very friable; common fine roots; few fine vesicular and common medium and fine tubular pores; common distinct dark grayish brown (10YR 4/2) coatings along root channels; few coarse fragments; slightly acid; clear smooth boundary.

Bw2—22 to 28 inches; yellowish brown (10YR 5/4) loam; few fine faint strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; few fine roots; common fine vesicular and few fine and medium tubular pores; common distinct dark grayish brown (10YR 4/2) coatings along root channels; few coarse fragments; slightly acid; clear smooth boundary.

Bw3—28 to 34 inches; yellowish brown (10YR 5/4) loam; common medium faint brown (10YR 5/3) and common coarse distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; few fine roots; few fine and medium vesicular and few medium tubular pores; few distinct dark grayish brown (10YR 4/2) coatings along root channels; few coarse fragments; neutral; clear smooth boundary.

C1—34 to 42 inches; dark yellowish brown (10YR 4/4) sandy loam; massive; very friable; few fine roots; common fine vesicular and few fine tubular pores; few coarse fragments; neutral; clear wavy boundary.

C2—42 to 50 inches; dark yellowish brown (10YR 4/4) loamy sand; single grained; loose; few fine roots; common fine vesicular and few fine tubular pores; few coarse fragments; neutral; gradual wavy boundary.

C3—50 to 55 inches; gray (10YR 5/1) sandy loam; common coarse faint brown (10YR 5/3) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; very friable; few fine roots; common fine vesicular and few fine and medium tubular pores; few coarse fragments; mildly alkaline; clear wavy boundary.

C4—55 to 66 inches; dark gray (10YR 4/1) loam; common coarse faint brown (10YR 5/3) and common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; common fine vesicular and few fine tubular pores; few coarse fragments; mildly alkaline; clear smooth boundary.

C5—66 to 80 inches; yellowish brown (10YR 5/4) very gravelly loamy sand; common medium distinct gray (10YR 5/1) and few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; about 35 percent gravel; about 10 percent cobbles; slight effervescence; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness. The content of coarse fragments ranges from 0 to 15 percent, by volume, in the solum and from 0 to 60 percent, by volume, in the underlying material.

The Ap horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4. It commonly is loam or fine sandy loam, but some pedons are silt loam. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is fine sandy loam, loam, or silt loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4. It is sandy loam, loam, loamy sand, or the gravelly or very gravelly analogs of those textures.

Wadsworth Series

The Wadsworth series consists of deep, somewhat poorly drained soils on ground moraines. These soils formed in glacial till. They have a fragipan. Permeability is moderately slow or moderate above the fragipan and slow or very slow in the fragipan. The slope ranges from 0 to 6 percent.

Wadsworth soils are commonly adjacent to Condit, Rittman, and Wooster soils. The moderately well drained Rittman soils are on side slopes and ridgetops. They have fewer low-chroma colors in the subsoil than the Wadsworth soils. The poorly drained Condit soils are in depressions and have a dominantly gray subsoil. The well drained Wooster soils do not have low-chroma mottles above the fragipan and are on side slopes and ridgetops.

Typical pedon of Wadsworth silt loam, 0 to 2 percent slopes, about 3 miles west of Blooming Grove, in North Bloomfield Township; 920 feet south and 1,550 feet west of the northeast corner of sec. 8, T. 19 N., R. 20 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; few fine vesicular and common medium tubular pores; few coarse fragments; neutral; abrupt smooth boundary.

Bt1—9 to 14 inches; yellowish brown (10YR 5/6) silty clay loam; few medium distinct grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; moderate fine and medium subangular blocky structure; firm; common fine roots; few medium tubular and common fine vesicular and tubular pores; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; many prominent grayish brown (10YR 5/2) and common distinct brown (10YR 5/3) silt coatings on faces of peds; few coarse fragments; very strongly acid; clear smooth boundary.

Bt2—14 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; common medium faint yellowish brown (10YR 5/8) and common medium distinct grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine vesicular and tubular pores; many distinct grayish brown (10YR 5/2) clay films on faces of peds; many prominent grayish brown (10YR 5/2) silt coatings on faces of peds; few coarse fragments; very strongly acid; gradual smooth boundary.

Btx1—21 to 29 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very firm; brittle in about 10 percent of the horizon, the percentage increasing with increasing depth; few fine roots along prism faces; common fine and few medium vesicular pores; common prominent gray (10YR 5/1) clay films on prism faces; common medium distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent coarse fragments; strongly acid; gradual smooth boundary.

Btx2—29 to 40 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct gray (10YR 5/6) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; very firm; brittle in about 60 percent of the horizon; few fine roots along prism faces; common fine and few medium vesicular pores; common fine grayish brown (10YR 5/2) clay films on prism faces; common fine distinct black (N 2/0) stains of iron and manganese oxide; few coarse fragments; slightly acid; gradual smooth boundary.

BC—40 to 48 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very firm; few fine roots; few fine and medium vesicular pores; common distinct gray (10YR 5/1) and brown (10YR 4/3) clay films on faces of peds; common distinct grayish brown (10YR 5/2) clay films on vertical faces of peds; common medium distinct black (N 2/0) stains of iron and manganese oxide; about 5 percent coarse fragments; mildly alkaline; clear wavy boundary.

C—48 to 80 inches; yellowish brown (10YR 5/4) and brown (10YR 4/3) clay loam; common medium faint yellowish brown (10YR 5/6) and few medium distinct yellowish red (5YR 4/6) mottles; massive; very firm; about 10 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 34 to 60 inches in thickness. Depth to the fragipan ranges from 18 to 30 inches. The content of coarse fragments ranges from 0 to 4 percent, by volume, in the Ap and Bt horizons and from 2 to 15 percent, by volume, in the Btx and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam, clay loam, or silt loam. The Btx horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

Wooster Series

The Wooster series consists of deep, well drained soils on end moraines and ground moraines. These soils formed in glacial till. They have a fragipan. Permeability is moderate above the fragipan and moderately slow in the fragipan. The slope ranges from 2 to 25 percent.

Wooster soils are commonly adjacent to Bennington, Canfield, and Rittman soils and are similar to Canfield and Rittman soils. The somewhat poorly drained Bennington soils have low-chroma mottles below the surface layer. They are in low areas and in depressions. The moderately well drained Canfield and Rittman soils have low-chroma mottles above the fragipan. They are in landscape positions similar to those of the Wooster soils.

Typical pedon of Wooster silt loam, 6 to 12 percent slopes, eroded, about 2.8 miles northeast of Chesterville, in Franklin Township; 2,376 feet east of the intersection of County Road 121 and Township Road 178, along County Road 121, then about 924 feet north:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; 15 percent yellowish brown (10YR 5/6) Bt material; weak medium subangular blocky structure parting to moderate medium granular; very friable; many fine and common medium roots; about 5 percent gravel; strongly acid; abrupt smooth boundary.

Bt1—9 to 17 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common medium and few fine roots; few fine and medium tubular pores; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent gravel; strongly acid; gradual smooth boundary.

Bt2—17 to 23 inches; yellowish brown (10YR 5/6) loam; common fine faint yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; few fine and medium tubular pores; common faint dark yellowish brown (10YR 4/4) and few faint brown (10YR 4/3) clay films on faces of peds; about 10 percent gravel; strongly acid; clear smooth boundary.

Bt3—23 to 29 inches; dark yellowish brown (10YR 4/4) gravelly loam; common fine faint strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak thick platy and then to moderate medium subangular blocky; firm; few very fine roots; few fine tubular and few fine vesicular pores; few faint brown (10YR 4/3) clay films on faces of peds; common faint brown (10YR 5/3) silt coatings on faces of peds; common medium distinct black (N 2/0) stains of iron and manganese oxide; about 15 percent gravel; strongly acid; clear smooth boundary.

Btx1—29 to 36 inches; yellowish brown (10YR 5/6) loam; common fine distinct gray (10YR 5/1) and strong brown (7.5YR 5/8) mottles; weak coarse and very coarse prismatic structure parting to moderate medium subangular blocky; very firm; about 60 percent brittle; few very fine roots along faces of peds; few fine and medium vesicular pores; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; common fine distinct black (N 2/0) stains of iron and manganese oxide; about 10 percent gravel; strongly acid; clear smooth boundary.

Btx2—36 to 44 inches; brown (10YR 4/3) clay loam; common fine distinct yellowish red (5YR 5/8) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; very firm; about 75 percent brittle; few very fine roots along faces of peds; few fine and medium vesicular pores; few faint dark brown (10YR 3/3) clay films on faces of peds; few faint grayish brown (10YR 5/2) clay films along old root channels; common distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 10 percent gravel; medium acid; gradual smooth boundary.

BC—44 to 48 inches; brown (10YR 4/3) loam; common fine distinct yellowish red (5YR 5/6) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few very fine roots; few fine and medium vesicular pores; few faint dark grayish brown (10YR 4/2) and light brownish gray (10YR 6/2) clay films along old root channels; about 10 percent gravel; slightly acid; gradual smooth boundary.

C1—48 to 55 inches; brown (10YR 4/3) gravelly loam; few fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; massive; firm; common fine distinct light gray (10YR 7/1) lime coatings; about 15 percent coarse fragments; neutral; gradual smooth boundary.

C2—55 to 80 inches; brown (10YR 4/3) gravelly loam; few fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; massive; firm; common fine distinct light gray (10YR 7/1) lime coatings; about 15 percent coarse fragments; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 34 to 60 inches. Depth to the fragipan ranges from 18 to 40 inches. The content of coarse fragments ranges from 2 to 15 percent above the fragipan and from 5 to 20 percent in and below the fragipan.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is loam or clay loam. The Btx and BC horizons have hue of 10YR, value of 4 or 5, and chroma of 3 to 6. They are loam, silt loam, clay loam, or the gravelly analogs of those textures. The C horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. It is loam or gravelly loam.

Formation of the Soils

This section describes how the major factors of soil formation have affected the soils in Morrow County and explains some of the processes of soil formation *(5, 19)*.

Factors of Soil Formation

A soil is a three-dimensional natural body that can support plant life. Unique soils are formed as a result of complex interactions among five general soil-forming factors—parent material, plants and animals, climate, relief, and time.

Parent Material

Parent material is the unconsolidated matter from which soils form. The other four soil-forming factors interact with parent material to form soil. Several different kinds of parent material are in Morrow County. Most of the parent material was deposited by the glaciers that covered the county thousands of years ago during the Wisconsin age. Other kinds of parent material in the county include alluvium deposited by recent streams and organic material from decayed plants.

Glacial till is the dominant parent material in the county. It was deposited directly beneath the glacial ice. It is a mixture of materials ranging from clay particles to large stones. The soils that formed in glacial till are generally compact and have moderately slow or slow permeability. The glacial till in the western third of the county has a high content of clay and lime. The calcium carbonate equivalent below a depth of about 40 inches is more than 22 percent. Blount and Glynwood soils formed in these deposits. The glacial till in the eastern two-thirds of the county has a medium or low content of lime. The calcium carbonate equivalent below a depth of about 60 inches is less than 22 percent.

Materials deposited by water from a melting glacier are called meltwater deposits. The two kinds of meltwater deposits are outwash deposits, which consist of stratified sand and gravel laid down by moving water, and lacustrine deposits, which are laid down in still water.

Outwash deposits occurred when sand and gravel were deposited in fast moving streams. As the water slowed the larger particles settled in the water. Gallman, Sleeth, and Ockley soils formed in these deposits. The soils formed in outwash deposits are of limited extent in the county.

Lacustrine deposits occurred when the melting water was still or moving very slowly. The finer clay particles were deposited at the bottom of small lakes and pools. Milford soils formed in these deposits. The soils formed in lacustrine deposits are not extensive in Morrow County.

Alluvium is material deposited by flowing streams during flooding. It consists of soil material eroded upstream and deposited downstream. Alluvial sediment varies over small distances because of differences in the speed and duration of the floodwater. It is stratified and generally has a high content of organic matter because occasional flooding continues to deposit fresh materials. Shoals, Sloan, and Lobdell soils, which are the youngest soils in the county, formed in alluvial deposits.

Organic material was deposited in very wet depressions. It consists of decaying plant materials that accumulated in bogs. The permanently wet condition minimized oxidation and slowed decomposition while the material accumulated. Carlisle soils formed in these deposits. The soils formed in organic deposits are of very limited extent in Morrow County.

Plants and Animals

Plants and animals affect soil properties, such as color, structure, and the content of organic matter. The soils that formed under trees generally have a lighter colored surface layer and less organic matter than soils that formed under grasses. Grasses generally return more organic matter to the soil than trees. They have many fine roots that die and decay each year, increasing the content of organic matter and darkening the surface layer. The soils that have a higher content of organic matter generally are more fertile. Most of the soils in Morrow County formed under hardwood forests *(10)*.

Animals also influence the formation of soils.

Earthworms mix leaf litter into the soil. Burrowing animals physically mix the soil. Earthworms, burrowing insects, and small animals make the soil more porous, helping to improve aeration and increase the rate of water infiltration.

Human activities have significantly influenced the formation of soils. Land has been cleared of trees and plowed. Intensive farming on sloping soils causes erosion. Applications of fertilizer and lime change the chemical composition of the soil. Artificial drainage reduces the content of organic matter.

Climate

Because the climate in Morrow County is fairly uniform the differences in the soils result from other soil-forming factors. The climate influences the rate of decomposition and weathering of minerals by leaching. Soluble bases are removed when they are released by the decomposition of the mineral material. Clay and sesquioxides are translocated by water percolating downward from the surface layer to the lower horizons. Centerburg, Morley, and other soils show evidence of the movement of clay from the A horizon to the B horizon.

A further description of the climate in Morrow County is in the section "General Nature of the County."

Relief

Relief influences soil formation by its effect on the amount of water that moves through the soil, the amount of organic matter in the surface layer, the depth of the soil, and the degree of erosion.

The amount of water that moves through the soil depends indirectly on relief. The rate of runoff is generally higher on the steeper slopes. Water that runs off the steeper slopes collects in depressions. Generally, soils on the steeper slopes have better drainage than nearly level soils because they receive less water from equivalent rainfalls. Different soils can form in the same parent material because of relief. For example, Glynwood and Pewamo soils formed in glacial till deposits. The moderately well drained Glynwood soils are typically on the more sloping or higher positions than the very poorly drained Pewamo soils, which are in nearly level, low areas.

A group of soils that form in the same parent material but differ in drainage mainly because of relief is called a toposequence, or a soil catena. For example, the well drained Amanda soils, the moderately well drained Centerburg soils, the somewhat poorly drained Bennington soils, the poorly drained Condit soils, and the very poorly drained Pewamo soils make up a toposequence.

The amount of organic matter in the surface layer may differ because of differences in relief. The soils in nearly level areas and in depressions generally have a higher amount of organic matter than the more sloping soils because the organic matter in these flatter, wetter areas does not decompose as readily as that in the drier, more sloping areas. The nearly level soils tend to have a thicker solum than that of the sloping soils. Erosion and the absence of water moving through the sloping soils inhibit soil formation. The degree of erosion generally increases as slope increases; therefore, soils on the steeper slopes generally are shallower than those on the gentle slopes.

Time

The length of time that parent material has been exposed to the other factors of soil formation is important in soil development. Generally, the longer that climate and living organisms have acted upon the parent material, the more distinct are the horizons in the profile. The distinctiveness of the horizons indicates the relative maturity of the soil.

The soils of Morrow County formed since the last glaciation, which was about 10,000 to 15,000 years ago. In most of the soils, the carbonates have been leached, a structure has developed in the subsoil, and organic matter has accumulated in the surface layer. In steep areas, geologic erosion has kept pace with soil formation; thus, the horizons are thin and depth to the parent material is less than 15 inches in places. In flat or rolling areas, the horizons are thicker and depth to the parent material generally is more than 24 inches.

In Morrow County the youngest soils, such as Shoals soils, formed in recent stream deposits. The horizons are less distinct in these younger soils than those in the older soils.

Processes of Soil Formation

Soil forms through complex processes that are grouped into four general categories. These are additions, removals, transfers, and transformations *(17)*. These processes occur in the formation of all of the soils in Morrow County, although in varying degrees.

The accumulation of organic matter in the formation of mineral soils is an example of an addition. The addition of organic residue has produced a dark surface layer. Examples of such additions are in Pewamo and Milford soils. Originally, the upper part of the parent material was not darker than the lower part.

The loss of lime from the upper 2 to 4 feet of many of the soils in Morrow County is an example of a removal. Although the parent material was limy, percolating water has leached the lime from the upper part of the soil. The removal of carbonates has been prominent in the formation of Amanda and Ockley soils.

Water carries most of the transfers that have occurred in the formation of soils in the county. In many of the soils, clay has been transferred from the A horizon to the B horizon. The A horizon has become a zone of eluviation and the B horizon a zone of illuviation. In the B horizon of some soils, thin films of clay that have been transferred from the A horizon are in the pores and on the faces of peds. The transfer of clay has been prominent in the formation of Amanda and Ockley soils.

The reduction and solution of ferrous iron is a transformation. This process has taken place in the very poorly drained, poorly drained, and somewhat poorly drained soils. Reduction of iron, or gleying, is evident in Pewamo, Condit, and Sloan soils. It is the result of a recurring water table. The gray color in the soil indicates gleying. Reduced iron is soluble; however, the iron in the soils in Morrow County commonly has remained in the horizon where it originated or has settled in an underlying horizon. It can be reoxidized and segregated in places to form yellowish brown mottles that are brighter than the surrounding soil. The transformation of iron causes mottling in soils that are not well drained.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock control. Configuration and relief of a landform is determined or strongly influenced by the underlying bedrock.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. The depth to bedrock. Deep soils are more than 40 inches to bedrock, moderately deep soils are 20 to 40 inches to bedrock, and shallow soils are 10 to 20 inches to bedrock.

Depth to bedrock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

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.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are end, terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Perimeter drain. Artificial drain placed around the perimeter of a septic tank absorption field to lower the water table; also called curtain drain.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and help to control erosion.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-80 at Marion, Ohio)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	33.0	16.2	24.6	61	-13	0	2.36	1.16	3.40	6	7.5
February----	37.1	18.8	28.0	62	-10	13	1.76	.72	2.62	5	6.5
March-------	47.6	27.3	37.5	76	1	14	2.87	1.57	4.00	7	4.8
April-------	61.1	38.1	49.6	84	19	94	3.61	1.76	5.21	8	.2
May---------	72.8	48.6	60.7	91	29	350	3.42	2.21	4.50	8	.0
June--------	81.9	57.2	69.6	97	41	588	3.42	1.91	4.75	7	.0
July--------	85.1	60.6	72.9	97	44	710	3.56	1.87	5.03	7	.0
August------	83.5	58.8	71.2	96	41	657	3.04	1.38	4.45	6	.0
September---	77.5	51.6	64.6	94	32	438	3.01	1.17	4.56	6	.0
October-----	64.6	40.3	52.5	87	21	164	2.11	.84	3.19	5	.0
November----	50.4	32.0	41.2	75	10	11	2.57	1.43	3.57	7	1.9
December----	38.1	21.6	29.9	66	-6	8	2.33	1.03	3.43	6	5.0
Yearly:											
Average---	61.1	39.3	50.2	---	---	---	---	---	---	---	---
Extreme---	---	---	---	98	-14	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,047	34.06	28.85	39.05	78	25.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-80 at Marion, Ohio)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 22	May 6	May 21
2 years in 10 later than--	Apr. 17	May 1	May 15
5 years in 10 later than--	Apr. 8	Apr. 20	May 3
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 13	Sept. 30	Sept. 20
2 years in 10 earlier than--	Oct. 18	Oct. 6	Sept. 24
5 years in 10 earlier than--	Oct. 29	Oct. 18	Oct. 3

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Marion, Ohio)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	182	154	129
8 years in 10	189	163	137
5 years in 10	203	179	152
2 years in 10	217	196	167
1 year in 10	224	205	175

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AdB	Amanda silt loam, 2 to 6 percent slopes	1,697	0.7
AdC2	Amanda silt loam, 6 to 12 percent slopes, eroded	10,153	3.9
AdD2	Amanda silt loam, 12 to 18 percent slopes, eroded	5,341	2.1
AdE2	Amanda silt loam, 18 to 25 percent slopes, eroded	1,246	0.5
BeA	Bennington silt loam, 0 to 2 percent slopes	25,281	9.8
BeB	Bennington silt loam, 2 to 6 percent slopes	9,970	3.9
BoA	Blount silt loam, 0 to 2 percent slopes	22,445	8.7
BoB	Blount silt loam, 2 to 6 percent slopes	5,869	2.3
CaB	Canfield silt loam, 2 to 6 percent slopes	5,741	2.2
CaC	Canfield silt loam, 6 to 12 percent slopes	605	0.2
CaC2	Canfield silt loam, 6 to 12 percent slopes, eroded	1,223	0.5
Cb	Carlisle muck	321	0.1
CdB	Centerburg silt loam, 2 to 6 percent slopes	49,435	19.2
CdC	Centerburg silt loam, 6 to 12 percent slopes	3,528	1.4
CdC2	Centerburg silt loam, 6 to 12 percent slopes, eroded	11,541	4.5
ChB	Chili loam, 2 to 6 percent slopes	2,629	1.0
ChC	Chili loam, 6 to 12 percent slopes	1,244	0.5
CkF	Colyer Variant silt loam, 25 to 70 percent slopes	277	0.1
Co	Condit silt loam	9,137	3.5
GaB	Gallman silt loam, loamy substratum, 2 to 6 percent slopes	2,481	1.0
GaC	Gallman silt loam, loamy substratum, 6 to 12 percent slopes	337	0.1
GnB2	Glynwood clay loam, 2 to 6 percent slopes, eroded	14,860	5.8
GnC2	Glynwood clay loam, 6 to 12 percent slopes, eroded	1,852	0.7
Lo	Lobdell silt loam, occasionally flooded	3,581	1.4
Mf	Milford silty clay loam	2,416	0.9
Mg	Millgrove silt loam	1,592	0.6
MoC	Morley silt loam, 6 to 12 percent slopes	342	0.1
MoC2	Morley silt loam, 6 to 12 percent slopes, eroded	514	0.2
MoD2	Morley silt loam, 12 to 18 percent slopes, eroded	206	0.1
OcB	Ockley silt loam, 2 to 6 percent slopes	834	0.3
OcC	Ockley silt loam, 6 to 12 percent slopes	627	0.2
Pm	Pewamo silty clay loam	18,910	7.3
Ps	Pits, gravel	96	*
RsB	Rittman silt loam, 2 to 6 percent slopes	10,216	4.0
RsC	Rittman silt loam, 6 to 12 percent slopes	1,411	0.5
RsC2	Rittman silt loam, 6 to 12 percent slopes, eroded	2,655	1.0
Sh	Shoals silt loam, occasionally flooded	12,236	4.7
SkA	Sleeth silt loam, loamy substratum, 0 to 3 percent slopes	4,040	1.6
So	Sloan silty clay loam, sandy substratum, occasionally flooded	1,992	0.8
Tg	Tioga loam, occasionally flooded	1,086	0.4
Ud	Udorthents, loamy	52	*
WaA	Wadsworth silt loam, 0 to 2 percent slopes	549	0.2
WaB	Wadsworth silt loam, 2 to 6 percent slopes	274	0.1
WsB	Wooster silt loam, 2 to 6 percent slopes	170	0.1
WsC	Wooster silt loam, 6 to 12 percent slopes	231	0.1
WsC2	Wooster silt loam, 6 to 12 percent slopes, eroded	2,255	0.9
WsD2	Wooster silt loam, 12 to 18 percent slopes, eroded	2,579	1.0
WsE2	Wooster silt loam, 18 to 25 percent slopes, eroded	774	0.3
	Water	1,261	0.5
	Total	258,112	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
AdB	Amanda silt loam, 2 to 6 percent slopes
BeA	Bennington silt loam, 0 to 2 percent slopes (where drained)
BeB	Bennington silt loam, 2 to 6 percent slopes (where drained)
BoA	Blount silt loam, 0 to 2 percent slopes (where drained)
BoB	Blount silt loam, 2 to 6 percent slopes (where drained)
CaB	Canfield silt loam, 2 to 6 percent slopes
CdB	Centerburg silt loam, 2 to 6 percent slopes
ChB	Chili loam, 2 to 6 percent slopes
Co	Condit silt loam (where drained)
GaB	Gallman silt loam, loamy substratum, 2 to 6 percent slopes
GnB2	Glynwood clay loam, 2 to 6 percent slopes, eroded
Lo	Lobdell silt loam, occasionally flooded
Mf	Milford silty clay loam (where drained)
Mg	Millgrove silt loam (where drained)
OcB	Ockley silt loam, 2 to 6 percent slopes
Pm	Pewamo silty clay loam (where drained)
RsB	Rittman silt loam, 2 to 6 percent slopes
Sh	Shoals silt loam, occasionally flooded (where drained)
SkA	Sleeth silt loam, loamy substratum, 0 to 3 percent slopes (where drained)
So	Sloan silty clay loam, sandy substratum, occasionally flooded (where drained)
Tg	Tioga loam, occasionally flooded
WaA	Wadsworth silt loam, 0 to 2 percent slopes (where drained)
WaB	Wadsworth silt loam, 2 to 6 percent slopes (where drained)
WsB	Wooster silt loam, 2 to 6 percent slopes

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Oats	Orchard-grass-alfalfa hay	Kentucky bluegrass	Orchardgrass
		Bu	Bu	Bu	Bu	Tons	AUM*	AUM*
AdB------------- Amanda	IIe	110	35	45	75	4.5	4.7	7.5
AdC2------------ Amanda	IIIe	100	30	40	70	4.1	4.5	6.8
AdD2------------ Amanda	IVe	88	---	35	65	3.7	4.1	6.1
AdE2------------ Amanda	VIe	---	---	---	---	3.3	3.8	5.5
BeA------------- Bennington	IIw	115	35	45	75	4.0	5.0	6.6
BeB------------- Bennington	IIe	110	30	42	75	4.1	5.0	6.8
BoA------------- Blount	IIw	120	38	48	80	4.0	5.0	6.6
BoB------------- Blount	IIe	115	35	47	75	4.1	5.0	6.8
CaB------------- Canfield	IIe	100	35	40	75	4.0	3.7	6.6
CaC------------- Canfield	IIIe	95	30	36	70	4.0	3.7	6.6
CaC2------------ Canfield	IIIe	85	25	33	65	3.8	3.5	6.3
Cb-------------- Carlisle	Vw	---	---	---	---	---	---	---
CdB------------- Centerburg	IIe	110	34	45	75	4.0	4.3	6.6
CdC------------- Centerburg	IIIe	105	32	40	72	4.0	4.3	6.6
CdC2------------ Centerburg	IIIe	95	30	35	70	3.8	4.2	6.3
ChB------------- Chili	IIe	100	32	45	78	4.0	4.3	6.6
ChC------------- Chili	IIIe	90	30	40	72	4.0	4.3	6.6
CkF------------- Colyer Variant	VIIe	---	---	---	---	---	---	---
Co-------------- Condit	IIIw	95	35	40	70	---	4.3	5.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Oats	Orchard-grass-alfalfa hay	Kentucky bluegrass	Orchardgrass
		Bu	Bu	Bu	Bu	Tons	AUM*	AUM*
GaB------------- Gallman	IIe	110	38	45	80	4.5	4.7	7.5
GaC------------- Gallman	IIIe	105	35	43	75	4.5	4.7	7.5
GnB2------------ Glynwood	IIIe	95	30	38	65	4.0	4.3	6.6
GnC2------------ Glynwood	IVe	80	25	34	60	3.5	4.0	5.8
Lo-------------- Lobdell	IIw	120	40	42	80	4.5	4.7	7.5
Mf-------------- Milford	IIw	131	45	55	85	5.2	5.3	8.6
Mg-------------- Millgrove	IIw	130	50	55	95	5.0	5.3	8.3
MoC------------- Morley	IIIe	100	34	40	70	4.2	4.6	7.0
MoC2------------ Morley	IIIe	97	33	38	65	4.0	4.3	6.6
MoD2------------ Morley	IVe	87	---	35	60	3.6	4.1	6.0
OcB------------- Ockley	IIe	110	35	45	85	4.0	4.3	6.6
OcC------------- Ockley	IIIe	100	32	43	80	4.0	4.3	6.6
Pm-------------- Pewamo	IIw	125	42	55	93	5.0	5.3	8.3
Ps**. Pits								
RsB------------- Rittman	IIe	100	30	40	75	4.0	3.7	6.6
RsC------------- Rittman	IIIe	90	25	36	68	4.0	3.7	6.6
RsC2------------ Rittman	IIIe	75	20	33	65	3.8	3.5	6.3
Sh-------------- Shoals	IIw	130	46	52	85	4.6	5.1	7.6
SkA------------- Sleeth	IIw	120	42	48	80	4.5	5.1	7.5
So-------------- Sloan	IIIw	120	42	45	75	4.5	5.1	7.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Oats	Orchard-grass-alfalfa hay	Kentucky bluegrass	Orchardgrass
		Bu	Bu	Bu	Bu	Tons	AUM*	AUM*
Tg------------ Tioga	IIw	120	40	48	80	4.5	4.7	7.5
Ud. Udorthents								
WaA------------ Wadsworth	IIIw	95	35	40	70	---	4.3	5.8
WaB------------ Wadsworth	IIIe	90	30	35	65	---	4.3	5.8
WsB------------ Wooster	IIe	110	35	45	75	4.5	3.7	7.5
WsC------------ Wooster	IIIe	105	32	40	70	4.5	3.7	7.5
WsC2----------- Wooster	IIIe	95	30	35	67	4.1	3.5	6.8
WsD2----------- Wooster	IVe	85	25	30	65	3.5	3.3	5.8
WsE2----------- Wooster	VIe	---	---	---	---	3.2	3.1	5.3

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
II	180,629	89,042	91,587	---
III	63,478	51,800	11,678	---
IV	9,978	9,978	---	---
V	321	---	321	---
VI	2,020	2,020	---	---
VII	277	277	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
AdB, AdC2: Amanda	5A	Slight	Slight	Slight	Slight	Northern red oak	87	69	Black walnut, white oak, yellow poplar, northern red oak, white ash, eastern white pine, red pine.
						Yellow poplar	---	---	
						White oak	---	---	
						Black walnut	---	---	
						Black cherry	---	---	
						Sugar maple	---	---	
						White ash	---	---	
AdD2, AdE2: Amanda	5R	Moderate	Moderate	Slight	Slight	Northern red oak	87	69	Black walnut, white oak, northern red oak, white ash, eastern white pine, red pine.
						Yellow poplar	---	---	
						White oak	---	---	
						Black walnut	---	---	
						Black cherry	---	---	
						Sugar maple	---	---	
						White ash	---	---	
BeA, BeB: Bennington	4A	Slight	Slight	Slight	Slight	Northern red oak	80	62	Eastern white pine, yellow poplar, black cherry, white ash, red pine, northern red oak, white oak, green ash, black locust.
						Yellow poplar	90	90	
						Sugar maple	---	---	
						Black cherry	---	---	
						White oak	---	---	
						White ash	---	---	
						American beech	---	---	
BoA, BoB: Blount	3C	Slight	Slight	Severe	Severe	White oak	65	48	Eastern white pine, eastern redcedar, red pine, yellow poplar.
						Northern red oak	65	48	
						Green ash	---	---	
						Bur oak	---	---	
						Pin oak	---	---	
CaB, CaC, CaC2: Canfield	5D	Slight	Slight	Moderate	Moderate	Northern red oak	87	69	White ash, Virginia pine, yellow poplar, red pine, black oak, eastern white pine.
						Sugar maple	70	43	
						White ash	83	85	
						White oak	---	---	
						Slippery elm	---	---	
						American beech	---	---	
						American sycamore	---	---	
CdB, CdC, CdC2: Centerburg	5A	Slight	Slight	Slight	Slight	Northern red oak	89	71	Eastern white pine, northern red oak, yellow poplar, red pine, white ash, white oak, green ash, black cherry, black locust.
						White oak	---	---	
						Sugar maple	---	---	
						Yellow poplar	---	---	
						White ash	---	---	
						Black cherry	---	---	
						Black walnut	---	---	
						American beech	---	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
ChB, ChC--------- Chili	4A	Slight	Slight	Slight	Slight	White oak-----------	80	62	Eastern white pine, red pine, black walnut, yellow poplar, white ash, northern red oak, white oak, green ash, black cherry, black locust.
						Northern red oak----	85	67	
						Black walnut--------	---	---	
						Black cherry--------	---	---	
						Sugar maple---------	---	---	
						White ash-----------	---	---	
						Yellow poplar-------	---	---	
CkF------------- Colyer Variant	4R	Severe	Severe	Slight	Slight	Northern red oak----	70	52	Black walnut, white oak, yellow poplar, northern red oak, white ash, eastern white pine, red pine.
						White oak-----------	---	---	
						Black walnut--------	---	---	
						Black cherry--------	---	---	
						Sugar maple---------	---	---	
						White ash-----------	---	---	
						Yellow poplar-------	---	---	
Co-------------- Condit	5W	Slight	Severe	Severe	Severe	Pin oak-------------	90	72	Pin oak, American sycamore, red maple, eastern cottonwood, sweetgum, baldcypress, green ash, swamp white oak.
						Eastern cottonwood--	---	---	
						Red maple-----------	---	---	
						Swamp white oak-----	---	---	
						Green ash-----------	---	---	
						Black cherry--------	---	---	
GaB, GaC-------- Gallman	5A	Slight	Slight	Slight	Slight	Northern red oak----	90	72	Black walnut, white oak, yellow poplar, northern red oak, white ash, eastern white pine, red pine.
						White oak-----------	---	---	
						Black walnut--------	---	---	
						Black cherry--------	---	---	
						Sugar maple---------	---	---	
						White ash-----------	---	---	
						Yellow poplar-------	---	---	
GnB2, GnC2------ Glynwood	4C	Slight	Slight	Moderate	Moderate	Northern red oak----	80	62	Austrian pine, yellow poplar, green ash, pin oak, red maple, black oak.
						Black oak-----------	80	62	
						White oak-----------	80	62	
						Red maple-----------	---	---	
						Slippery elm--------	---	---	
						Black cherry--------	---	---	
						White ash-----------	---	---	
Lo-------------- Lobdell	5A	Slight	Slight	Slight	Slight	Northern red oak----	87	69	Eastern white pine, white oak, yellow poplar, white ash, red pine, northern red oak.
						Yellow poplar-------	96	100	
						Sugar maple---------	---	---	
						White ash-----------	---	---	
						White oak-----------	---	---	
						Black cherry--------	---	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Mg-------------- Millgrove	5W	Slight	Severe	Severe	Severe	Pin oak------------- Northern red oak---- Swamp white oak----- Red maple----------- Eastern cottonwood-- Black cherry-------- Green ash-----------	86 80 85 --- --- --- ---	68 62 67 --- --- --- ---	Swamp white oak, eastern cottonwood, green ash, pin oak, red maple, silver maple, American sycamore, sweetgum.
MoC, MoC2------- Morley	4A	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Yellow poplar------- Black walnut-------- Bur oak------------- Shagbark hickory----	80 80 90 --- --- ---	62 62 90 --- --- ---	White oak, black walnut, green ash, eastern white pine, red pine, white spruce.
MoD2------------ Morley	4R	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak---- Yellow poplar------- Black walnut-------- Bur oak------------- Shagbark hickory----	80 80 90 --- --- ---	62 62 90 --- --- ---	White oak, black walnut, green ash, eastern white pine, red pine, white spruce.
OcB, OcC-------- Ockley	5A	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Yellow poplar------- Sweetgum------------	90 90 98 76	72 72 104 70	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
Pm-------------- Pewamo	5W	Slight	Severe	Severe	Severe	Pin oak------------- Swamp white oak----- Red maple----------- White ash----------- Eastern cottonwood-- Green ash-----------	90 --- 71 71 98 ---	72 --- 44 67 --- ---	White ash, eastern white pine, red maple, green ash.
RsB, RsC, RsC2-- Rittman	5D	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- White oak----------- Yellow poplar------- Black cherry-------- White ash-----------	90 70 --- --- --- ---	72 43 --- --- --- ---	Eastern white pine, yellow poplar, black cherry, white ash, red pine, northern red oak, white oak, green ash, black locust, American sycamore, eastern cottonwood.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
Sh: Shoals	5A	Slight	Moderate	Moderate	Slight	Pin oak	90	72	Sweetgum, red maple, swamp chestnut oak, pin oak, yellow poplar, eastern cottonwood, American sycamore.
						Sweetgum	86	95	
						Yellow poplar	90	90	
						Eastern cottonwood	---	---	
						White ash	---	---	
SkA: Sleeth	5A	Slight	Slight	Slight	Slight	Pin oak	85	67	Eastern white pine, American sycamore, white ash, red maple, yellow poplar.
						Yellow poplar	85	81	
						White oak	70	52	
So: Sloan	5W	Slight	Severe	Moderate	Moderate	Pin oak	86	68	Pin oak, American sycamore, eastern cottonwood, red maple, green ash, swamp white oak, silver maple, sweetgum.
						Green ash	---	---	
						Red maple	---	---	
						Swamp white oak	---	---	
						Eastern cottonwood	---	---	
Tg: Tioga	4A	Slight	Slight	Slight	Slight	Northern red oak	75	57	Eastern white pine, yellow poplar, black walnut, European larch.
						Yellow poplar	85	81	
						Sugar maple	67	41	
WaA, WaB: Wadsworth	5D	Slight	Slight	Moderate	Moderate	Pin oak	90	72	Yellow poplar, white ash, red pine, eastern white pine, black oak.
						Northern red oak	85	67	
						Black oak	85	67	
						White oak	---	---	
						White ash	---	---	
						Slippery elm	---	---	
						American beech	---	---	
						Sugar maple	---	---	
						American sycamore	---	---	
WsB, WsC, WsC2: Wooster	5D	Slight	Slight	Slight	Moderate	Northern red oak	86	68	Eastern white pine, black oak, yellow poplar, white ash, red pine.
						Yellow poplar	96	100	
						Sugar maple	85	52	
						White oak	---	---	
						White ash	---	---	
						American beech	---	---	
WsD2, WsE2: Wooster	5R	Moderate	Moderate	Slight	Moderate	Northern red oak	86	68	Eastern white pine, black oak, white ash, Virginia pine, red pine.
						Yellow poplar	96	100	
						Sugar maple	85	52	
						White oak	---	---	
						White ash	---	---	
						American beech	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AdB, AdC2, AdD2, AdE2 Amanda	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
BeA, BeB Bennington	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
BoA, BoB Blount	---	American cranberrybush, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, Austrian pine.	Pin oak, eastern white pine, Norway spruce.	---
CaB, CaC, CaC2 Canfield	---	American cranberrybush, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
Cb. Carlisle					
CdB, CdC, CdC2 Centerburg	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Norway spruce	Pin oak, eastern white pine.
ChB, ChC Chili	Siberian peashrub	Lilac, Amur honeysuckle, autumn olive, Washington hawthorn, radiant crabapple, eastern redcedar.	Jack pine, red pine, Austrian pine, eastern white pine.	---	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
CkF--------------- Colyer Variant	Siberian peashrub	Lilac, Amur honeysuckle, autumn olive, Washington hawthorn, radiant crabapple, eastern redcedar.	Jack pine, red pine, Austrian pine, eastern white pine.	---	---
Co---------------- Condit	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
GaB, GaC---------- Gallman	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Norway spruce-----	Pin oak, eastern white pine.
GnB2, GnC2-------- Glynwood	---	Amur honeysuckle, Washington hawthorn, Amur privet, arrowwood, eastern redcedar, American cranberrybush.	Austrian pine, green ash, Osageorange.	Pin oak, eastern white pine.	---
Lo---------------- Lobdell	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Pin oak, eastern white pine.
Mf---------------- Milford	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
Mg---------------- Millgrove	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MoC, MoC2, MoD2--- Morley	---	Amur honeysuckle, Washington hawthorn, eastern redcedar, Amur privet, arrowwood, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
OcB, OcC---------- Ockley	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Pm---------------- Pewamo	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Ps*. Pits					
RsB, RsC, RsC2---- Rittman	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Green ash, Osageorange, Austrian pine.	Pin oak, eastern white pine.	---
Sh---------------- Shoals	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
SkA--------------- Sleeth	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
So---------------- Sloan	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Tg: Tioga	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, northern whitecedar, white fir, Austrian pine.	Norway spruce	Pin oak, eastern white pine.
Ud. Udorthents					
WaA, WaB: Wadsworth	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
WsB, WsC, WsC2, WsD2, WsE2: Wooster	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Green ash, Osageorange, Austrian pine.	Pin oak, eastern white pine.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AdB Amanda	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Slight.
AdC2 Amanda	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
AdD2, AdE2 Amanda	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
BeA, BeB Bennington	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BoA, BoB Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CaB Canfield	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones.	Moderate: wetness.	Moderate: wetness.
CaC, CaC2 Canfield	Moderate: wetness, slope.	Moderate: wetness, slope.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
Cb Carlisle	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
CdB Centerburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Moderate: wetness.	Moderate: wetness.
CdC, CdC2 Centerburg	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
ChB Chili	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
ChC Chili	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
CkF Colyer Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Co Condit	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
GaB: Gallman	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
GaC: Gallman	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
GnB2: Glynwood	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Slight.
GnC2: Glynwood	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Lo: Lobdell	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight	Moderate: flooding.
Mf: Milford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mg: Millgrove	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MoC, MoC2: Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MoD2: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
OcB: Ockley	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
OcC: Ockley	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Pm: Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ps*. Pits					
RsB: Rittman	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
RsC, RsC2: Rittman	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
Sh: Shoals	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SkA-------------------- Sleeth	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
So--------------------- Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Tg--------------------- Tioga	Severe: flooding.	Slight----------	Moderate: flooding.	Severe: erodes easily.	Moderate: flooding.
Ud. Udorthents					
WaA, WaB--------------- Wadsworth	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
WsB-------------------- Wooster	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: erodes easily.	Slight.
WsC, WsC2-------------- Wooster	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
WsD2, WsE2------------- Wooster	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
AdB----------------- Amanda	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AdC2, AdD2--------- Amanda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AdE2---------------- Amanda	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BeA----------------- Bennington	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BeB----------------- Bennington	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BoA----------------- Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BoB----------------- Blount	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CaB----------------- Canfield	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CaC, CaC2---------- Canfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Cb------------------ Carlisle	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
CdB----------------- Centerburg	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CdC, CdC2---------- Centerburg	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ChB----------------- Chili	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ChC----------------- Chili	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CkF----------------- Colyer Variant	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Co------------------ Condit	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
GaB----------------- Gallman	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
GaC----------------- Gallman	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	---
GnB2---------------- Glynwood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
GnC2: Glynwood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Lo: Lobdell	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Mf: Milford	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Mg: Millgrove	Fair	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
MoC, MoC2: Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MoD2: Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
OcB: Ockley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OcC: Ockley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Pm: Pewamo	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
Ps*. Pits										
RsB: Rittman	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RsC, RsC2: Rittman	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Sh: Shoals	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
SkA: Sleeth	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
So: Sloan	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
Tg: Tioga	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ud. Udorthents										
WaA: Wadsworth	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
WaB: Wadsworth	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WsB: Wooster	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
WsC, WsC2 Wooster	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WsD2 Wooster	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
WsE2 Wooster	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AdB: Amanda	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Slight.
AdC2: Amanda	Moderate: dense layer, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
AdD2, AdE2: Amanda	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BeA, BeB: Bennington	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
BoA, BoB: Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
CaB: Canfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: frost action.	Moderate: wetness.
CaC, CaC2: Canfield	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: frost action.	Moderate: wetness, slope.
Cb: Carlisle	Severe: excess humus, ponding.	Severe: ponding, low strength, subsides.	Severe: ponding, low strength, subsides.	Severe: ponding, low strength, subsides.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
CdB: Centerburg	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: frost action.	Moderate: wetness.
CdC, CdC2: Centerburg	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: frost action.	Moderate: wetness, slope.
ChB: Chili	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
ChC: Chili	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
CkF: Colyer Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Co: Condit	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
GaB----------------- Gallman	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: small stones.
GaC----------------- Gallman	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, slope.
GnB2---------------- Glynwood	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
GnC2---------------- Glynwood	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Lo------------------ Lobdell	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Mf------------------ Milford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Mg------------------ Millgrove	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
MoC, MoC2----------- Morley	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MoD2---------------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
OcB----------------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
OcC----------------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
Pm------------------ Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Ps*. Pits						
RsB----------------- Rittman	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
RsC, RsC2: Rittman	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: frost action.	Moderate: wetness, slope.
Sh: Shoals	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness.
SkA: Sleeth	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
So: Sloan	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
Tg: Tioga	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Ud. Udorthents						
WaA, WaB: Wadsworth	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
WsB: Wooster	Moderate: wetness.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: low strength, frost action.	Slight.
WsC, WsC2: Wooster	Moderate: wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
WsD2, WsE2: Wooster	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AdB: Amanda	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Moderate: too clayey.	Slight	Fair: too clayey.
AdC2: Amanda	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
AdD2, AdE2: Amanda	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
BeA: Bennington	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey, hard to pack.
BeB: Bennington	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey, hard to pack.
BoA, BoB: Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
CaB: Canfield	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Fair: small stones, wetness.
CaC, CaC2: Canfield	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: small stones, slope, wetness.
Cb: Carlisle	Severe: ponding, percs slowly, subsides.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
CdB: Centerburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: small stones, wetness.
CdC, CdC2: Centerburg	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Moderate: wetness, slope.	Fair: small stones, slope, wetness.
ChB: Chili	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey, small stones.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ChC Chili	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too clayey, small stones, slope.
CkF Colyer Variant	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope, too clayey.	Severe: slope.	Poor: area reclaim, too clayey, small stones.
Co Condit	Severe: percs slowly, ponding.	Severe: ponding.	Severe: too clayey, ponding.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
GaB Gallman	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey, small stones.
GaC Gallman	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too clayey, small stones, slope.
GnB2 Glynwood	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
GnC2 Glynwood	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
Lo Lobdell	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
Mf Milford	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Mg Millgrove	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: small stones, ponding.
MoC, MoC2 Morley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
MoD2 Morley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
OcB Ockley	Slight	Severe: seepage.	Severe: seepage.	Slight	Poor: small stones.
OcC Ockley	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: small stones.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Pm: Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
Ps*. Pits					
RsB: Rittman	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, small stones.
RsC, RsC2: Rittman	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: too clayey, small stones, slope.
Sh: Shoals	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
SkA: Sleeth	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
So: Sloan	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
Tg: Tioga	Severe: flooding, wetness, poor filter**.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: thin layer.
Ud. Udorthents					
WaA: Wadsworth	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
WaB: Wadsworth	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
WsB: Wooster	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: wetness, small stones.
WsC, WsC2: Wooster	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: wetness, small stones, slope.
WsD2, WsE2: Wooster	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

** Because of a poor filtering capacity, the effluent can pollute streams, lakes, springs, and shallow wells.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AdB Amanda	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
AdC2 Amanda	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
AdD2, AdE2 Amanda	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
BeA, BeB Bennington	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BoA, BoB Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
CaB, CaC, CaC2 Canfield	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Cb Carlisle	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
CdB, CdC, CdC2 Centerburg	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
ChB, ChC Chili	Good	Probable	Probable	Poor: small stones, area reclaim.
CkF Colyer Variant	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Co Condit	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
GaB, GaC Gallman	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
GnB2, GnC2 Glynwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Lo Lobdell	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Mf Milford	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Mg Millgrove	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MoC, MoC2 Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MoD2 Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
OcB, OcC Ockley	Good	Probable	Probable	Poor: small stones, area reclaim.
Pm Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ps*. Pits				
RsB Rittman	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
RsC, RsC2 Rittman	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
Sh Shoals	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
SkA Sleeth	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
So Sloan	Poor: wetness.	Probable	Probable	Poor: area reclaim, wetness.
Tg Tioga	Good	Probable	Probable	Poor: small stones, area reclaim.
Ud. Udorthents				
WaA, WaB Wadsworth	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
WsB, WsC, WsC2 Wooster	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
WsD2, WsE2 Wooster	Fair: wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AdB: Amanda	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
AdC2, AdD2, AdE2: Amanda	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
BeA: Bennington	Slight	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, erodes easily, percs slowly.	Wetness, percs slowly, rooting depth.
BeB: Bennington	Moderate: slope.	Moderate: piping, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, erodes easily, percs slowly.	Wetness, percs slowly, rooting depth.
BoA: Blount	Slight	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
BoB: Blount	Moderate: slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
CaB: Canfield	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
CaC, CaC2: Canfield	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Cb: Carlisle	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
CdB: Centerburg	Moderate: slope.	Slight	Severe: no water.	Frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
CdC, CdC2: Centerburg	Severe: slope.	Slight	Severe: no water.	Frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
ChB: Chili	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Droughty.
ChC: Chili	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, droughty.
CkF: Colyer Variant	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Co: Condit	Slight	Severe: ponding.	Severe: slow refill.	Percs slowly, frost action, ponding.	Ponding, erodes easily, percs slowly.	Wetness, percs slowly, erodes easily.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
GaB: Gallman	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
GaC: Gallman	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope.
GnB2: Glynwood	Moderate: slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
GnC2: Glynwood	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily.
Lo: Lobdell	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Flooding, frost action.	Erodes easily, wetness.	Erodes easily.
Mf: Milford	Slight	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
Mg: Millgrove	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding	Wetness.
MoC, MoC2, MoD2: Morley	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, rooting depth.
OcB: Ockley	Severe: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
OcC: Ockley	Severe: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Pm: Pewamo	Slight	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Wetness.
Ps*. Pits						
RsB: Rittman	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
RsC, RsC2: Rittman	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Sh: Shoals	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
SkA: Sleeth	Moderate: seepage.	Severe: wetness.	Severe: cutbanks cave.	Frost action	Wetness	Wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
So----------------- Sloan	Severe: seepage.	Severe: thin layer, wetness.	Severe: slow refill, cutbanks cave.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Tg----------------- Tioga	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Erodes easily	Erodes easily, droughty.
Ud. Udorthents						
WaA---------------- Wadsworth	Slight---------	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
WaB---------------- Wadsworth	Moderate: slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
WsB---------------- Wooster	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Slope----------	Erodes easily, wetness.	Erodes easily, rooting depth.
WsC, WsC2, WsD2, WsE2-------------- Wooster	Severe: slope.	Severe: piping.	Severe: no water.	Slope----------	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
AdB-------------- Amanda	0-10	Silt loam--------	ML, CL-ML, CL	A-4	0-5	90-100	85-100	75-100	55-90	20-35	3-10
	10-37	Clay loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-95	25-40	5-18
	37-58	Clay loam, loam	CL, CL-ML, ML	A-4, A-6	0-5	85-100	75-95	70-95	55-75	25-40	3-18
	58-80	Loam, silt loam	ML, CL-ML, CL	A-4	0-5	85-100	75-95	65-95	50-85	20-35	3-10
AdC2, AdD2, AdE2- Amanda	0-12	Silt loam--------	ML, CL-ML, CL	A-4	0-5	90-100	85-100	75-100	55-90	20-35	3-10
	12-29	Clay loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-95	25-40	5-18
	29-38	Clay loam, loam	CL, CL-ML, ML	A-4, A-6	0-5	85-100	75-95	70-95	55-75	25-40	3-18
	38-80	Loam, silt loam	ML, CL-ML, CL	A-4	0-5	85-100	75-95	65-95	50-85	20-35	3-10
BeA, BeB--------- Bennington	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-2	95-100	90-100	85-100	65-90	22-38	3-14
	9-49	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0-2	85-100	80-100	75-100	70-95	30-50	12-30
	49-80	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-2	80-100	75-100	70-100	60-90	25-40	6-18
BoA, BoB--------- Blount	0-10	Silt loam--------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	10-23	Silty clay loam, silty clay, clay.	CH, CL	A-7, A-6	0-5	95-100	90-100	80-90	75-85	35-60	15-35
	23-36	Silty clay loam, clay loam, clay.	CL, CH, ML, MH	A-6, A-7	0-5	95-100	90-100	80-90	70-90	35-55	10-30
	36-80	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
CaB, CaC, CaC2--- Canfield	0-7	Silt loam--------	ML	A-4	0-2	90-100	75-100	70-100	55-90	25-35	2-10
	7-26	Loam, silt loam, gravelly loam.	ML, CL, CL-ML, SC	A-4, A-6	0-3	80-100	70-95	60-90	45-85	20-40	3-16
	26-34	Loam, silt loam, gravelly loam.	ML, CL, CL-ML, SM	A-4, A-6	0-3	80-95	70-90	60-85	45-80	20-35	3-14
	34-80	Loam, silt loam, gravelly loam.	ML, CL, CL-ML, SM	A-4, A-6	0-5	80-95	70-90	60-85	45-80	20-35	2-12
Cb--------------- Carlisle	0-80	Sapric material	PT	A-8	---	---	---	---	---	---	---
CdB, CdC, CdC2--- Centerburg	0-8	Silt loam--------	ML, CL-ML, CL	A-4	0-5	90-100	85-100	80-100	65-90	20-30	3-10
	8-13	Clay loam, silty clay loam, silt loam.	ML, CL, CL-ML	A-6, A-4	0-5	90-100	75-100	70-100	55-90	25-40	5-18
	13-35	Clay loam, loam	ML, CL-ML, CL	A-4, A-6	0-5	85-100	75-95	70-95	55-85	25-40	5-18
	35-80	Loam, silt loam	ML, CL-ML, CL	A-4	0-5	85-100	75-95	65-90	50-80	20-30	3-10

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
ChB, ChC--------- Chili	0-10	Loam-------------	ML, CL-ML	A-4	0	85-100	75-100	65-85	55-75	25-35	4-10
	10-42	Loam, gravelly clay loam, gravelly sandy loam.	ML, SM, GM, CL	A-4, A-2, A-6, A-1-b	0	65-100	50-80	35-70	20-65	<30	NP-12
	42-52	Very gravelly sandy loam, very gravelly loam, gravelly sandy loam.	SM, GM, GM-GC, SM-SC	A-1, A-2	0-5	45-80	35-75	25-55	15-35	<30	NP-8
	52-80	Stratified gravelly loamy coarse sand to very gravelly sand.	GW, GM, SP, SM	A-1	5-10	30-70	25-65	10-45	2-20	---	NP
CkF-------------- Colyer Variant	0-9	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0-5	90-100	85-100	80-100	60-90	20-35	3-13
	9-14	Loam-------------	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-75	25-40	5-20
	14-33	Clay, gravelly clay loam, silty clay loam.	CL, CL-ML, SC, SM-SC	A-6, A-7, A-4	0-5	70-100	50-95	50-90	40-90	25-45	5-25
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
Co--------------- Condit	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-2	95-100	95-100	90-100	80-90	22-40	3-16
	8-72	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0-2	95-100	85-100	80-100	70-90	35-50	12-28
	72-82	Clay loam, loam, silt loam.	CL, CL-ML	A-6, A-4	0-2	90-100	80-100	70-95	65-85	25-40	6-18
GaB, GaC--------- Gallman	0-10	Silt loam--------	ML, CL-ML, CL	A-4	0	75-100	70-100	65-100	50-100	20-35	3-10
	10-77	Loam, gravelly clay loam, clay loam.	CL, GM, GC, SC	A-4, A-2, A-6	0	70-100	65-95	55-90	30-70	30-40	7-17
	77-88	Gravelly loam, loam, silt loam.	CL, ML, SM, SC	A-4, A-2, A-6	0	60-100	45-90	40-80	30-65	25-35	5-15
GnB2, GnC2------- Glynwood	0-8	Clay loam--------	CL	A-6, A-7	0-2	95-100	85-100	75-100	60-95	25-45	10-22
	8-22	Clay, clay loam, silty clay.	CL, CH	A-7, A-6	0-5	95-100	85-100	75-100	65-95	35-55	15-30
	22-80	Clay loam, silty clay loam.	CL	A-6, A-4	0-5	95-100	80-100	75-95	65-90	25-40	7-18
Lo--------------- Lobdell	0-12	Silt loam--------	ML, CL-ML, CL	A-4	0	95-100	90-100	80-100	65-90	20-30	NP-8
	12-38	Loam, silt loam	ML	A-4	0	90-100	80-100	70-95	55-85	20-35	NP-10
	38-80	Stratified sandy loam to silt loam.	ML, SM, CL-ML, CL	A-4	0	90-100	80-100	65-85	40-80	15-35	NP-10
Mf--------------- Milford	0-13	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	75-95	40-55	20-30
	13-50	Silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	100	95-100	90-100	75-100	40-60	20-40
	50-80	Stratified clay to sandy loam.	CL, SC	A-6, A-7	0	95-100	95-100	90-100	45-100	25-50	10-30

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Mg-------------- Millgrove	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	85-100	80-100	70-100	55-85	20-40	3-16
	9-50	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	85-100	80-100	70-95	40-75	25-40	11-26
	50-80	Stratified very gravelly loam to fine sand.	SM, ML, GM, GM-GC	A-2, A-4	0-5	60-100	35-85	30-70	25-55	15-35	NP-10
MoC, MoC2-------- Morley	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	8-28	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	28-39	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
	39-80	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
MoD2------------ Morley	0-5	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	5-20	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	20-29	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
	29-80	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
OcB, OcC--------- Ockley	0-9	Silt loam--------	CL, ML, CL-ML	A-4	0	95-100	85-100	70-100	50-90	15-30	3-10
	9-23	Silty clay loam, clay loam, silt loam.	CL	A-6, A-4	0	90-100	80-100	70-90	55-90	25-40	8-15
	23-47	Gravelly clay loam, gravelly coarse sandy loam.	CL, SC	A-6, A-4, A-2	0-2	70-85	45-85	40-70	25-55	25-40	8-15
	47-80	Stratified sand to gravelly loamy coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	10-40	2-10	---	NP
Pm-------------- Pewamo	0-15	Silty clay loam	CL	A-6, A-7	0-5	90-100	80-100	80-100	70-90	35-50	15-25
	15-66	Clay loam, silty clay, silty clay loam.	CL, CH	A-7, A-6	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	66-80	Clay loam, silty clay loam.	CL	A-7	0-5	95-100	90-100	90-100	70-90	40-50	15-25
Ps*. Pits											
RsB, RsC, RsC2--- Rittman	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-1	95-100	90-100	85-100	70-90	25-40	4-14
	7-21	Clay loam, silty clay loam.	CL	A-6, A-7	0-1	90-100	85-100	80-95	60-85	30-45	11-20
	21-33	Clay loam, silty clay loam, loam.	CL, ML, CL-ML	A-6, A-4	0-2	85-100	75-95	65-90	50-85	25-40	6-18
	33-80	Clay loam, silt loam, loam.	CL, ML, CL-ML	A-6, A-4	0-2	85-100	75-95	65-90	50-85	25-40	6-16

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sh----- Shoals	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	6-15
	12-36	Silt loam, loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	5-15
	36-80	Stratified silt loam to sandy loam.	ML, CL, CL-ML	A-4	0-3	90-100	85-100	60-80	50-70	<30	4-10
SkA----- Sleeth	0-10	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	85-95	16-30	3-10
	10-60	Clay loam, silt loam, loam.	CL	A-6, A-4	0	100	95-100	85-100	65-90	25-40	8-16
	60-80	Stratified sand to gravelly clay loam.	ML, CL-ML, SM, SM-SC	A-4, A-2	0	100	95-100	50-90	5-70	<24	2-7
So----- Sloan	0-12	Silty clay loam	CL	A-6, A-7	0	90-100	85-95	80-95	60-90	35-50	15-30
	12-48	Loam, silty clay loam, clay loam.	CL	A-6, A-7	0	85-95	80-95	65-95	50-85	30-50	10-30
	48-64	Stratified sandy loam to silty clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6, A-7	0	85-95	80-95	45-95	35-85	25-45	5-20
	64-80	Coarse sand, gravelly sand, gravelly loamy sand.	SP, SP-SM, SM	A-1, A-3, A-2	0-5	55-90	50-90	20-60	3-15	---	NP
Tg----- Tioga	0-12	Loam-------------	ML, SM	A-4	0	100	95-100	65-95	40-85	<15	NP-4
	12-42	Sandy loam, loam, fine sandy loam.	SM, GM, ML	A-1, A-2, A-4	0	55-100	50-100	35-90	20-80	<15	NP-2
	42-80	Stratified loam to very gravelly loamy sand.	GW-GM, GM, SM, ML	A-1, A-2, A-4, A-3	0-10	35-100	30-100	15-90	5-80	<15	NP-2
Ud. Udorthents											
WaA, WaB----- Wadsworth	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-1	95-100	90-100	90-100	75-90	20-35	3-12
	9-21	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0-1	95-100	90-100	80-95	70-85	30-45	12-20
	21-40	Clay loam, silty clay loam, loam.	CL, CL-ML	A-6, A-4	0-2	85-100	75-95	70-90	55-80	25-40	6-18
	40-80	Clay loam, silty clay loam, loam.	CL, CL-ML	A-6, A-4	0-2	85-100	75-95	70-90	55-80	25-40	6-16
WsB, WsC, WsC2--- Wooster	0-9	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	90-100	80-100	70-95	50-90	25-40	4-14
	9-29	Loam, gravelly loam, silt loam.	ML, CL, SM, SC	A-4, A-6	0	85-100	70-100	60-95	45-90	30-40	6-15
	29-44	Loam, gravelly loam, clay loam.	CL, CL-ML, SC, SM-SC	A-6, A-4	0-5	80-100	65-95	60-90	45-75	25-40	4-15
	44-80	Loam, gravelly loam, sandy loam.	ML, CL, SM, SC	A-4, A-6, A-2	0-5	75-100	60-95	45-85	30-70	20-35	3-12

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
WsD2: Wooster	0-6	Silt loam	ML, CL-ML, CL	A-4, A-6	0	90-100	80-100	70-95	50-90	25-40	4-14
	6-28	Loam, gravelly loam, silt loam.	ML, CL, SM, SC	A-4, A-6	0	85-100	70-100	60-95	45-90	30-40	6-15
	28-40	Loam, gravelly loam, clay loam.	CL, CL-ML, SC, SM-SC	A-6, A-4	0-5	80-100	65-95	60-90	45-75	25-40	4-15
	40-80	Loam, gravelly loam, sandy loam.	ML, CL, SM, SC	A-4, A-6, A-2	0-5	75-100	60-95	45-85	30-70	20-35	3-12
WsE2: Wooster	0-5	Silt loam	ML, CL-ML, CL	A-4, A-6	0	90-100	80-100	70-95	50-90	25-40	4-14
	5-27	Loam, gravelly loam, silt loam.	ML, CL, SM, SC	A-4, A-6	0	85-100	70-100	60-95	45-90	30-40	6-15
	27-40	Loam, gravelly loam, clay loam.	CL, CL-ML, SC, SM-SC	A-6, A-4	0-5	80-100	65-95	60-90	45-75	25-40	4-15
	40-80	Loam, gravelly loam, sandy loam.	ML, CL, SM, SC	A-4, A-6, A-2	0-5	75-100	60-95	45-85	30-70	20-35	3-12

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
AdB-------------- Amanda	0-10	12-27	1.25-1.45	0.6-2.0	0.18-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	10-37	23-35	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	Moderate-----	0.37			
	37-58	23-35	1.45-1.70	0.2-0.6	0.13-0.19	5.6-7.8	Moderate-----	0.37			
	58-80	15-25	1.50-1.85	0.2-0.6	0.08-0.12	7.4-8.4	Low----------	0.37			
AdC2, AdD2, AdE2- Amanda	0-12	12-27	1.25-1.45	0.6-2.0	0.18-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	12-29	23-35	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	Moderate-----	0.37			
	29-38	23-35	1.45-1.70	0.2-0.6	0.13-0.19	5.6-7.8	Moderate-----	0.37			
	38-80	15-25	1.50-1.85	0.2-0.6	0.08-0.12	7.4-8.4	Low----------	0.37			
BeA, BeB--------- Bennington	0-9	15-25	1.30-1.50	0.6-2.0	0.17-0.21	4.5-7.3	Low----------	0.43	3	6	2-4
	9-49	18-35	1.40-1.70	0.06-0.2	0.10-0.17	4.5-7.8	Moderate-----	0.32			
	49-80	24-33	1.65-1.80	0.06-0.2	0.07-0.12	7.4-8.4	Low----------	0.32			
BoA, BoB--------- Blount	0-10	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.43	3	6	2-3
	10-23	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-6.5	Moderate-----	0.43			
	23-36	27-38	1.50-1.70	0.06-0.6	0.12-0.19	6.1-7.8	Moderate-----	0.43			
	36-80	27-38	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate-----	0.43			
CaB, CaC, CaC2--- Canfield	0-7	10-22	1.30-1.50	0.6-2.0	0.18-0.23	4.5-7.3	Low----------	0.37	4	5	1-3
	7-26	18-27	1.45-1.70	0.6-2.0	0.14-0.19	4.5-5.5	Low----------	0.37			
	26-34	15-27	1.60-1.90	0.06-0.2	0.07-0.10	4.5-7.3	Low----------	0.37			
	34-80	15-25	1.55-1.85	0.06-0.2	0.07-0.10	5.1-7.8	Low----------	0.37			
Cb--------------- Carlisle	0-80	---	0.13-0.23	0.2-6.0	0.35-0.45	4.5-7.3	-------------	----	5	2	>70
CdB, CdC, CdC2--- Centerburg	0-8	10-22	1.25-1.45	0.6-2.0	0.18-0.24	4.5-7.3	Low----------	0.37	5	5	1-3
	8-13	20-35	1.40-1.70	0.6-2.0	0.15-0.22	4.5-6.0	Moderate-----	0.37			
	13-35	25-35	1.45-1.70	0.2-0.6	0.15-0.19	5.1-7.8	Moderate-----	0.37			
	35-80	15-25	1.55-1.85	0.2-0.6	0.09-0.13	6.6-8.4	Low----------	0.37			
ChB, ChC--------- Chili	0-10	5-18	1.30-1.50	0.6-2.0	0.14-0.18	4.5-7.3	Low----------	0.32	4	5	1-3
	10-42	18-27	1.30-1.55	2.0-6.0	0.09-0.16	4.5-6.5	Low----------	0.32			
	42-52	5-18	1.30-1.55	2.0-6.0	0.06-0.12	5.1-6.5	Low----------	0.17			
	52-80	1-10	1.25-1.50	6.0-20	0.02-0.08	5.1-7.8	Low----------	0.10			
CkF-------------- Colyer Variant	0-9	15-25	1.25-1.45	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.37	4	5	1-3
	9-14	15-27	1.35-1.55	0.6-2.0	0.15-0.18	5.6-7.3	Moderate-----	0.37			
	14-33	35-45	1.45-1.65	0.6-2.0	0.12-0.17	5.6-7.3	Moderate-----	0.28			
	33	---	---	---	---	---	-------------	----			
Co--------------- Condit	0-8	18-27	1.30-1.50	0.6-2.0	0.19-0.23	4.5-7.3	Low----------	0.37	5	6	2-4
	8-72	18-35	1.45-1.75	0.06-0.2	0.08-0.16	4.5-7.8	Moderate-----	0.37			
	72-82	23-36	1.65-1.82	0.06-0.6	0.07-0.12	7.4-8.4	Moderate-----	0.37			
GaB, GaC--------- Gallman	0-10	10-25	1.30-1.50	0.6-2.0	0.14-0.15	5.6-7.3	Low----------	0.32	5	5	1-3
	10-77	18-30	1.45-1.65	2.0-6.0	0.10-0.16	4.5-7.8	Low----------	0.20			
	77-88	15-27	1.30-1.50	2.0-6.0	0.08-0.14	6.6-8.4	Low----------	0.32			
GnB2, GnC2------- Glynwood	0-8	27-38	1.35-1.55	0.2-0.6	0.17-0.23	5.6-7.3	Low----------	0.43	2	6	1-2
	8-22	35-55	1.45-1.75	0.06-0.2	0.11-0.18	4.5-7.8	Moderate-----	0.32			
	22-80	27-36	1.65-1.85	0.06-0.2	0.06-0.10	7.4-8.4	Moderate-----	0.32			
Lo--------------- Lobdell	0-12	15-27	1.20-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.37	5	5	1-3
	12-38	18-30	1.25-1.60	0.6-2.0	0.17-0.22	5.1-7.3	Low----------	0.37			
	38-80	15-30	1.20-1.60	0.6-6.0	0.12-0.18	5.6-7.3	Low----------	0.37			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Mf---------------- Milford	0-13	35-40	1.30-1.50	0.6-2.0	0.20-0.23	5.6-7.3	High---------	0.28	5	4	5-6
	13-50	35-42	1.40-1.60	0.2-0.6	0.18-0.20	5.6-7.8	Moderate-----	0.43			
	50-80	20-30	1.50-1.70	0.2-0.6	0.20-0.22	6.6-8.4	Moderate-----	0.43			
Mg---------------- Millgrove	0-9	18-27	1.30-1.50	0.6-2.0	0.19-0.24	5.6-7.3	Low----------	0.28	5	6	3-8
	9-50	18-35	1.40-1.70	0.6-2.0	0.12-0.16	6.1-7.8	Moderate-----	0.28			
	50-80	5-18	1.25-1.60	2.0-6.0	0.08-0.12	7.4-8.4	Low----------	0.28			
MoC, MoC2-------- Morley	0-8	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.43	3	6	1-3
	8-28	35-50	1.55-1.70	0.2-0.6	0.11-0.15	6.1-7.8	Moderate-----	0.43			
	28-39	27-50	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
	39-80	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
MoD2------------- Morley	0-5	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.43	3	6	1-3
	5-20	35-50	1.55-1.70	0.2-0.6	0.11-0.15	6.1-7.8	Moderate-----	0.43			
	20-29	27-50	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
	29-80	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
OcB, OcC--------- Ockley	0-9	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-6.5	Low----------	0.37	5	5	.5-3
	9-23	20-35	1.45-1.60	0.6-2.0	0.15-0.22	4.5-6.0	Moderate-----	0.37			
	23-47	20-35	1.40-1.55	0.6-2.0	0.06-0.11	5.6-6.5	Moderate-----	0.24			
	47-80	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
Pm--------------- Pewamo	0-15	27-40	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.3	Moderate-----	0.28	5	6	3-10
	15-66	35-50	1.40-1.70	0.2-0.6	0.12-0.20	5.6-7.8	Moderate-----	0.28			
	66-80	30-40	1.50-1.70	0.2-0.6	0.14-0.18	7.4-8.4	Moderate-----	0.28			
Ps*. Pits											
RsB, RsC, RsC2--- Rittman	0-7	11-27	1.30-1.50	0.6-2.0	0.18-0.22	3.6-7.3	Low----------	0.43	4	6	2-3
	7-21	27-35	1.45-1.70	0.6-2.0	0.14-0.18	3.6-6.6	Moderate-----	0.43			
	21-33	20-32	1.60-1.85	0.06-0.2	0.06-0.10	4.5-7.3	Low----------	0.43			
	33-80	20-30	1.55-1.85	0.06-0.6	0.06-0.10	5.6-7.8	Low----------	0.43			
Sh--------------- Shoals	0-12	18-27	1.30-1.50	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.37	5	5	2-5
	12-36	18-33	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.8	Low----------	0.37			
	36-80	12-25	1.35-1.60	0.6-2.0	0.12-0.21	6.1-8.4	Low----------	0.37			
SkA-------------- Sleeth	0-10	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-6.5	Low----------	0.32	5	5	.5-3
	10-60	20-35	1.45-1.60	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.32			
	60-80	3-18	1.50-1.70	0.6-6.0	0.13-0.18	6.6-8.4	Low----------	0.32			
So--------------- Sloan	0-12	27-33	1.25-1.50	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.28	5	7	3-6
	12-48	20-35	1.25-1.55	0.2-2.0	0.17-0.20	6.1-8.4	Moderate-----	0.37			
	48-64	10-30	1.25-1.55	0.2-2.0	0.19-0.21	6.6-8.4	Low----------	0.37			
	64-80	0-10	1.20-1.50	6.0-20	0.02-0.05	6.6-8.4	Low----------	0.10			
Tg--------------- Tioga	0-12	5-18	1.15-1.40	0.6-6.0	0.15-0.21	5.1-7.3	Low----------	0.37	5	5	2-6
	12-42	5-18	1.15-1.45	0.6-6.0	0.07-0.20	5.1-7.3	Low----------	0.28			
	42-80	3-15	1.25-1.55	0.6-20	0.02-0.20	5.6-7.8	Low----------	0.28			
Ud. Udorthents											
WaA, WaB--------- Wadsworth	0-9	13-27	1.30-1.50	0.6-2.0	0.17-0.22	3.6-7.3	Low----------	0.43	4	6	2-4
	9-21	25-35	1.45-1.70	0.2-2.0	0.14-0.18	3.6-6.0	Moderate-----	0.43			
	21-40	22-32	1.60-1.85	<0.2	0.06-0.10	4.5-7.3	Low----------	0.43			
	40-80	15-32	1.55-1.85	0.06-0.6	0.06-0.12	5.6-8.4	Low----------	0.43			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
WsB, WsC, WsC2--- Wooster	0-9	11-20	1.30-1.50	0.6-2.0	0.18-0.23	4.5-6.0	Low-----------	0.37	4	6	1-3
	9-29	18-24	1.35-1.65	0.6-2.0	0.14-0.18	4.5-6.0	Low-----------	0.37			
	29-44	18-28	1.55-1.75	0.2-0.6	0.08-0.12	4.5-6.0	Low-----------	0.37			
	44-80	12-22	1.40-1.65	0.2-2.0	0.08-0.14	4.5-7.8	Low-----------	0.37			
WsD2------------- Wooster	0-6	11-20	1.30-1.50	0.6-2.0	0.18-0.23	4.5-6.0	Low-----------	0.37	4	6	1-3
	6-28	18-24	1.35-1.65	0.6-2.0	0.14-0.18	4.5-6.0	Low-----------	0.37			
	28-40	18-28	1.55-1.75	0.2-0.6	0.08-0.12	4.5-6.0	Low-----------	0.37			
	40-80	12-22	1.40-1.65	0.2-2.0	0.08-0.14	4.5-7.8	Low-----------	0.37			
WsE2------------- Wooster	0-5	11-20	1.30-1.50	0.6-2.0	0.18-0.23	4.5-6.0	Low-----------	0.37	4	6	1-3
	5-27	18-24	1.35-1.65	0.6-2.0	0.14-0.18	4.5-6.0	Low-----------	0.37			
	27-40	18-28	1.55-1.75	0.2-0.6	0.08-0.12	4.5-6.0	Low-----------	0.37			
	40-80	12-22	1.40-1.65	0.2-2.0	0.08-0.14	4.5-7.8	Low-----------	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AdB, AdC2, AdD2, AdE2 Amanda	C	None	---	---	>4.0	Perched	Dec-May	>60	---	Moderate	Moderate	Moderate.
BeA, BeB Bennington	C	None	---	---	1.0-2.5	Perched	Nov-May	>60	---	High	High	Moderate.
BoA, BoB Blount	C	None	---	---	1.0-3.0	Perched	Jan-May	>60	---	High	High	High.
CaB, CaC, CaC2 Canfield	C	None	---	---	1.5-3.0	Perched	Nov-May	>60	---	High	Moderate	Moderate.
Cb Carlisle	A/D	None	---	---	+.5-1.0	Apparent	Sep-Jun	>60	---	High	High	Low.
CdB, CdC, CdC2 Centerburg	C	None	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
ChB, ChC Chili	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
CkF Colyer Variant	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Co Condit	D	None	---	---	+1-1.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
GaB, GaC Gallman	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
GnB2, GnC2 Glynwood	C	None	---	---	2.0-3.5	Perched	Jan-Apr	>60	---	High	High	Moderate.
Lo Lobdell	B	Occasional	Brief	Jan-Apr	2.0-3.5	Apparent	Dec-Apr	>60	---	High	Low	Moderate.
Mf Milford	B/D	None	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	High	High	Low.
Mg Millgrove	B/D	None	---	---	+1-1.0	Apparent	Nov-May	>60	---	High	High	Low.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
MoC, MoC2, MoD2--- Morley	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
OcB, OcC---------- Ockley	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Pm---------------- Pewamo	C/D	None--------	---	---	+1-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
Ps*. Pits												
RsB, RsC, RsC2---- Rittman	C	None--------	---	---	1.5-3.0	Perched	Nov-May	>60	---	High-----	High-----	High.
Sh---------------- Shoals	C	Occasional	Brief-----	Oct-Jun	0.5-1.5	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.
SkA--------------- Sleeth	C	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.
So---------------- Sloan	B/D	Occasional	Brief-----	Nov-Jun	0-1.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
Tg---------------- Tioga	B	Occasional	Brief-----	Nov-May	3.0-6.0	Apparent	Feb-Apr	>60	---	Moderate	Low------	Moderate.
Ud. Udorthents												
WaA, WaB---------- Wadsworth	C	None--------	---	---	1.0-2.0	Perched	Nov-Jun	>60	---	High-----	High-----	High.
WsB, WsC, WsC2, WsD2, WsE2------- Wooster	C	None--------	---	---	2.5-4.0	Perched	Feb-Apr	>60	---	Moderate	Low------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Amanda	Fine-loamy, mixed, mesic Typic Hapludalfs
*Bennington	Fine, illitic, mesic Aeric Ochraqualfs
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Canfield	Fine-loamy, mixed, mesic Aquic Fragiudalfs
Carlisle	Euic, mesic Typic Medisaprists
Centerburg	Fine-loamy, mixed, mesic Aquic Hapludalfs
Chili	Fine-loamy, mixed, mesic Typic Hapludalfs
Colyer Variant	Fine, mixed, mesic Typic Hapludalfs
*Condit	Fine, illitic, mesic Typic Ochraqualfs
Gallman	Fine-loamy, mixed, mesic Typic Hapludalfs
Glynwood	Fine, illitic, mesic Aquic Hapludalfs
Lobdell	Fine-loamy, mixed, mesic Fluvaquentic Eutrochrepts
Milford	Fine, mixed, mesic Typic Haplaquolls
Millgrove	Fine-loamy, mixed, mesic Typic Argiaquolls
Morley	Fine, illitic, mesic Typic Hapludalfs
Ockley	Fine-loamy, mixed, mesic Typic Hapludalfs
Pewamo	Fine, mixed, mesic Typic Argiaquolls
Rittman	Fine-loamy, mixed, mesic Aquic Fragiudalfs
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Sleeth	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Tioga	Coarse-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Udorthents	Loamy, mixed, mesic Typic Udorthents
Wadsworth	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Wooster	Fine-loamy, mixed, mesic Typic Fragiudalfs

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Map symbol and soil name	Land capability	Prime farmland	Pasture suitability group	Woodland ordination symbol
AdB--- Amanda	IIe	Yes	A-1	5A
AdC2-- Amanda	IIIe	---	A-1	5A
AdD2-- Amanda	IVe	---	A-1	5R
AdE2-- Amanda	VIe	---	A-2	5R
BeA--- Bennington	IIw	Yes*	C-1	4A
BeB--- Bennington	IIe	Yes*	C-1	4A
BoA--- Blount	IIw	Yes*	C-1	3C
BoB--- Blount	IIe	Yes*	C-1	3C
CaB--- Canfield	IIe	Yes	F-3	5D
CaC, CaC2------------------------------------- Canfield	IIIe	---	F-3	5D
Cb-- Carlisle	Vw	---	D-1	---
CdB--- Centerburg	IIe	Yes	A-6	5A
CdC, CdC2------------------------------------- Centerburg	IIIe	---	A-6	5A
ChB--- Chili	IIe	Yes	A-1	4A
ChC--- Chili	IIIe	---	A-1	4A
CkF--- Colyer Variant	VIIe	---	H-1	4R
Co-- Condit	IIIw	Yes*	C-2	5W
GaB--- Gallman	IIe	Yes	A-1	5A
GaC--- Gallman	IIIe	---	A-1	5A
GnB2-- Glynwood	IIIe	Yes	A-6	4C

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Pasture suitability group	Woodland ordination symbol
GnC2 Glynwood	IVe	---	A-6	4C
Lo Lobdell	IIw	Yes	A-5	5A
Mf Milford	IIw	Yes*	C-1	---
Mg Millgrove	IIw	Yes*	C-1	5W
MoC, MoC2 Morley	IIIe	---	A-1	4A
MoD2 Morley	IVe	---	A-1	4R
OcB Ockley	IIe	Yes	A-1	5A
OcC Ockley	IIIe	---	A-1	5A
Pm Pewamo	IIw	Yes*	C-1	5W
Ps. Pits, gravel				
RsB Rittman	IIe	Yes	F-3	5D
RsC, RsC2 Rittman	IIIe	---	F-3	5D
Sh Shoals	IIw	Yes*	C-3	5A
SkA Sleeth	IIw	Yes*	C-1	5A
So Sloan	IIIw	Yes*	C-3	5W
Tg Tioga	IIw	Yes	A-5	4A
Ud. Udorthents, loamy				
WaA Wadsworth	IIIw	Yes*	C-2	5D
WaB Wadsworth	IIIe	Yes*	C-2	5D
WsB Wooster	IIe	Yes	F-3	5D
WsC, WsC2 Wooster	IIIe	---	F-3	5D

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability	Prime farmland	Pasture suitability group	Woodland ordination symbol
WsD2 Wooster	IVe	---	F-3	5R
WsE2 Wooster	VIe	---	F-3	5R

* Where drained.

* U.S. G.P.O.:1994-300-438:80019

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